

SPECIFICATIONS
FOR
NORTHERN KENTUCKY
WATER DISTRICT

Taylor Mill Treatment Plant
Belt Filter Press Replacement Project

NKWD Project No. 184-0488

January 2017

Bid Set

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

IN ASSOCIATION WITH:



engineering | architecture | geospatial



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

FOR

NORTHERN KENTUCKY WATER DISTRICT

Taylor Mill Treatment Plant Belt Filter Press Replacement Project

January 2017

GOVERNING BODY

COMMISSIONERS:

**FRED A. MACKE, JR. - CHAIR
CLYDE CUNNINGHAM - VICE-CHAIR
DAVID M. SPAULDING, ESQ. - SECRETARY
DOUGLAS C. WAGNER, CDT - TREASURER
DR. PATRICIA SOMMERKAMP – COMMISSIONER
JOSEPH J. KOESTER - 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:



engineering | architecture | geospatial

**801 Corporate Drive
Lexington, KY 40503**

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TABLE OF CONTENTS

Bidding and Contract Requirements

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

- 001120 - Invitation to Bid
- 002100 - Instructions To Bidders
- 004100 - Bid Form
- 004313 - Bid Bond
- 004513 - Bidders Qualifications Questionnaire
- 004600 - Non-Collusion Affidavit
- 004610 - Affidavit for Claiming Resident Bidder Status
- 005000 - Agreement
- 005100 - Notice Of Award
- 005500 - Notice To Proceed
- 006113 - Performance Bond
- 006114 - Payment Bond
- 006276 - Application For Payment
- 006363 - Change Order
- 006500 - Certificate Of Insurance
- 006520 - Certificate Of Property Insurance
- 007200 - EJCDC – Standard General Conditions
- 007300 - NKWD Supplementary Conditions
- 007310 - GRW Supplemental General Conditions to EJCDC General Conditions
- 007343 - Prevailing Wage Rate Requirements and Labor Provisions

Technical Specifications

DIVISION 01 – GENERAL REQUIREMENTS

- 011100 - Summary of Work
- 011400 - General Provisions
- 011410 - Special Provisions
- 012213 - Basis of Measurement and Payment – Lump Sum
- 012500 - Products and Substitutions
- 013113 - Project Coordination
- 013213 - Guidelines for Contractors Sequence of Construction Schedule
- 013216 - Progress Schedules
- 013323 - Shop Drawings, Product Data, Samples and RFI's
- 014216 - Definitions and Standards – Short Form
- 014533 - Special Inspections
- 015000 - Temporary Facilities and Controls
- 017329 - Cutting and Patching
- 017400 - Cleaning
- 017700 - Project Closeout
- 017823 - Operating and Maintenance Manuals
- 017834 - Warranties and Bonds
- 017839 - Project Record Documents – Water

TABLE OF CONTENTS (Cont'd.)

Technical Specifications (Cont'd.)

DIVISION 02 – EXISTING CONDITIONS

024100 - Demolition and Salvage

DIVISION 03 – CONCRETE

033100 - Cast-in-Place Concrete

DIVISION 04 – MASONRY

042000 - Unit Masonry

DIVISION 05 – METALS

051200 - Structural Steel
055119 - Aluminum Grating Stairs
055202 - Aluminum Handrails and Railings
055210 - Safety Railings and Gates
055300 - Aluminum Grating

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

079200 - Joint Sealants

DIVISION 08 – OPENINGS

081113 - Hollow Metal Doors and Frames
083323 - Overhead Coiling Doors
083610 - Chain Drive Opener
085123 - Steel Windows
087111 - Door Hardware
089119 - Fixed Louvers

DIVISION 09 – FINISHES

099600 - High Performance Paints and Coatings – Water Plant

TABLE OF CONTENTS (Cont'd.)

Technical Specifications (Cont'd.)

DIVISION 22 - PLUMBING

- 220100 - General Plumbing Provisions
- 220513 - Common Motor Requirements for Plumbing Equipment
- 220529 - Hangers and Supports for Plumbing Piping and Equipment
- 220719 - Plumbing Piping Insulation
- 221116 - Domestic Water Piping
- 221119 - Domestic Water Piping Specialties
- 221123 - Domestic Water Pumps
- 224500 - Emergency Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

- 235123 - Gas Vents

DIVISION 26 – ELECTRICAL

- 260000 - Basic Electrical Materials and Methods
- 260100 - Electrical Demolition
- 260519 - Conductors and Cables
- 260526 - Secondary Grounding
- 260529 - Supporting Devices and Hangers
- 260533 - Raceways
- 260534 - Boxes
- 260553 - Electrical Identification
- 262419 - Motor Control Centers
- 262716 - Controls
- 262816 - Safety Switches
- 264313 - Surge Protective Devices
- 265110 - LED Lighting

DIVISION 41 – MATERIAL PROCESS & HANDLING EQUIPMENT

- 412222 - Belt Conveyor
- 412223 - Trolley Hoist Equipment

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT

- 462010 - Interior Process Piping
- 462012 - Interior Process Valves - Sanitary
- 463305 - Polymer Feed Equipment
- 467621 - Belt Filter Press

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DIVISION 00

**PROCUREMENT AND CONTRACTING
REQUIREMENTS - NONFUNDED**

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Section 001120

INVITATION TO BID

Advertisement Run Dates: January 5, 2017

PROJECT: Taylor Mill Treatment Plant Belt Filter Press Replacement Project

SEALED BIDS WILL BE RECEIVED AT:

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

UNTIL: Date: January 25, 2017
Time: 2:00 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: Renovation of the Residuals Handling Building, the demolition of the existing equipment and installation of new equipment. The renovations of the Residuals Handling Building includes the demolition and construction of a new interior wall, a new monorail and hoist system and a new access door. The equipment to be demolished is the existing belt filter press, conveyor, control panels, polymer feed system, mixing/storage tanks and associated piping. The new equipment to be installed is a new belt filter press, polymer feed system with mixing and aging tanks, chemical metering pumps, conveyor, control panel, associated piping, valves, accessories and associated electrical and instrumentation work.

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:

	<u>Charge</u>
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 David C. Osborne with GRW Engineers (DOsborne@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 January 12, 2017 at 10:00 a.m. at the Taylor Mill Treatment Plant. 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 Kevin Owen, Maintenance Supervisor with the Northern Kentucky Water District, at (859) 991-1641.

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, P.E., 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 January 12, 2017 at 10:00 a.m. at the Taylor Mill Treatment Plant which is located at 608 Grand Avenue in Taylor Mill, Kentucky. 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 Kevin Owen,

Maintenance Supervisor with the Northern Kentucky Water District, at (859) 991-1641, 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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Section 004100

BID FORM

PROJECT IDENTIFICATION: **Taylor Mill Treatment Plant Belt Filter Press Replacement Project**

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. A Contract award will be based on the lowest responsive, responsible bidder after consideration of the (optional) proposed deductive alternates. The Owner reserves the right to select any, all, or none of the alternates.
 3. 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.

Lump Sum Deduction - Alternates as Selected By Owner:

\$ _____ in numbers

and _____ in words.

(Above Is To be Filled In By Owner After Review of Bid Alternates)

Total Bid:

\$ _____ in numbers

and _____ in words.

(Above Is To be Filled In By Owner)

Alternative Equipment Information			
Equipment Item	Base Bid Equipment Manufacturer	Alternate Bid Equipment Manufacturer	Lump Sum Deduction
1. Belt Filter Press	Andritz	a.	a.
		b.	b.
2. Horizontal Belt Conveyor	Keystone	a.	a.
		b.	b.
3. Polymer Feed System	Acrison	a.	a.
		b.	b.
4. Chemical Metering Pumps	Watson-Marlow	a.	a.
		b.	b.
5. Trolley Hoist	Yale	a.	a.
		b.	b.

Notes: 1. The design has been completed using listed Base Bid equipment manufacturer. Should the Owner select other Alternate Bid equipment, the Bidder, at no additional cost to the Owner, shall make any changes to structure, piping controls, electrical, instrumentation, architectural, mechanical, etc. that may be necessary to accommodate this equipment.

2. Should the Bidder choose to offer for consideration to the Owner, any alternate manufacturers/products to those listed above, the Bidder shall provide a detailed submittal of applicable items such as catalog cut sheets, pump curves, hydraulic calculations, specifications, wiring diagrams, technical literature, dimensional drawings, etc., or any other information requested by the Owner. This submittal information shall be included with the Bidder's bidding documents for proper evaluation by the Owner. These submittal items shall be in addition to the submittal requirements listed in the respective technical specifications section of the equipment item or product hereinafter. Alternates will not be evaluated or pre-qualified prior to Bid opening.

3. The best, lowest Bidder will be determined by reducing the lump sum Bid proposal by the amount of the deductive alternates selected by the Owner for each Bidder.

7. Bidder agrees that the Work will be substantially complete within 350 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 400 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 work with its own forces, the phrase "Prime Contractor" shall be enter in the box provided

d.

Branch of Work	Name of Subcontractor
1. Electrical	
2. Instrumentation/SCADA	
3. Plumbing	
4. Mechanical/HVAC	

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: _____

Signature and Title

By: _____

Signature and Title
(Attach Power of Attorney)

Attest: _____

Signature and Title

Attest: _____

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: Taylor Mill Treatment Plant Belt Filter Press Replacement Project

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:

This project consists of the renovation of the Residuals Handling Building, the demolition of the existing equipment and installation of new equipment. The renovations of the Residuals Handling Building includes the demolition and construction of a new interior wall, a new monorail and hoist system and a new access door. The equipment to be demolished is the existing belt filter press, conveyor, control panels, polymer feed system, mixing/storage tanks and associated piping. The new equipment to be installed is a new belt filter press, polymer feed system with mixing and aging tanks, chemical metering pumps, conveyor, control panel, associated piping, valves, 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 350 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 400 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:

Lump Sum Base Bid of (as indicated in Contractor's bid):

\$ _____ in numbers

and _____ in words

Selected Deductive Alternate (if any) of (as indicated in Contractor's bid):

\$ _____ in numbers

and _____ in words

Total Contract Price:

\$ _____ in numbers

and _____ in words

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 1.07.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 and Federal
- G. Specifications (including Geotechnical Exploration Report);
- H. Drawings consisting of a cover sheet and sheets numbered G-001 through E-702 inclusive, with each sheet bearing the following general title;
 - Belt Filter Press Replacement
 - Taylor Mill Treatment Plant
 - Northern Kentucky Water District
- 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

Taylor Mill Treatment Plant Belt Filter Press Replacement Project

To: Contractor Name
Street Address
City, State, Zip

Description of Work: The proposed work is generally described, but not limited to the following:
Renovation of the Residuals Handling Building, the demolition of the existing equipment and installation of new equipment. The renovations of the Residuals Handling Building includes the demolition and construction of a new interior wall, a new monorail and hoist system and a new access door. The equipment to be demolished is the existing belt filter press, conveyor, control panels, polymer feed system, mixing/storage tanks and associated piping. The new equipment to be installed is a new belt filter press, polymer feed system with mixing and aging tanks, chemical metering pumps, horizontal belt conveyor, control panel, associated piping, valves, accessories and associated electrical and instrumentation work.

The Owner represented by the undersigned has considered the Bid submitted by you on January 25, 2017 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 _____, 2016.

Owner
Northern Kentucky Water District

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

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged this _____ day of _____, 2016.
_____(contractor name)

By: _____
Title: _____

2835 Crescent Springs Rd. PO Box 18640 Erlanger, KY 41018 (859) 578-9898 Fax (859) 578-7893
4384

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NOTICE TO PROCEED

Taylor Mill Treatment Plant Belt Filter Press Replacement Project

To: Contractor Name
Address
City, State Zip
Attention:

Date: _____, 2017

Description of Work: The proposed work is generally described, but not limited to the following: Renovation of the Residuals Handling Building, the demolition of the existing equipment and installation of new equipment. The renovations of the Residuals Handling Building includes the demolition and construction of a new interior wall, a new monorail and hoist system and a new access door. The equipment to be demolished is the existing belt filter press, conveyor, control panels, polymer feed system, mixing/storage tanks and associated piping. The new equipment to be installed is a new belt filter press, polymer feed system with mixing and aging tanks, chemical metering pumps, horizontal belt conveyor, control panel, associated piping, valves, accessories and associated electrical and instrumentation work.

You are hereby notified to commence WORK in accordance with the agreement dated _____, 2017 on or before _____, 2017. 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
P.E, V.P. Eng, Production & Distribution
ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged this the _____ day of _____, 2016.

By: _____

Title

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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)

SURETY

Company: (Corp. Seal)

Signature _____
Name and Title:

Signature _____
Name and Title:

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

SURETY

Company: (Corp. Seal)

Signature _____
Name and Title:

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 be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the OWNER's 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 be 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

Company: (Corp. Seal)

SURETY

Company: (Corp. Seal)

Signature _____
Name and Title:

Signature _____
Name and Title:
(Attach Power of Attorney)

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

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

SURETY

Company: (Corp. Seal)

Signature _____
Name and Title:

Signature _____
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 or 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 be 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 be 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):



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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Change Order

Date:
Project:

Change Order No.:
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
<hr/>		
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:		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				
Code	Sub-Code	COMPANY LETTER A				
INSURED:		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,
	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY	(Completed Operations & Products Liability remains in force for 2 years after final payment)			PRODUCTS-COMP/OPS AGGREGATE	\$1,000,
	<input checked="" type="checkbox"/> OCCURRENCE				PERSONAL & ADVERTISING INJURY	\$1,000,
	<input checked="" type="checkbox"/> BLANKET CONTRACTUAL				EACH OCCURRENCE	\$1,000,
	AUTOMOBILE LIABILITY				COMBINED SINGLE LIMIT EACH OCCURRENCE Bodily Injury & Property Damage	\$1,000,
	<input checked="" type="checkbox"/> ANY AUTO					
	<input checked="" type="checkbox"/> HIRED AUTOS					
	<input checked="" type="checkbox"/> NON-OWNED AUTOS					
	EXCESS LIABILITY				EACH OCCURRENCE	\$4,000,
	<input checked="" type="checkbox"/> UMBRELLA FORM	(Follows Form of the Primary)			AGGREGATE	\$4,000,
	WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY				STATUTORY	
		(Includes US Longshoremen and Harbor Workers Act and Maritime Coverage Where Applicable and All States Endorsement)			EACH ACCIDENT	\$1,000,
					DISEASE-POLICY LIMIT	\$1,000,
					DISEASE-EACH EMPLOYEE	\$1,000,
	OTHER				EACH OCCURRENCE	
					AGGREGATE	
DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS:						
<ol style="list-style-type: none"> 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.) Blanket Coverage for XCU Hazards (General Liability & Excess Liability). Waiver of Subrogation Against Certificate Holder(s), Their Officers, Directors, Partners, Employees, & Agents (all policies). Contractual Coverage covers liability assumed in the Indemnification Clause of the Contract between Certificate Holder and Insured (General Liability & Excess Liability). General and Products/Completed Operations aggregates apply for each Certificate Holder contract(s) or amendments (General Liability & Excess Liability). Contractual Liability Limitation Endorsement CG2139 or its equivalent is not included in either General or Excess Liability policies. 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					

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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 Code Sub-Code		COMPANY	
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



AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by



CONSTRUCTION SPECIFICATIONS INSTITUTE

**STANDARD GENERAL CONDITIONS OF THE
CONSTRUCTION CONTRACT**

TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology	1
1.01 Defined Terms.....	1
1.02 Terminology	5
Article 2 – Preliminary Matters	6
2.01 Delivery of Bonds and Evidence of Insurance	6
2.02 Copies of Documents	6
2.03 Commencement of Contract Times; Notice to Proceed.....	7
2.04 Starting the Work	7
2.05 Before Starting Construction	7
2.06 Preconstruction Conference; Designation of Authorized Representatives	7
2.07 Initial Acceptance of Schedules	8
Article 3 – Contract Documents: Intent, Amending, Reuse	8
3.01 Intent.....	8
3.02 Reference Standards.....	8
3.03 Reporting and Resolving Discrepancies.....	9
3.04 Amending and Supplementing Contract Documents	10
3.05 Reuse of Documents	10
3.06 Electronic Data.....	10
Article 4 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions; Reference Points.....	11
4.01 Availability of Lands.....	11
4.02 Subsurface and Physical Conditions.....	11
4.03 Differing Subsurface or Physical Conditions	12
4.04 Underground Facilities.....	13
4.05 Reference Points.....	14
4.06 Hazardous Environmental Condition at Site	14
Article 5 – Bonds and Insurance.....	16
5.01 Performance, Payment, and Other Bonds.....	16
5.02 Licensed Sureties and Insurers.....	17
5.03 Certificates of Insurance	17
5.04 Contractor’s Insurance	17
5.05 Owner’s Liability Insurance.....	19
5.06 Property Insurance.....	19
5.07 Waiver of Rights	20

5.08	Receipt and Application of Insurance Proceeds	21
5.09	Acceptance of Bonds and Insurance; Option to Replace	22
5.10	Partial Utilization, Acknowledgment of Property Insurer.....	22
Article 6 – Contractor’s Responsibilities		22
6.01	Supervision and Superintendence.....	22
6.02	Labor; Working Hours	22
6.03	Services, Materials, and Equipment	23
6.04	Progress Schedule	23
6.05	Substitutes and “Or-Equals”	23
6.06	Concerning Subcontractors, Suppliers, and Others.....	26
6.07	Patent Fees and Royalties	27
6.08	Permits.....	28
6.09	Laws and Regulations	28
6.10	Taxes	28
6.11	Use of Site and Other Areas.....	28
6.12	Record Documents.....	29
6.13	Safety and Protection	29
6.14	Safety Representative.....	31
6.15	Hazard Communication Programs.....	31
6.16	Emergencies	31
6.17	Shop Drawings and Samples	31
6.18	Continuing the Work.....	33
6.19	Contractor’s General Warranty and Guarantee	33
6.20	Indemnification	34
6.21	Delegation of Professional Design Services.....	34
Article 7 – Other Work at the Site.....		35
7.01	Related Work at Site	35
7.02	Coordination.....	36
7.03	Legal Relationships.....	36
Article 8 – Owner’s Responsibilities.....		36
8.01	Communications to Contractor.....	36
8.02	Replacement of Engineer	37
8.03	Furnish Data	37
8.04	Pay When Due.....	37
8.05	Lands and Easements; Reports and Tests.....	37
8.06	Insurance.....	37
8.07	Change Orders.....	37
8.08	Inspections, Tests, and Approvals	37
8.09	Limitations on Owner’s Responsibilities	37
8.10	Undisclosed Hazardous Environmental Condition	38
8.11	Evidence of Financial Arrangements.....	38
8.12	Compliance with Safety Program	38

Article 9 – Engineer’s Status During Construction.....	38
9.01 Owner’s Representative	38
9.02 Visits to Site	38
9.03 Project Representative.....	39
9.04 Authorized Variations in Work	39
9.05 Rejecting Defective Work.....	39
9.06 Shop Drawings, Change Orders and Payments.....	39
9.07 Determinations for Unit Price Work	40
9.08 Decisions on Requirements of Contract Documents and Acceptability of Work	40
9.09 Limitations on Engineer’s Authority and Responsibilities	40
9.10 Compliance with Safety Program	41
Article 10 – Changes in the Work; Claims	41
10.01 Authorized Changes in the Work	41
10.02 Unauthorized Changes in the Work.....	41
10.03 Execution of Change Orders.....	41
10.04 Notification to Surety	42
10.05 Claims.....	42
Article 11 – Cost of the Work; Allowances; Unit Price Work	43
11.01 Cost of the Work	43
11.02 Allowances	46
11.03 Unit Price Work	46
Article 12 – Change of Contract Price; Change of Contract Times	47
12.01 Change of Contract Price	47
12.02 Change of Contract Times	48
12.03 Delays.....	48
Article 13 – Tests and Inspections; Correction, Removal or Acceptance of Defective Work.....	49
13.01 Notice of Defects.....	49
13.02 Access to Work	49
13.03 Tests and Inspections	49
13.04 Uncovering Work.....	50
13.05 Owner May Stop the Work.....	51
13.06 Correction or Removal of Defective Work	51
13.07 Correction Period	51
13.08 Acceptance of Defective Work.....	52
13.09 Owner May Correct Defective Work	52
Article 14 – Payments to Contractor and Completion	53
14.01 Schedule of Values.....	53
14.02 Progress Payments	53
14.03 Contractor’s Warranty of Title.....	56
14.04 Substantial Completion.....	56
14.05 Partial Utilization	57

14.06 Final Inspection	58
14.07 Final Payment.....	58
14.08 Final Completion Delayed	59
14.09 Waiver of Claims	59
Article 15 – Suspension of Work and Termination	60
15.01 Owner May Suspend Work.....	60
15.02 Owner May Terminate for Cause	60
15.03 Owner May Terminate For Convenience	61
15.04 Contractor May Stop Work or Terminate.....	61
Article 16 – Dispute Resolution	62
16.01 Methods and Procedures	62
Article 17 – Miscellaneous	63
17.01 Giving Notice	63
17.02 Computation of Times	63
17.03 Cumulative Remedies	63
17.04 Survival of Obligations	63
17.05 Controlling Law	63
17.06 Headings.....	63

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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, expeditors, 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 indicated 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:

A Geotechnical Exploration Report was not completed for this project.

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 its 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:
- 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;
 - 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

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**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 006363.

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 006276.

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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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Matthew G. Bevin
Governor

Jenean M. Hampton
Lt. Governor

Kentucky Labor Cabinet
Department of Workplace Standards
Division of Employment Standards, Apprenticeship
and Mediation

1047 US Hwy 127 S STE 4
Frankfort, Kentucky 40601
Phone: (502) 564-3070
Fax: (502) 696-1897
www.labor.ky.gov

Derrick K. Ramsey
Secretary

December 13, 2016

David Osborne
GRW Engineers Inc.
801 Corporate Drive
Lexington KY 40503

Re: Northern KY Water District, Taylor Mill Treatment Plant Belt Filter Press Replacement

Advertising Date as Shown on Notification: January 5, 2017

Dear David Osborne:

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 1-023, dated August 1, 2016 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-00678-16-1, Heavy/Highway

Sincerely,

Michael C. Donta



Deputy Commissioner

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

KENTON COUNTY

Determination No. CR 1-023 2016

PROJECT NO. 059-H-00678-16-1

Date of Determination: August 1, 2016

_____ **BLDG** ___ **X** ___ **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 1-023 2016.

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.



Ervin Dimeny, Commissioner
Department of Workplace Standards
Kentucky Labor Cabinet

ASBESTOS/INSULATION WORKERS:

(Including duct (hot/cold), Pipe Insulator, pipe wrapping):		BASE RATE	\$29.40
		FRINGE BENEFITS	14.77

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	\$32.22
		FRINGE BENEFITS	24.26

BRICKLAYERS:

Bricklayers:	BUILDING	BASE RATE	\$26.77
		FRINGE BENEFITS	11.49

Tile Setters:	BUILDING	BASE RATE	\$27.71
		FRINGE BENEFITS	11.34

Tile Finishers:	BUILDING	BASE RATE	\$23.17
		FRINGE BENEFITS	11.34

Bricklayer:	HEAVY	BASE RATE	\$26.50
		FRINGE BENEFITS	11.17

CARPENTERS:

Includes Form Work:	BUILDING	BASE RATE	\$23.85
		FRINGE BENEFITS	12.37

Carpenters & Piledrivermen:	HEAVY	BASE RATE	\$27.05
		FRINGE BENEFITS	9.69

Divers:	HEAVY	BASE RATE	\$40.58
		FRINGE BENEFITS	9.69

Form Work Only:	HEAVY	BASE RATE	\$24.80
		FRINGE BENEFITS	8.76

CEMENT MASON / CONCRETE FINISHERS:

	BUILDING	BASE RATE	\$22.00
		FRINGE BENEFITS	12.55

	HEAVY	BASE RATE	\$25.75
		FRINGE BENEFITS	8.60

ELECTRICIANS:

Electricians (includes low voltage);	BUILDING	BASE RATE	\$27.47
		FRINGE BENEFITS	17.13

Electricians:	HEAVY	BASE RATE	\$30.56
		FRINGE BENEFITS	16.10

ELECTRICIAN/LINE CONSTRUCTION:

Linemen:		BASE RATE	\$30.50
		FRINGE BENEFITS	11.15
Equipment Operator:		BASE RATE	\$27.45
		FRINGE BENEFITS	10.51
Groundmen:		BASE RATE	\$19.83
		FRINGE BENEFITS	8.92
SOUND & COMMUNICATION TECHNICIAN:		BASE RATE	\$21.55
		FRINGE BENEFITS	8.46

ELEVATOR MECHANICS:

		BASE RATE	\$41.26
		FRINGE BENEFITS	28.385

GLAZIERS:

		BASE RATE	\$25.00
		FRINGE BENEFITS	12.60

IRONWORKERS:

Structural & Ornamental:		BASE RATE	\$26.40
		FRINGE BENEFITS	19.15
Fence Erector:		BASE RATE	\$22.70
		FRINGE BENEFITS	18.40
REINFORCING:		BASE RATE	\$27.00
		FRINGE BENEFITS	19.00
Ornamental:	HEAVY	BASE RATE	\$27.91
		FRINGE BENEFITS	21.11

LABORERS / BUILDING:

Mason Tender-Brick:	BUILDING	BASE RATE	\$22.10
		FRINGE BENEFITS	11.70
Pipelayer:	BUILDING	BASE RATE	\$20.36
		FRINGE BENEFITS	9.90
Power Tool Operator:	BUILDING	BASE RATE	\$28.38
		FRINGE BENEFITS	14.90
LABORER	COMMON OR GENERAL	BASE RATE	\$22.10
		FRINGE BENEFITS	11.70
Mason Tender-Cement/Concrete:		BASE RATE	\$25.10
		FRINGE BENEFITS	13.67

LABORER / HEAVY:

Concrete Worker & Grade Checker:			
	HEAVY	BASE RATE	\$22.30
		FRINGE BENEFITS	12.46
Tamper (hand held/walk behind):	HEAVY	BASE RATE	\$22.55
		FRINGE BENEFITS	12.46
Concrete Saw (hand held/walk behind) & Pipelayer:			
	HEAVY	BASE RATE	\$28.89
		FRINGE BENEFITS	9.85
Flagger & Landscaper:	HEAVY	BASE RATE	\$28.72
		FRINGE BENEFITS	9.85
Common or General:	HEAVY	BASE RATE	\$25.27
		FRINGE BENEFITS	8.34
Concrete Finishing:	HEAVY	BASE RATE	\$25.75
		FRINGE BENEFITS	9.85

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

MILLWRIGHTS:

	BASE RATE	\$27.55
	FRINGE BENEFITS	15.39

OPERATING ENGINEERS / BUILDING:

Drill:	BUILDING	BASE RATE	\$28.85
		FRINGE BENEFITS	14.40
Crane:	BUILDING	BASE RATE	\$31.76
		FRINGE BENEFITS	14.65
Oiler:	BUILDING	BASE RATE	\$26.05
		FRINGE BENEFITS	14.65
Backhoe/Excavator/Trackhoe:	BUILDING	BASE RATE	\$24.66
		FRINGE BENEFITS	10.81
Bulldozer:	BUILDING	BASE RATE	\$19.69
		FRINGE BENEFITS	4.71
Paver (Asphalt, Aggregate & Concrete:			
	BUILDING	BASE RATE	\$22.52
		FRINGE BENEFITS	4.00
Roller:	BUILDING	BASE RATE	\$23.60
		FRINGE BENEFITS	12.65
Loader & Forklift:	BUILDING	BASE RATE	\$29.86
		FRINGE BENEFITS	14.65

Cranes with boom 150 ft and over including JIB shall receive \$.50 above wage rate

OPERATING ENGINEERS / HEAVY:

Backhoe/Excavator/Trackhoe:	HEAVY	BASE RATE	\$33.34
		FRINGE BENEFITS	14.25
Crane; Forklift:	HEAVY	BASE RATE	\$27.66
		FRINGE BENEFITS	14.15
GROUP 1			
Drill; Pumpcrete; Roller (Bituminous):	HEAVY	BASE RATE	\$29.95
		FRINGE BENEFITS	14.40
GROUP 2			
Bobcat/Skid Steer/Skid Loader; Concrete Pump; Roller (Rock):	HEAVY	BASE RATE	\$27.26
		FRINGE BENEFITS	14.40
GROUP 3			
Articulating Truck Operator:	HEAVY	BASE RATE	\$27.68
		FRINGE BENEFITS	14.40
GROUP 4			
Pump; Roller (Earth):	HEAVY	BASE RATE	\$26.96
		FRINGE BENEFITS	14.40
Bulldozer:	HEAVY	BASE RATE	\$28.04
		FRINGE BENEFITS	13.00
Loader:	HEAVY	BASE RATE	\$29.37
		FRINGE BENEFITS	10.13
Mechanic:	HEAVY	BASE RATE	\$28.60
		FRINGE BENEFITS	11.83
Oiler:	HEAVY	BASE RATE	\$24.34
		FRINGE BENEFITS	13.00
Trencher:	HEAVY	BASE RATE	\$26.27
		FRINGE BENEFITS	12.37

Operators on cranes with booms 150 ft and over including jib, shall receive \$1.00 above Group 1 rate; 250 ft and over including jib shall receive \$1.50 above Group 1 rate. Combination Rate: All crane operators operating cranes where the length of the boom in combination with the length of the piling leads equal or exceeds 150 ft, shall receive \$1.00 above Group 1 rate.

PAINTERS / BUILDING:

Brush & Roller Only:	BUILDING	BASE RATE	\$23.39
		FRINGE BENEFITS	9.06
Spray Only:	BUILDING	BASE RATE	\$22.81
		FRINGE BENEFITS	11.87
Sign Painter & Erector:	BUILDING	BASE RATE	\$20.23
		FRINGE BENEFITS	3.25

PAINTERS / HEAVY

Bridge/Equipment Tender and/or Containment Builder:	HEAVY	BASE RATE	\$20.73
		FRINGE BENEFITS	8.71
Brush & Roller:	HEAVY	BASE RATE	\$23.39
		FRINGE BENEFITS	8.71

PAINTERS / HEAVY CONTINUED:

Spray:	HEAVY	BASE RATE	\$23.89
		FRINGE BENEFITS	9.06
Sandblasting & Water Blasting:	HEAVY	BASE RATE	\$24.14
		FRINGE BENEFITS	8.71
Bridge:	HEAVY	BASE RATE	\$24.39
		FRINGE BENEFITS	8.71

PLUMBERPIPEFITTER:

BASE RATE	\$31.95
FRINGE BENEFITS	17.30

PLASTERERS: BUILDING

BASE RATE	\$22.00
FRINGE BENEFITS	10.10

ROOFERS

BASE RATE	\$27.01
FRINGE BENEFITS	13.62

SHEETMETAL WORKERS

(including HVAC duct installation)

BASE RATE	\$27.63
FRINGE BENEFITS	19.86

SPRINKLER FITTERS:

(Fire Sprinklers)

BASE RATE	\$31.35
FRINGE BENEFITS	17.52

TRUCK DRIVERS / BUILDING:

10 Yard Truck:	BUILDING	BASE RATE	\$16.27
		FRINGE BENEFITS	1.50
Dump Truck:	BUILDING	BASE RATE	\$24.35
		FRINGE BENEFITS	14.59

TRUCK DRIVER / HEAVY:

Driver:	HEAVY	BASE RATE	\$15.85
		FRINGE BENEFITS	4.60
Euclid Wagon, End Dump, Lowboy, Heavy Duty Equipment, Tractor-Trailer Combination, & Drag:	HEAVY	BASE RATE	\$16.29
		FRINGE BENEFITS	4.60
Dump Truck:	HEAVY	BASE RATE	\$19.00
		FRINGE BENEFITS	4.78

BRICKLAYER: HIGHWAY

BASE RATE	\$26.50
FRINGE BENEFITS	11.17

CEMENT MASON/CONCRETE FINISHER:

HIGHWAY

BASE RATE	\$25.75
FRINGE BENEFITS	8.60

CARPENTER & PILEDRIVER:

HIGHWAY	BASE RATE	\$27.27
	FRINGE BENEFITS	14.59

DIVER:

HIGHWAY	BASE RATE	\$40.58
	FRINGE BENEFITS	9.69

ELECTRICIAN:

HIGHWAY	BASE RATE	\$27.47
	FRINGE BENEFITS	17.13

SOUND & COMMUNICATION TECHNICIAN:

HIGHWAY	BASE RATE	\$22.75
	FRINGE BENEFITS	10.08

IRONWORKERS:

Fence Erector:	HIGHWAY	BASE RATE	\$23.76
		FRINGE BENEFITS	19.15

Structural:	HIGHWAY	BASE RATE	\$26.40
		FRINGE BENEFITS	19.15

Reinforcing:	HIGHWAY	BASE RATE	\$27.00
		FRINGE BENEFITS	19.00

LABORERS / HIGHWAY:

Group 1: aging and curing of concrete, asbestos abatement worker, asphalt plant, asphalt, batch truck dump, carpenter tender, cement mason tender, cleaning of machines, concrete, demolition, dredging, environmental-nuclear, radiation, toxic & hazardous waste – level D, flagperson, grade checker, hand digging & hand back filling, highway marker placer, landscaping, mesh handler & placer, puddler, railroad, rip-rap & grouter, right of way, sign, guard rail & fence installer, signal person, sound barrier installer, storm & sanitary sewer, swamper, truck spotter & dumper, wrecking of concrete forms, general cleanup.

HIGHWAY	BASE RATE	\$29.22
	FRINGE BENEFITS	10.35

Group 2: batter board man (sanitary storm sewer), brickmason tender, mortar mixer operator, scaffold builder, Burner & welder, bushhammer, chainsaw operator, concrete saw operator, deckhand scow man, dry cement Handler, environmental – nuclear, radiation, toxic & hazardous waste – Level C, forklift operator for masonry, form setter, green concrete cutting, hand operated grouter & grinder machine operator, jackhammer, pavement breaker, paving joint machine, pipelayer, plastic pipe fusion, power driven Georgia Buggy & wheel barrow, power post hole digger, precast manhole setter, walk behind tamper, walk behind trencher, sand blaster, concrete chipper, surface grinder, vibrator operator, wagon driller.

HIGHWAY	BASE RATE	\$29.39
	FRINGE BENEFITS	10.35

Group 3: asphalt lutemen & raker, gunnite nozzleman, gunnite operator & mixer, group pump operator, side rail setter, rail paved ditches, screw operator, tunnel (free air) water blaster:

HIGHWAY	BASE RATE	\$29.72
	FRINGE BENEFITS	10.35

Group 4: Caisson worker (free air), cement finisher, environmental-nuclear, radiation, toxic & hazardous waste Levels A & B, miner & driller (free air), tunnel blaster & tunnel mucker (free air), directional & horizontal boring, air Track drillers (all types), powderman & blasters, troxler & concrete tester if Laborer is utilized.

HIGHWAY	BASE RATE	\$30.17
	FRINGE BENEFITS	10.35

OPERATING ENGINEERS/ HIGHWAY

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), gradall, helicopter crew (operator-hoist or winch), hoe (all types, hoisting engine on shaft or tunnel work, 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:

HIGHWAY	BASE RATE	\$33.24
	FRINGE BENEFITS	14.25

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, horizontal directional drill (over 500,000 ft lbs thrust), 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),k grinder & planers of all types, trench machine (24" wide & under), vermeer type concrete saw:

HIGHWAY	BASE RATE	\$33.22
	FRINGE BENEFITS	14.25

Group 3: A-frame, air compressor on tunnel work (low pressure), asphalt plant engineer, bobcat 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 (4" & over discharge), roller, asphalt, rotovator (lime soil stabilizer), switch & tie tampers (without lifting & aligning device), utility operator (small equipment), welding machines:

HIGHWAY	BASE RATE	\$32.18
	FRINGE BENEFITS	14.25

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 (cap. 4 yd & under), concrete saw (multiple), conveyor (highway), form trencher, hydro hammer, hydro seeder, pavement breaker, plant mixer, post driver, post hole digger (power auger), power bursh burner, power form handling equipment, road widening trencher, roller (brick, grade & macadam), self-propelled power spreader & power subgrader, steam fireperson, tractor (pulling sheepfoot, roller or grader), vibratory compactor with integral power:

HIGHWAY	BASE RATE	\$31.00
	FRINGE BENEFITS	14.25

Group 5: compressor (portable, sewer, heavy & highway), drum fireperson (asphalt), generator, masonry fork lift, 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:

HIGHWAY	BASE RATE	\$25.54
	FRINGE BENEFITS	14.25

GROUP 6: Master mechanic & boom from 150 to 180:

HIGHWAY	BASE RATE	\$33.59
	FRINGE BENEFITS	14.25

OPERATING ENGINEERS / HIGHWAY CONTINUED:

Group 7: Boom from 180 & over:

HIGHWAY	BASE RATE	\$33.84
	FRINGE BENEFITS	14.25

Cranes with booms 150 ft & over including JIB and where length of the boom in combination with the length of the piling leads equals or 150 ft - \$1.00 over Group 1 rate.

PAINTERS:

Bridge:	HIGHWAY	BASE RATE	\$24.39
		FRINGE BENEFITS	9.06

Bridge equipment tender & containment builder:

HIGHWAY	BASE RATE	\$20.73
	FRINGE BENEFITS	9.06

Brush & Roller:	HIGHWAY	BASE RATE	\$23.39
		FRINGE BENEFITS	9.06

Sandblasting & water blasting:	HIGHWAY	BASE RATE	\$24.14
		FRINGE BENEFITS	9.06

Spray:	HIGHWAY	BASE RATE	\$23.89
		FRINGE BENEFITS	9.06

PLUMBERS:	HIGHWAY	BASE RATE	\$29.80
		FRINGE BENEFITS	17.79

TRUCK DRIVERS

Group 1: driver:	HIGHWAY	BASE RATE	\$15.85
		FRINGE BENEFITS	4.60

Group 2: Euclid wagon, end dump, lowboy, heavy duty equipment, tractor trailer combination & drag:

HIGHWAY	BASE RATE	\$16.29
	FRINGE BENEFITS	4.60

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CR 1-023 2016
AUGUST 1, 2016**

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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 renovation of the Residuals Handling Building, the demolition of the existing equipment and installation of new equipment. The renovations of the Residuals Handling Building includes the demolition and construction of a new interior wall, a new monorail and hoist system and a new access door. The equipment to be demolished is the existing belt filter press, conveyor, control panels, polymer feed system, mixing/storage tanks and associated piping. The new equipment to be installed is a new belt filter press, polymer feed system with mixing and aging tanks, chemical metering pumps, horizontal belt conveyor, control panel, associated piping, valves, 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011400

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SECTION 011410 - SPECIAL PROVISIONS

PART 1 - GENERAL

1.1 SEQUENCE OF WORK, CONTINUOUS OPERATION

The existing belt filter press, conveyor and chemical feed equipment shall remain in continuous operation during the normal operation of the Taylor Mill Treatment Plant. Plant shutdown is scheduled to occur between November 2017 through March 2018. Contractor shall sequence all equipment replacement work within this plant shutdown window. Contractor shall complete all renovations to the Residual Handling Building including installation of monorail system, new access door, new interior utility room wall, etc., before anticipated plant shutdown. 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 MANUFACTURE & DELIVERY OF EQUIPMENT

The manufacture and delivery of equipment shall coincide with the sequence of work outlined in Paragraph 1.1. Equipment shall be manufactured and delivered in a timely manner to avoid degradation of equipment parts. Equipment shall be delivered within thirty (30) days of the equipment installation date.

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.

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

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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 6.05 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 damaged, 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 water treatment operations 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 water treatment plant during the construction period of the renovations to the Residual Handling Building and new belt filter press. The Contractor shall take all necessary precautions to minimize if not totally eliminate, the disruption in existing water treatment 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. Demolition and removal of the existing belt filter press, horizontal belt conveyor and polymer feed system and installation of the new belt filter press, horizontal belt conveyor and polymer feed system and must be coordinated with Owner. Anticipated project schedule is as follows:
 - 1. Notice of Award/Notice to Proceed – April 2017
 - 2. Equipment Submittal – May 2017
 - 3. Submittal Review – June 2017
 - 4. Equipment Fabrication and Delivery – December 2017
 - 5. Anticipated Plant Shutdown – November 2017 through March 2018
 - 6. Substantial Completion – February 2018
 - 7. Project Completion – March 2018
- B. Renovations to the building, including installation of the monorail system, new access door, new interior utility room wall, etc. shall be completed before anticipated plant shutdown.
- C. Blasting/sealing of existing concrete floors shall be completed after the installation of the new equipment but prior to new equipment startup.

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.
- 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. Perform Special Inspection as specified. Special Inspector personnel shall be in addition to the quality control inspections and inspectors required elsewhere in other Specifications.
- D. Special Inspection is required on the following structures:
 - 1. Residuals Handling Building – Taylor Mill Treatment Plant

1.3 SUBMITTALS

- A. Overall:
 - 1. Prepare and submit certifications:
 - a. Contractor's Statement of Responsibility: Submit before the start of construction, acknowledging the following:
 - 1) Awareness of the special requirements contained in the statement of special inspections.
 - 2) Acknowledgement that control will be exercised by the contractor to ensure conformance with the construction documents.
 - 3) Description of the procedures within the contractor's organization to exercise such control.
 - 4) The method by and frequency of which reports are distributed to the persons in the contractor's organization exercising the control.
 - 5) 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: BFW Engineering to submit before the start of construction.
 - c. Special Inspector's Final Certification: BFW Engineering to 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).

1.4 QUALIFICATIONS

- A. Use a qualified Special Inspector to perform Special Inspections required by this Section.
- B. Special Inspector's qualifications shall include information which provides evidence of the knowledge and experience necessary to qualify a person as a Special Inspector for the category of work being certified.
- C. The Special Inspector is a person employed by the Owner.
- D. Special Inspectors perform their duties independent from the construction quality control staff employed by the Contractor.
- E. More than one Special Inspector may be required to provide the varied knowledge and experience necessary to adequately inspect all of the categories of work requiring Special Inspection.

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.
 - 1. Reviewed 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, etc.) 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 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, etc.) 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 his obligation to perform the work in accordance with the Contract Documents.

END OF SECTION 014533

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. Temporary roads and paving.
 - 3. Sanitary facilities, including drinking water.
 - 4. Dewatering facilities and drains.
 - 5. Temporary enclosures.
 - 6. Project identification, bulletin boards and signs.
 - 7. Waste disposal services.
 - 8. Construction aids and miscellaneous general services and facilities.
 - 9. 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 Internet Service:
- 1. Furnish and install temporary telephone and internet service for construction needs throughout construction periods.
 - 2. Pay costs for temporary telephone and internet service including installation, maintenance, and removal.
 - 3. Pay service costs for all local telephone and internet 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.

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 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 paint, 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-exposed 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 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 SALVAGE MATERIAL

- A. All mixers, air compressors, polymer feed pumps, PLC's, 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. The Contractor shall keep a file of all salvage material and a copy shall be given to the Owner at the completion of the project.
- B. The existing belt filter press, conveyor and all remaining equipment not listed as salvage to be demolished and disposed of by the Contractor.

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 SUBMITTALS

The Contractor shall submit the following data for Engineer's review in accordance with Section 01 33 23.

- A. Concrete mixture proportions, test results and curves plotted to establish water-cementitious materials ratio if ACI 301-05 Section 4.2.3.4.b is followed.
- B. Proposed mix designs and all necessary substantiating data used to establish the proposed mix designs if ACI 301-05 Section 4.2.3.1 is followed.
- 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

1.3 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. Selection of Proportions for Class A Concrete:
 - a. 4,500 psi compressive for strength at 28 days.
 - b. Type 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.
 - 2. Selection of Proportions for Class B Concrete:
 - a. 3,000 psi compressive strength at 28 days.
 - b. Type I cement plus supplementary cementitious materials.
 - c. Max. water-cementitious materials ratio = 0.45.
 - d. Min. cement content = 470 lbs. (5.0 bags)/cu. yd. concrete.
 - 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. Concrete shall be used as follows:
 - 1. Class A concrete for all concrete work except as noted below.
 - 2. Class B concrete for fill concrete, thrust blocks and topping over hollow-core slabs, and where indicated on the Drawings.
- C. Type 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.
- D. 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.
- E. 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. He 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 use of admixtures to retard setting of the concrete during hot weather, to accelerate setting during cold weather, and to reduce water content without impairing workability will be permitted if the following conditions are met:
- J. 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.
- K. Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Engineer may at his 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 80oF. 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.
- L. When more than one (1) admixture is used, all admixtures shall be compatible. They should preferably be by the same manufacturer.
- M. 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.
3. Concrete anchors shall be an approved expansion type conforming to Federal Specification FF-S-325, Groups I, II, III, or VIII and shall be installed in strict accordance with the manufacturer's recommendations. Material for anchors shall be as specified in Section 05500 "Miscellaneous Metals". Anchors shall develop ultimate shear and pull out loads of not less than the following values in Class A concrete:

Bolt Diameter (Inches)	Min. Shear (Pounds)	Min. Pull-Out Load (Pounds)
2	4,500	4,600
5/8	6,900	7,700
3/4	10,500	9,900

- B. Epoxy bonding adhesive used to bond fresh plastic concrete to sound, hardened concrete shall meet the following Specification. Contractor shall furnish a notarized certification by the manufacturer that the proposed material meets the Specification.

1. Material:

The epoxy material shall consist of a 2-component system whose components conform to the following requirements:

- a. Component A - Component A shall be a modified epoxy resin of the epichlorohydrin bisphenol A condensation type, containing suitable viscosity control agents and having an epoxide equivalent of 180-200.
- b. Component B - The B component shall be primarily a reaction product of one mole of an aliphatic polyamine and two moles of mono-functional epoxide containing compounds modified with 2, 4, 6 tri (dimethylaminomethyl) phenol.
- c. The component ratio of B to A by volume shall be as specified by the manufacturer.

2. Properties of Mixed Components:

- | | | |
|----|-------------------------|---|
| a. | Solids Content | 100% by weight |
| b. | Pot Life | 25-35 min. @ 73oF. |
| c. | Tack-Free Time | 4-5-1/2 hrs @ (Thin Film) 73oF. |
| d. | Final Cure ASTM D 695 | 3 days at 73oF. (75% ultimate strength) |
| e. | Initial Viscosity (A+B) | 2,000 cps. min at 73oF. |
| f. | Color Mixed | Straw |

3. Properties of Cured Material (Neat Material):

- | | | |
|----|------------------------------------|--|
| a. | Tensile Strength
ASTM D 638 | 3,000 psi min. @
14 days 73oF. cure |
| b. | Tensile Elongation
ASTM D 638 | 2 - 2% at 14
modified days 73oF. cure |
| c. | Compressive Strength
ASTM D 695 | 12,500 psi min. at
73o F. cure |
| d. | Compressive Modules
ASTM D 695 | 470,000 psi min. @
28 days, 73oF cure |
| e. | Compressive Strength
ASTM D 695 | 5,500 psi min. @
24 days 73oF cure |
| f. | Water Pick-up
ASTM D 570 | 1.5 max. |

- C. Flashing reglets shall be as specified in Section 075300. Reglets shall be correctly placed into forms prior to placing concrete in formwork.
- D. Premolded expansion-joint filler strips shall conform to ASTM D 1752 and shall be 3/8-inch thick unless otherwise shown.
- E. 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.
- F. 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.
- G. 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.
- H. 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.

- I. 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.
- J. Form Liners: Form liners for construction of fluted wall treatment shall be prefabricated plastic liners as manufactured by Greenstreak Plastic Products, Interform Company, or Symons Corporation.
 - 1. Liners shall be fiberglass or ABS (acrylonitrile - butadiene - styrene) of such configuration as to obtain the fluted pattern shown or indicated on the Drawings.
 - 2. For purposes of designating type and quality of material required, form liners shall be pattern 361 trapezoidal liners as manufactured by Greenstreak Plastic Products.
 - 3. Preparation of forming materials, sealing of joints to prevent grout leakage and form release treatment (if required) shall be in strict compliance with the manufacturer's printed instructions and recommendations.

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. Patching 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 least 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. As soon as practicable, after the completion of the structures, the Contractor shall fill them with water and if leakages develop or wet spots show, the Contractor shall empty such structures and correct the leakage in an approved manner. Any cracks which appear in the concrete shall be dug out and suitably repaired. Temporary bulkheads over pipe openings in walls shall be provided as required for the testing.
 - 3. After repairs, if any are required, the structures shall be tested again and further repaired if necessary until satisfactory results are obtained. All work in connection with these tests and repairs shall be at the expense of the Contractor.
 - 4. Waterstops shall be placed in other locations as indicated on the Drawings and as may be required to assure the watertightness of all containers of liquids. 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 shimmed 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 his own expense, remove the entire section containing such defects and replace it with acceptable concrete.
- O. Manhole or access steps shall be plastic, constructed of copolymer polypropylene meeting the requirements of ASTM D 2146 for Type II, Grade 16906 material. Step shall be reinforced with ASTM A 615, Grade 60, #4 deformed steel reinforcing bar, be 9" deep, 14" wide, provided with notched tread ridge, foot retainer lugs on each side of tread and penetration stops for press fit installation. Plastic steps shall be PS2-PF as manufactured by M.A. industries, Inc., Peachtree City, Georgia. Steps shall be installed by drilling 1" diameter holes, minimum 3-3/4 inches deep into the wall, and then driving steps into hole to the penetration stop, resulting in a press fit condition.
- P. Tank pressure relief valves shall be 6" diameter Neenah Foundry Company R-5001-1, American Valve & Hydrant B315.1, or equal, floor type, with outside hooks or inside self-contained lock; quantity and spacing as shown on structural drawings. No part of pressure relief valves shall project above the neat line of the tank floor to prevent fouling of scraper mechanisms where used.
- Q. All existing contact surfaces with new patch shall be coated with moisture insensitive epoxy bonding adhesive, Sikadur Hi-Mod, Concrese 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

DIVISION 04

MASONRY

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SECTION 042000 - UNIT MASONRY

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. Concrete masonry units.
2. Concrete building brick.
3. Building (common) brick.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Masonry cavity insulation.
11. Dampproofing

- B. Intent: Work of the project includes a new opening in an existing masonry wall for a new overhead coiling door. The contractor shall salvage brick or match brick to tooth brick around the opening so there are only factory ends / edges exposed. Contractor shall also tooth CMU wythe around the opening with new CMU so there are only factory ends / edges exposed.

- C. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 - 1. Clay face brick, in the form of straps of five or more bricks if not using salvaged brick.
 - 2. Colored mortar.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect/Engineer and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties and material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 3. Mortar admixtures.
 - 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 5. Grout mixes. Include description of type and proportions of ingredients.
 - 6. Reinforcing bars.
 - 7. Joint reinforcement.
 - 8. Anchors, ties, and metal accessories.

- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Sample Panels: Not required.
- C. Mockups: Not required.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 24 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or 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 TMS 602/ACI 530.1/ASCE 6.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Not applicable.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi .
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 4. Exposed Faces: Provide color and texture matching the range of the existing brick masonry.

2.5 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C 216.

1. Grade: SW.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4150 psi (28.61 MPa).
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.
6. Color: Match existing.

2.6 MORTAR AND GROUT MATERIALS

A. Color: Match existing.

B. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

F. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

- H. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- I. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Wire Size for Veneer Ties: 0.187-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.
- E. Masonry-Joint Reinforcement for Multiwythe Masonry:
 - 1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.8 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
- B. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch (0.40 mm) thick.
 2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. (4.9-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. (3.7-kg/sq. m) weight or 0.0162 inch (0.41 mm) thick.
 3. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
 4. Fabricate through-wall flashing with drip edge. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees.
 5. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 6. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
 7. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
 8. Solder metal items at corners.
- B. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. Solder for Copper: ASTM B 32, Grade Sn50 with maximum lead content of 0.2 percent.
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use one of the following unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
 2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 3. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Configuration: Provide one of the following:
 - a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.11 MASONRY-CAVITY 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 17 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, and compatible with C.M.U. dampproofing coating.
- C. Dampproofing Coating: Provide cold-applied emulsified asphalt dampproofing coating compatible with rigid insulation board and rigid insulation board adhesive onto the exterior side of interior wythe (of C.M.U.) masonry wall.

2.12 COLD-APPLIED EMULSIFIED-ASPHALT DAMPPROOFING

- 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. APOC, Inc.; a division of Gardner-Gibson.
 2. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products.
 3. Brewer Company (The).
 4. ChemMasters, Inc.
 5. Euclid Chemical Company (The); an RPM company.
 6. Gardner-Gibson, Inc.
 7. Henry Company.
 8. Karnak Corporation.

9. Koppers Inc.
10. Malarkey Roofing Products.
11. Meadows, W. R., Inc.
12. Engineer approved equal

- B. Trowel Coats: ASTM D 1227, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.
- E. VOC Content: 30 g/L or less.
- F. Low-Emitting Materials: Damp-proofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.13 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type M or S.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.

3. Provide grout with a slump of 8 to 11 inch as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 3. Wedge nonload-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.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

2. Allow cleaned surfaces to dry before setting.
 3. Wet joint surfaces thoroughly before applying mortar.
 4. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive direct-applied finishes (other than paint) unless otherwise indicated.
- F. Cut joints flush where indicated to receive cavity wall insulation unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:
1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes or tab-type reinforcement.
 - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. 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.
1. Fill cracks and open gaps in insulation with Manufacturer's recommended crack sealer compatible with insulation and masonry.

3.7 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
- C. Form expansion joints in brick as follows:
 - 1. Build in compressible joint fillers where indicated.

3.9 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weeps in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at base and top of wall, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (**200 mm**), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry.
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 - 4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with

- elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent products to form weep holes.
 2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.11 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Contractor will engage Owner selected special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspector has verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspector has verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 4 inches in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

DIVISION 05

METALS

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SECTION 051200 - STRUCTURAL STEEL

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 framing and all miscellaneous steel.

- B. Related Sections:

- 1. Division 01 Section "Quality Requirements" for testing agency procedures and administrative requirements.
 - 2. Division 09 Section "High Performance Paints & Coatings" for painting requirements.

- C. Shop Drawings: Show fabrication of structural-steel components.

- 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. 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.
 - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabricator shall have minimum 3 years of successful past performance of contracts for similar structures and shall be subject to approval by the Owner and Engineer based on successful past performance of contracts on similar structures.

- B. Installer Qualifications: Installer shall have minimum 3 years of successful past performance of contracts for similar structures for similar projects and shall be subject to approval by the Owner and Engineer based on successful past performance of contracts on similar structures.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- D. Comply with applicable provisions of the following specifications and documents:

- 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.4 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. Structural Steel Shapes shall conform to the ASTM specifications indicated on the drawings.
- B. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-strength structural bolts, nuts and washers shall conform to the requirements indicated on the drawings.

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: ASTM A 780.

2.4 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

4. Mark and match-mark materials for field assembly.
 5. 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. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.6 SHOP PRIMING & PAINTING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar
 2. Surfaces to be field welded.
 3. Galvanized surfaces.
- 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, except as otherwise required for special finishes:
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. 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.

2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Where indicated, apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
- B. 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.

2.8 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner may engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- 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.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove shims.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges." Tolerances of Runway beam after erection shall be in accordance with CMAA 70.
- D. 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 will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Structural Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: As-indicated on drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to inspect steel construction.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. 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.
- B. Painting: Paint steel in accordance with the Division 9 Painting and Coating Specification.
- C. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

END OF SECTION 051200

SECTION 055119 – ALUMINUM GRATING STAIRS

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 industrial type aluminum stair structural framing, grating treads risers, and railings as specified herein, and as needed for a complete and proper installation..

1.3 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments.

1.5 QUALITY ASSURANCE

- A. Comply with OSHA and local building codes.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with no less than three years of experience.
- C. Comply with recommendations of AWS, Structural Welding Code on Aluminum, D1.2 latest edition.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft..

2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360.

2.2 MATERIALS

A. Aluminum

1. Plate: Alloy 6061-T6, Mill Finish, Heat Treatable.
2. Structural Shapes: Alloy 6061-T6, ASTM B 308
3. Sheet Aluminum: ASTM B209 (ASTM B209M), Alloy 5052, H32 or H22 Temper.
4. Round Pipe: Alloy 6061-T6, ASTM B429
5. Square Tubing: Alloy 6063-T52, Extruded
6. Rectangular Tubing: Alloy 6063-T52, Extruded
7. Aluminum- Alloy Bars: ASTM B211 (ASTM B211M), Alloy 6061-T6

B. Grating- Aluminum

1. Material: ASTM B 211, Alloy 6061-T6 or 6063-T6
2. Construction Type: Swage-Locked , Standard Rectangular Bar
3. Surface: Serrated

2.3 FASTENERS

- A. All steel fasteners used with aluminum grating shall be galvanized or 316 Stainless Steel.
- B. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs.

2.4 MISCELLANEOUS MATERIALS

- A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Form exposed work with accurate angles and surfaces and straight edges.
- C. Weld connections to comply 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.
- D. Fabricate joints in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STAIR RAILINGS

- A. Comply with applicable requirements in Section 055202 "Aluminum Handrails and Railings".

2.7 FINISHES

- A. Grind weld joints smooth with adjacent finish surface.
- B. Coat aluminum in contact with dissimilar metals, masonry or lime products with one coat of bituminous paint.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

END OF SECTION 055119

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SECTION 055202 – ALUMINUM HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Extent and dimensions of handrails and railings are indicated on Drawings and include miscellaneous handrails and railing systems not included in other Sections of these Specifications.
- B. Type of handrails and railing systems in this Section is aluminum pipe handrails and railing systems.
- C. Products furnished but not installed under this Section include inserts and anchors preset in masonry and concrete for anchorage of hand rails and railing systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to Work of this Section.
- B. Structural Steel: Section 051200

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical data for products and processes used in handrails and railing systems, including finishes and grout.
- B. Shop Drawings: Shop details of fabrication and installation for each type and material of handrail and railing system required including plans, elevations, sections, profiles of rails, fittings, connections, and anchors.
- C. Samples: Prepare samples of each type of metal finish required on metal of same thickness and alloy indicated for final work. Where finish involves normal color and texture variations, include sample sets composed of two (2) or more units showing limits of such variations expected in completed work. Include 6" long samples of each distinctly different railing member including handrails, top rails, posts, and samples of fittings and brackets.

1.4 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.5 SYSTEM DESCRIPTION

- A. Structural Performance of Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
 - 1. Top Rail of Guardrail Systems: Concentrated load of 200 lbf (890 N) applied at any point and in any direction and a uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with a uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
 - 2. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf (890 N) applied at any point and in any direction and a uniform load of 50 lbf per linear foot (730 N/m) applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
 - 3. Infill Area of Guardrail Systems: Horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in the system including gates, panels, intermediate rails, balusters, or other elements composing the infill area. Loads on infill area need not be assumed to act concurrently with loads on top rails.
- B. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- C. Material for rails and gates shall be a minimum of 1-1/2" diameter Schedule 40 and for posts, a minimum of Schedule 80.

1.6 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.
- B. Design Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of structural computations for handrails and railing systems to determine compliance with structural performance requirements indicated.

1.7 STORAGE

- A. Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide handrails and railing systems of one of the following, or an approved equal. Handrail System shall be equal to "TUFRAIL" as manufactured by Thompson Fabricating Company.
 - 1. Thompson Fabricating Company, Inc., Birmingham, Alabama.
 - 2. Superior Railing Company
 - 3. Alumaguard

2.2 METALS

- A. General: Comply with standards indicated for forms and types of metals indicated or required for handrail and railing system components.
- B. Aluminum: Provide alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.
 - 1. Extruded Bar and Shapes: ASTM B 221, 6063-T6.
 - 2. Extruded Pipe and Tube: ASTM B 429, 6063-T6.
 - 3. Plate and Sheet: ASTM B 209, 6061-T6.
 - 4. Die and Hand Forgings: ASTM B 247, 6061-T6.
 - 5. Castings: ASTM B 26, 356-T6.

2.3 MISCELLANEOUS MATERIALS

- A. Nonshrink Nonmetallic Grout: Pre-mixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this Section.
- B. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS Specifications, and as required for color match, strength, and compatibility in fabricated items.
- C. Fasteners: Use fasteners of stainless steel for aluminum components, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials joined.
- D. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.
- E. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- F. Anchors and Inserts: Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated. Use nonferrous metal of hot-dipped galvanized anchors and inserts for exterior locations and

elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

- G. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel: Sherwin-Williams Zinc-Clad Galvanizing Compound #143-0255 or equal.
- H. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).
- I. Zinc Chromate Primer for Galvanized Metals: Sherwin-Williams Galvite, B50W3 or equal; for Ferrous Metals: Sherwin-Williams KemKromik Universal, B50Z Series or equal.

2.4 FABRICATION

- A. General: Fabricate handrails and railing systems to design, dimensions and details shown. Provide handrail and railing members in sizes and profiles indicated, with supporting posts and brackets of size and spacing shown, but not less than required to comply with requirements indicated for structural performance. Handrail systems which use fittings which are glued or pop-riveted will not be acceptable.
- B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Nonwelded Connections: Fabricate railing systems and handrails for interconnection of members by means of railing manufacturer's standard concealed mechanical fasteners and fittings unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- D. Welded Connections for Aluminum Pipe: Fabricate aluminum pipe handrails and railing systems for interconnection of members by concealed internal welds, which eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- E. Form changes in direction of railing members by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering.
- F. For handrails and railing systems with nonwelded connections which are exposed to exterior or to moisture from condensation or other sources, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing members.
- G. Toe Boards: Where required by O.S.H.A. and where indicated on the Drawings, provide toe boards at railing systems around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details shown or, if not shown, use manufacturer's standard detail. Toe boards shall be 4" high.
- H. Brackets, Flanges, Fittings and Anchors: Provide manufacturer's standard wall brackets, flanges, hinges, miscellaneous fittings and anchors for interconnection of handrail and railing members to other work, unless otherwise indicated.
- I. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work. Fabricate anchorage devices which are capable of withstanding

loadings imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

- J. For railing posts set in concrete provide preset sleeves of steel, not less than 6" long and inside dimensions not less than 2" greater than outside dimensions of post, with steel plate forming bottom closure.
- K. Provide slip-fit metal sockets to receive removable railing posts. Fabricate sockets for a close fit with posts and to limit deflection of post without lateral load, measured at top, not to exceed 1/12 of post height. Design and fabricate socket covers to resist accidental dislodgement.
- L. Gates: Provide gates of equal structural properties of railing system, with toe board. Hinges shall be capable of providing a swing of 180 degrees. Provide positive latching device which shall be operable from both sides of gate.

2.5 METAL FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations and designations of finishes, except as otherwise indicated.
- B. Class I Clear Anodized Finish: AA-M10C22A41 (medium satin directional textured mechanical finish; chemical etch, medium matte; 0.7 mil min. thick clear anodic coating) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.
- B. Field Measurements: Take field measurements prior to fabrication.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installation of handrails and railing systems. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Do not weld, cut or abrade surfaces of handrails and railing components which have been coated or finished after fabrication, and are intended for field connection by mechanical means without further cutting or fitting.
- C. Field Welding: Comply with applicable AWS Specification for procedures of manual shielded metal-arc welding, for appearance and quality, of welds made, and for methods used in

correcting welding work. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent rail surfaces.

- D. Corrosion Protection: Coat concealed surfaces of aluminum, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint or zinc chromate primer.
- E. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at 5'-0" o.c. MAX but not more than that required by design loadings.

3.3 ANCHORING POSTS

- A. Anchor aluminum handrail posts to concrete with manufacturer's base flange assembly (3 anchors per base) for top and side mount brackets recommended for meeting the design criteria. Base flanges and side mount brackets will not be welded to the post but will be mechanically fastened so as to achieve a rigid construction without annealing the post. All connections to concrete will be made using stainless steel wedge anchors, which are to be sized and furnished by the handrail manufacturer as an integral part of their handrail system. Anchor post on new concrete shall be side mounted except where shown otherwise on the drawings.
- B. Anchor posts to metal surfaces with manufacturer's standard fittings designed for this purpose unless otherwise indicated.
- C. Provide removable railing sections as indicated, using slip-fit metal sockets. Accurately locate sockets to match post spacing.

3.4 RAILING CONNECTIONS

- A. Nonwelded Connections: Use manufacturer's standard mechanical joints for permanently connecting railing components. Components that are glued or pop riveted at the joints will not be acceptable. All components must be mechanically fastened with stainless steel hardware. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic filler cement colored to match finish of handrails and railing systems.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fittings designed for this purpose.

3.5 ANCHORING RAILING ENDS

- A. Anchor railing ends into concrete or masonry with manufacturer's standard fittings designed for this purpose, unless otherwise indicated.
- B. Anchor railing ends to metal surfaces with manufacturer's standard fittings using concealed fasteners, unless otherwise indicated.

- C. Expansion Joints: Provide expansion joints at locations indicated or, if not indicated, at intervals not to exceed 40 feet. Provide slip-joint internal sleeve extending 2" beyond joint on either side; fasten internal sleeve securely to one side, locate joint within 6" of post.

3.6 ATTACHMENT OF HANDRAILS TO WALLS

- A. General: Secure handrails to walls with manufacturer's standard wall brackets and end fittings, unless otherwise indicated.
- B. For concrete and solid masonry, use drilled-in expansion shields and concealed hanger bolts, unless otherwise indicated.
- C. For hollow masonry anchorage, use toggle bolts with square heads, unless otherwise indicated.

3.7 PROTECTION

- A. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

END OF SECTION 055202

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SECTION 055210 - SAFETY RAILINGS AND GATES

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. Self-closing safety gates of the following types:
 - a. Extended coverage self-closing safety gates. (XL Series)

1.3 REFERENCES

- A. Product Data:

- 1. OSHA 29 CFR 1910.23 - Guarding Floor and Wall Openings and Holes.

1.4 SUBMITTALS

- A. Product Data Sheet:

- 1. Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
- 2. Shop Drawings: Drawings showing plans, elevations, sections and details of components.

1.5 QUALITY ASSURANCE

- A. Provide safety gates which meet or exceed OSHA 29CFR 1910.23 standards as applicable.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Where safety railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before delivery.

1.7 WARRANTY

- A. Warranty: Provide manufacture's standard limited warranty.

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - 1. FabEnCo, Inc.
 - 2. Approved equal.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 SELF-CLOSING SAFETY GATES

- A. Extended Coverage Self-Closing Safety Gates: XL Series by FabEnCo, Inc.
 - 1. Material: A36 carbon steel with safety yellow powder coat, Model No. XL71-PC.
 - 2. Height and Width: To fit clear opening indicated on the Drawings.
 - 3. Hardware: Stainless steel spring and zinc-plated bolts, nuts and washers.
 - 4. 12 gauge solid panel facing with safety yellow powder coat, flush facing on interior face.
 - 5. Impact bumper.

PART 3 - EXECUTION EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are achieved.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 055210

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SECTION 055300 – ALUMINUM GRATING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services required to furnish and install metal bar grating in accordance with the Drawings and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work of this section.
- B. Miscellaneous Metals and Fasteners are included in Division 05.

1.3 SUBMITTALS

Comply with Section 013323 as well as the requirements specified herein.

- A. Submit shop drawings to the Engineer for review before fabrication.
- B. Indicate areas to receive grating, grating details and dimensions, and material specifications.
- C. Show anchorage details and locations.
- D. Indicate coordination with equipment suppliers where openings for such equipment are required.

1.4 REFERENCE STANDARDS

- A. Design, fabrication and installation of grating shall be in accordance with Standard Specifications and Voluntary Code of Practice in Metal Bar Grating Manual, 1979 Edition, published by National Association of Architectural Metal Manufacturers, Chicago, Illinois (ANSI A 202.1).

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. Gratings shall meet or exceed the following design criteria:
- B. Support uniform live load of 100 psf.

- C. Deflection not to exceed span of bearing bars (in inches) divided by 360.
- D. Maximum fiber stress: 12,000 psi.

2.2 BASIC DESIGN

The basic design requirements are listed below:

- A. Shape: Rectangular.
- B. Type Construction: Pressure locked.
- C. Bar Sizes, unless otherwise shown on the Drawings:
 - 1. Bearing Bars: 1-1/2" x 3/16".
 - 2. Cross Bars: 1" x 1/8".
- D. Maximum Bar Spacing:
 - 1. Bearing Bars: 1-3/16" c-c.
 - 2. Cross Bars: 4" c-c.
- E. Banding Bars:
 - 1. Same thickness as bearing bars to which they are attached.
 - 2. At free ends: Same depth as bearing bars.
 - 3. At supported ends: 1/8" less in depth than bearing bars.
- F. Bearing and crossbars shall be flush at surface.
- G. All free and supported bar ends around perimeter and around cutouts shall be banded.
- H. Provide removable sections of grating with suitable end bearing where noted on the Drawings or otherwise required.

2.3 MATERIALS

- A. Aluminum Grating:

The materials of construction shall meet the following requirements:

- 1. Bearing Bars: ASTM B 221, 6061-T6 or 6063-T6, aluminum.
- 2. Cross Bars: ASTM B 221 (extruded) or ASTM B 210 (drawn) aluminum.
- 3. All steel fasteners used with aluminum grating shall be galvanized.
- 4. Finish: Aluminum mill finish (as fabricated).
- 5. Anchors: Saddle clips of manufacturer's standard design, galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Grating shall be fabricated as indicated by shop drawings which have been revised to reflect actual field measurements.
- B. Grating shall be set with full and uniform end bearing to preclude rocking; do not use wedges or shims.
- C. Provide 1-inch minimum bearing with maximum erection clearance of 1/4-inch all around.
- D. Anchor grating with saddle clips in accordance with manufacturer's recommendations or as detailed on the Drawings.
- E. Provide cutouts for the passage of pipe, valve and equipment operators, conduit, stems and similar work; cutouts for circular obstructions shall be at least 2" larger in diameter than the obstruction.
- F. Protect all surfaces of angles and frames to be in contact with concrete or dissimilar metals with two (2) coats of Fed. Spec. TT-V-51F Asphalt Varnish.

END OF SECTION 055300

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DIVISION 07

**THERMAL AND MOISTURE
PROTECTION**

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services for furnishing and installing the joint sealers in accordance with the Drawings and as specified herein.
- B. The extent of each form and type of joint sealer includes but is not limited to, the following general locations:
 - 1. Joints at penetrations of walls, decks, and floors by piping and other services and equipment.
 - 2. Joints between items of equipment and other construction.
 - 3. Joints at windows, doors and louvers.

1.2 RELATED DOCUMENTS SPECIFIED ELSEWHERE

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.3 SUBMITTALS

Comply with the requirements of Section 013323 as well as the requirements specified herein.

- A. Product Data: Submit manufacturer's technical data for each joint sealer product required, including instruction for joint preparation and joint sealer application.
- B. Samples for Initial Selection Purposes: Submit manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- C. Certificates: Submit certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.
- B. System Performance: Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi component materials.
- B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 degrees F. (4.4 degrees C).
 - 2. When joint substrates are wet due to rain, frost, condensation or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealers, 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 testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class, and Uses.
- B. Two-Part Pourable Urethane Sealant: Type M; Grade NS; Class 25; Uses T, M, A, and as applicable to joint substrates indicated.
- C. One-Part Nonsag Urethane Sealant: Type S; Grade NS; Class 25; Uses NT, M, A, and as applicable to joint substrates indicated.
- D. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Two Part, Pourable, Urethane Sealant:

"Chem-Calk 550"; Bostik Construction Product Division
"Pourthane"; W.R. Meadows, Inc.
"Sonolastic Paving Joint Sealant"; Sonneborn Building
Products Division, Rexnord Chemical Products, Inc.

2. One-Part Nonsag Urethane Sealant:

"Chem-Calk 900"; Bostik Construction Products Division
"Vulkem 116"; Mameco International, Inc.
"Sonolastic NP 1"; Sonneborn Building Products Division,
Rexnord Chemical Products, Inc.

2.3 LATEX JOINT SEALANTS

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, acrylic, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 384, formulated to be paintable and recommended for exposed applications on interior and on protected exterior exposures involving joint movement of not more than + or - 7.5%.
- B. Products: Subject to compliance with requirements, provide one of the following:

"Chem-Calk 600"; Bostik Construction Products Division
"AC-20"; Pecora Corp.
"Sonolac"; Sonneborn Building Products Division;
Rexnord Chemical Products, Inc.
"Tremco Acrylic Latex Caulk"; Tremco, Inc.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type which are non-staining; 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, non-waxing, non-extruding strips of plastic foam of material and size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Provide either flexible, open cell polyurethane foam or non-gassing, closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate and field tests.

- B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.
- C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Require Installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance.
- B. Obtain Installer's written report listing any conditions detrimental to performance of joint sealer work.
- C. Do not allow joint sealer work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
 - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.
 - 2. Clean concrete, masonry and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer 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 which 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 SEALERS

- A. General: Comply with joint sealer 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 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.
- D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
- E. 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 which allow optimum sealant movement capability. Do not leave gaps between ends of joint-fillers. Do not stretch, twist, puncture or tear joint-fillers. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.
- 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 which allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning of 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 which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.

3.4 PROTECTION AND CLEANING

- A. Protect joint sealers 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 sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.
- B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

END OF SECTION 07900

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DIVISION 08

OPENINGS

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SECTION 081113 - HOLLOW METAL 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087110 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. **Minimum Thickness:** Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. **Product Data:** For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. **Shop Drawings:** Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.

- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Custom Metal Products.
 - 4. Gensteel Doors, Inc.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches
- c. Half glass glazing: Factory install glazing in doors indicated to be factory finished.
 - 1) Safety glazing, provide glazing that complies with 16 CFR 1201, Category II.

2. Frames:

- a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
- b. Gauge: 18ga

3. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

2.5 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 - 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Three anchors per jamb from 60 to 90 inches high.
 - b. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

5. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; Position switches and Electronic Hardware include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates. See section 087111 "Door Hardware".
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.7 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
 - c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
 - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

3.4 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 hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

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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. Service doors.

- B. Related Requirements:

- 1. Section 051200 "Structural Steel" for miscellaneous steel supports.
 - 2. Section 083610 "Chain Drive Opener" for coordination of Obstruction Detection Devices limiting Chain Drive Opener to function only when Overhead Door is in open position.
 - 3. Division 26 for electrical service.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.

- 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include 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. Include diagrams for power, signal, and control wiring.

- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

- 1. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

- A. Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.
- B. Manufacturer's limited door warranty for 5 years on door system materials and workmanship.
- C. Manufacturer's limited door system warranty for 2 years for all parts and components.
- D. Manufacturer's limited door and operator warranty for 2 years for all parts and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - 1. Overhead Door Corporation - Rolling Aluminum Service Doors - Model 620.
 - a. RSX standard duty commercial operator.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: 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.

2.3 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Door Curtain Material: Aluminum.
- D. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
- E. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch; fabricated from aluminum extrusions and finished to match door.
- F. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats.
- G. Hood: Match curtain material and finish.
 - 1. Shape: Square.
 - 2. Mounting: Face of wall.
- H. Electric Door Operator - standard duty commercial operator:
 - 1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
 - 2. Operator Location: Top of hood.
 - 3. Motor Exposure: Exterior, wet, and humid.
 - 4. Emergency Manual Operation: Chain type.
 - 5. Obstruction-Detection Device: Automatic photoelectric sensor and bottom sensing edge.
 - 6. Secondary Obstruction-Detection Device: Auxiliary Output Module - Chain Drive Operator to be tied into Overhead Door via Auxiliary Output Module. This module will limit Chain Drive Operator to only function while Overhead Door is in open position.
 - 7. Control Station(s): Interior mounted.
- I. Curtain Accessories: Equip door with weatherseals.
- J. Door Finish:
 - 1. Aluminum Finish: Clear anodized.

2.4 MATERIALS, GENERAL

- 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.

2.5 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 sheet or ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch; and as required.
- B. 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.

2.6 HOODS

- A. General: Form 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. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.7 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.

2.8 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, seamless or welded 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. Counterbalance Spring: 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.

2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 - 1. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - 1. Bottom Sensing Edge
 - a. Electrically activated sensing edges separated by perforated foam when touch-activated send an electrical signal to stop or reverse the door
 - 2. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - 3. Auxiliary Output Module – Hoist beam Chain Drive Operator to be tied into Overhead Door via Auxiliary Output Module. This module will limit Chain Drive Operator to only function while Overhead Door is in open position.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 30 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" 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.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. 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, controls, and operators at the mounting locations indicated for each door.
- C. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

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SECTION 083610 - CHAIN AND BELT DRIVE OPENER

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. Electrical operators.

- B. Related Requirements:

- 1. Section 083323 "Overhead Coiling Doors" for coordination of Obstruction Detection Devices limiting Chain Drive Opener to function only when Overhead Door is in open position.
 - 2. Division 26 for electrical service.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:

- 1. Preparation instructions and recommendations.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. Installation methods.

- 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. Include diagrams for power, signal, and control wiring.

- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

- 1. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificates: Certify products meet or exceed specified requirements
- B. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric operators to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened labeled packaging until ready for installation.
- B. Protect materials from exposure to moisture until ready for installation.
- C. Store materials in a dry, ventilated weathertight location.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 WARRANTY

- A. Lifetime motor and integrated gearbox; 5 year limited warranty on chain; 5 year limited warranty on all other parts; 1 year limited warranty on accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - 1. Overhead Door Corporation - Chain Drive Opener – Legacy 800, Model 2026.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain opener and controls from overhead coiling door manufacturer.

2.2 ELECTRIC DOOR OPENER

- A. General: Electric Opener: Complete with electric motor and factory-prewired motor controls, solid state microcontroller with built-in surge suppressor, UL listed self-monitoring infrared sensing device integral to operator system and accessories required for proper operation.
- B. Motor: Reversible-type motor.
 1. 140 Volt AC, 1/2 HPc (Horsepower Comparable) Power Plus with 110 VAC power supply.
 2. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
- C. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses travel.
 1. Chain Drive Operator to be tied into Overhead Door via Auxiliary Output Module. This module will limit Chain Drive Operator to only receive power while Overhead Door is in fully open position.
- D. Drive Type / Speed:
 1. Chain Drive: Approximately 7.5 inches per second plus or minus 0.5 inch minimum.
- E. Operator Controls: RF315 MHz and 390 MHz Auto Seek dual frequency remote system in compliance with FCC:
 1. One transmitter: 3-button wall console.
- F. Lighting: 110V, designed for up to two 100W bulbs. Light is set to stay on for 4 minutes during operation of opener.
- G. Materials:
 1. Steel chassis
 2. Solid steel C-channel rail

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until openings and substrates have been properly prepared.

- B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- C. Verify electric power is available and of correct characteristics.
- D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- A. Install electric operator complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- C. Anchor assembly to construction and building framing without distortion or stress.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that opener operates easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

END OF SECTION 083610

SECTION 085123 - STEEL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes steel windows.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For hot-rolled steel windows.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Product test reports.
- C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating hot-rolled steel windows that meet performance requirements indicated and of documenting performance by labels, test reports, and calculations.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of hot-rolled steel windows that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. Window: Two years from date of Substantial Completion.
 - b. Finish: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. SWI Standards: Comply with applicable requirements in SWI's "The Architect's Guide to Steel Windows and Doors".
- B. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressures.

2.2 STEEL WINDOWS

- A. Operating Types: Provide the following operating types in locations indicated on Drawings:
 - 1. Fixed.
- B. Steel Windows: Provide frame and sash members formed from new billet steel sections. Provide combined weight of frame and sash members and depth of frame or sash members according to the SWI specifications category for Standard Intermediate hot-rolled steel windows.
- C. Window Finish: Factory primed.
- D. Glazing Stops: Provide manufacturer's standard screw-applied or snap-on glazing stops fabricated from extruded or formed sheet aluminum. Finish glazing stops with same finish as window units if fabricated of steel; otherwise, provide manufacturer's standard finish. Match color to window units.

2.3 GLAZING

- A. Safety glazing, provide glazing that complies with 16 CFR 1201, Category II. Fully tempered in windows within 48" of a door.

2.4 ACCESSORIES

- A. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of hot-rolled steel windows.
- B. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A 123/A 123M. Provide units with sufficient strength to withstand design pressure indicated.
 - 1. Windborne-Debris-Impact Resistance: Provide anchors and clips of same design used to pass windborne-debris-impact-resistance testing.

2.5 FABRICATION

- A. General: Fabricate windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.
- B. Provide weep holes and internal water passages to conduct infiltrating water to the exterior.

2.6 STEEL FINISHES

- A. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. SWI Publication: Comply with applicable requirements in SWI's "General Guidelines on the Installation of Steel Windows," except where more stringent requirements are indicated.
- B. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.
- C. Install windows level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- D. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- E. Install windows and components to drain condensation, water-penetrating joints, and moisture migrating within windows to the exterior.
- F. Separate corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112.

3.2 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

END OF SECTION 085123

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SECTION 087111 - DOOR HARDWARE

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. Mechanical door hardware for swinging doors.

- B. Related Sections:

- 1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Other Action Submittals:

- 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

- a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

- b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.

- c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

- d. Content: Include the following information:

- 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
- 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.

- 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
- 4) Fastenings and other pertinent information.
- 5) Explanation of abbreviations, symbols, and codes contained in schedule.
- 6) Mounting locations for door hardware.
- 7) List of related door devices specified in other Sections for each door and frame.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1.5 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article and on Drawings to comply with requirements in this Section.
 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 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. Baldwin Hardware Corporation.
 - b. Hager Companies.
 - c. Ives; an Allegion brand.
 - d. Lawrence Hardware Inc.
 - e. McKinney Products Company; an ASSA ABLOY Group company.
 - f. PBB, Inc.

g. Stanley Commercial Hardware; a division of Stanley Security Solutions.

B. Antifriction-Bearing Hinges:

1. Mounting: Full mortise (butts).
2. Bearing Material: Ball bearing.
3. Grade: Grade 1 (heavy weight).
4. Base and Pin Metal:

a. Interior Hinges: Brass with stainless-steel pin body and brass protruding heads or stainless steel with stainless-steel pin.

5. Pins: Non-rising loose unless otherwise indicated.
6. Tips: Flat button.
7. Corners: Square.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 9/16-inch latchbolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim: Provide BEST 14D lever and rose, or equivalent.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

2.4 MECHANICAL STOPS AND HOLDERS

A. Wall-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

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. Architectural Builders Hardware Mfg., Inc.
- b. Baldwin Hardware Corporation.
- c. Hager Companies.
- d. Ives; an Allegion brand.
- e. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
- f. Stanley Commercial Hardware; a division of Stanley Security Solutions.
- g. Trimco.

B. Wall Bumpers: Provide IVES WS401CCV x US26D or equivalent.

2.5 FABRICATION

- A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

2.6 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8, and ADA requirements.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface

protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

3.4 ADJUSTING

- A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

Door Hardware Set No. 01 - Passage		
Qty.	Item	Finish
3ea.	Full Mortise Hinge: Stanley FBB199 4.5x4.5 or equal.	US26D/US32D
1ea.	Lockset: BEST Series 9K; F75 Passage Function	US26D
1ea.	Closer: LCN4111 x CUSH or equal.	Alum.
1ea.	Stop: IVES WS401CCV or equal	US26D

END OF SECTION 087111

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SECTION 089119 - FIXED LOUVERS

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. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show mullion profiles and locations.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
- B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Blade Louver :
 - 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. Greenheck Fan Corporation.
 - c. Ruskin Company.
 - 2. Louver Depth: 6 inches (150 mm).
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
 - 4. Mullion Type: Exposed.

2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 - 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.5 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide subsills made of same material as louvers or extended sills for recessed louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

DIVISION 09

FINISHES

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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 Galvapak 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	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning			
1st Coat	Epoxoprime Series 201	6.0 - 8.0	Macropoxy 646 PW	4.0 – 6.0		
2nd Coat	Everthane Series 248	2.0 - 3.0	Macropoxy 646 PW	4.0 – 6.0		

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 145 SL	25 mils (Broadcast Silica)
3rd Coat	282 Theme-Glaze	8.0 – 12.0	CorCote HCR	15.0 – 20.0	Semstone 145 SL	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 Tufcrl	2.0-3.0 - 3.5	DTM Acrylic Coating	2.0 – 3.0	Carbocrylic 3359 DTM	2.0 – 3.0
3rd Coat	1029 Tufcrl	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 bandd
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

	<u>Location and/or Description</u>	<u>System</u>
1.	Residual Handling Building	
a.	Existing Concrete Floors	D.3
b.	Doors and Frame, Interior	A.6
c.	Cast-In-Place Concrete	D.3
d.	Piping & Equipment	A
e.	Block Walls	C.1
f.	Chemical Containment	D. 5

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DIVISION 22

PLUMBING

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SECTION 220100 - GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

- A. The General Requirements of this specification and Division 01, in its entirety, shall be considered part of this section and incorporated hereby, as if fully set forth herein. Requirements of Division 01 supersede and replace any statements in Division 23 with which they are in direct conflict. Sections 220100 through 228000 (as included) contain basic mechanical materials and methods of a general nature and apply to all work specified in Division 22, except as modified in individual sections.

1.1 SYSTEM DESCRIPTION

- A. Consult Plans and Specifications Sections 220100-208000
- B. Drawings:
 - 1. Drawings are schematic and show approximate locations of ducts, piping and equipment. Coordinate and field verify exact locations with other trades.
 - 2. Obtain Engineer's approval for significant deviations from drawing locations and layout.
 - 3. The Engineer reserves the right to make minor changes in the location of mechanical work or equipment prior to roughing-in without additional cost.
 - 4. Examine the Contract Documents and immediately report any error, discrepancy or omission. The Engineer will determine which interpretation shall take precedence where two or more conflicting statements occur. Otherwise, the Contractor is responsible for the more stringent (or expensive) interpretation. In general, schedules, wherever they appear, supersede specifications, and specifications supersede plans.
 - 5. Contractor shall make use of all data in all Contract Documents and shall verify this information at the building site. All Drawings of the Contract set are hereby made a part of these Specifications and shall be consulted by Contractor and his work adjusted to meet the conditions shown thereon.

1.2 QUALITY ASSURANCE

- A. Materials, equipment and installation shall meet the requirements of the following as applicable:
 - 1. American Gas Association (AGA)
 - 2. American National Standards Institute (ANSI).
 - 3. American Society for Testing and Materials (ASTM).
 - 4. American Society of Mechanical Engineers (ASME).
 - 5. National Fire Protection Association (NFPA).
 - 6. Underwriters Laboratories (UL).
- B. All equipment shall bear the label of an approved independent testing laboratory (e.g. UL), where such standards exist.
- C. All equipment shall be supplied with integral fusing as required for compliance with its listing.

- D. Performance of work shall be in strict accordance with the best common practices of the trades involved, in a thorough, substantial, neat, and workman-like manner by competent, qualified workmen. No trainees or apprentice workmen shall be allowed at the job site unless under the direct, continuous supervision of a qualified journeyman. All work on HVAC, plumbing, fire protection or electrical systems shall be supervised and performed by individuals properly licensed, where required by state law, or as otherwise indicated in these Documents.

1.3 REGULATORY REQUIREMENTS

- A. The work in this Division shall meet the requirements, as applicable, of the following Codes and regulatory bodies:
 - 1. Kentucky Building Code.
 - 2. Kentucky Department for Natural Resources and Environmental Protection.
 - 3. Kentucky and Local Construction and Building Code Officials.
 - 4. Life Safety Code - NFPA 101.
 - 5. Local Building Codes and Health Department.
 - 6. Local Utility Regulations.
 - 7. ANSI 17.1 Elevator Code as adopted by IBC.
 - 8. Americans with Disabilities Act (ADA) - Where referenced, product design and installation shall meet minimum requirements of the Act.
- B. Conformity with code requirements shall be maintained whether or not official inspections, fees or certificates are required due to project not falling under scope or jurisdiction of regulatory agencies.

1.4 REFERENCES

- A. With regard to this Project and these Contract Documents, the following specific definitions shall apply:
 - 1. "Furnish": To purchase and deliver products to the project site and prepare for installation.
 - 2. "Install": To take furnished products, assemble, erect, secure, connect and place into operation.
 - 3. "Provide": To furnish and install.
 - 4. "Products": Includes materials, systems, equipment and accessories, as specified.
 - 5. "Work": The providing of products for any or all of the entire Contract.
 - 6. "Project": The sum total of all work by all parties, to be accomplished as directed in the Contract Documents.
 - 7. "Documents", "Contract Documents": All Plans, Specifications, addenda, bid packages and any other enclosures, agreements or instruments specifically included in the Contract.
 - 8. "Division(s)": Means the generally accepted subdivisions of the Specifications, usually according to the CSI scheme of organizing construction documents, such as Division 23 - Mechanical, Division 26 - Electrical, etc. Also refers to all work covered within the referenced Division(s) of the Specifications.
 - 9. "Section(s)": Means the subdivisions of the "Division" of construction specifications, such as, under Division 23, Section 230100 - General Mechanical Provisions, Section

230111 - Scope of Work, etc. Also refers to all work covered within the referenced Section(s) of the Specifications.

10. "Engineer", "Architect", "E/A", "A/E": The engineering, architectural or architectural/engineering firm with design authority for the Project.
11. "Contractor": Means the General Contractor and also the Plumbing, Fire Protection, Controls, HVAC or any other Mechanical Contractor, individually or collectively.
12. "Concealed": Embedded in or installed behind walls, within partitions, above ceilings, in trenches, in tunnels and crawl spaces. Areas above lay-in ceilings, in crawl spaces or in service tunnels and trenches, other than stand-up utility tunnels, chases or vaults, may be considered concealed with reference to appearance or finish but not concealed with respect to accessibility. Check for specific exceptions.
13. "Exposed": Not installed underground or "concealed" as defined above. Generally, systems in all mechanical spaces, including mechanical or boiler rooms, stand-up or walk-thru chases and utility tunnels or vaults shall be considered to be exposed with respect to finish or accessibility requirements.
14. "Equivalent" or "Equal": In the opinion of the Engineer, acceptably comparable in concept, form, quality, performance and compatibility with the design.
15. "Mechanical": May refer to all mechanical trades, including HVAC, plumbing, fire protection, or may refer to HVAC work as opposed to say plumbing, the difference being necessarily taken from context.
16. "Plans", "Drawings": Mean all information presented in a drawing or graphical format, which have been included in the Contract, including but not limited to plans, sections, elevations, details, diagrams, schedules, notes, legends and addenda thereto.
17. "Specifications": Means all information pertaining to performing the Work, presented in text format and in the accepted organization of Divisions and Sections and in the addenda thereto.
18. "Addendum", "Addenda": Means information published after the original distribution of Documents (but before the Bid Opening), which may contain changes to Drawings, Specifications or the bidding process. Such information carries the same weight as if originally included in the Documents.
19. "Demolish": Means to carefully and legally disconnect, separate and remove the item from the project site and dispose of it, unless specific directions are given in these Documents to move, preserve, store or transport the item to a different location, in which case, "Demolish" shall mean to disconnect and take out of service.

B. Abbreviations and Symbology:

1. Refer to the following references for any abbreviations, acronyms or symbols not defined in the Contract Documents:
 - a. ASHRAE Fundamentals Handbook, current edition, chapter on Abbreviations and Symbols.
2. The following abbreviations may be used throughout the mechanical Documents. Refer also to legends or symbol lists on Drawings and to architectural abbreviations. Note that all abbreviations are not necessarily used.

A, AMP	Ampere	AAE	Automatic Air
AV	Air Vent		Eliminator
AAV	Automatic Air Vent	ABV	Above
AC	Alternating Current	ACCU	Air Cooled Condensing

	Air Conditioning		Unit
AD	Access Door	ADDL	Additional
ADJ	Adjustable	ARL	Above Roof Level
	Adjacent		
A/E	Architect/Engineer	AFF	Above Finished Floor
AHU	Air Handling Unit	ALT	Altitude
AL	Aluminum		Alternate
ALTN	Alternate	ANOD	Anodized, Anode
AP	Access Panel	APPROX	Approximate
ARCH	Architect(ural)	ATM	Atmosphere
AUTO	Automatic	AV	Acid Vent
AVG	Average	AW	Acid Waste
AWG	American Wire	AWT	Average Water
	Gauge		Temperature
AFD	Adj. Freq. Drive		
BDD	Backdraft Damper	BD	Board
BEL	Below	BHP	Brake Horsepower
BLDG	Building	BOD	Bottom of Duct
BOP	Bottom of Pipe	(Elevation)	
	(Elevation)	BRK	Break, Breaker
BRKT	Bracket	BRZ	Bronze, Braze
BS	Bird Screen	BSMT	Basement
BTU	British Thermal	BTUH	BTU/HR
	Unit	BFP	Backflow Preventer
CAP	Capacity	CB	Catch Basin
CC	Center to Center	CD	Ceiling Diffuser
CEIL	Ceiling	CENT	Central
CFH	Cubic Feet/Hour	CFM	Cubic Feet/Minute
CHG	Charge, Change	CG	Ceiling Grille
CI	Cast Iron	CKT	Circuit
CLG	Cooling	CLO	Closet
CLR	Clear	CO	Carbon Monoxide
CO	Cleanout	CO2	Carbon Dioxide
COL	Column	COMP	Compound
CONC	Concrete		Compressor (ed)
COND	Condensate,	CONFIG	Configuration
	Condensation	CONN	Connection
	Condenser	CONST	Construction
CONT	Control(s),	CONTR	Contractor
	Continuous	COP	Coefficient of
	Coupling		Performance,
CPLG	Coupling		
CT	Cooling Tower	Copper	
CTR	Center	CU	Copper, Condensing
CUH	Cabinet Unit		Unit, Cubic
	Heater	CIRC	Circular
CW	Cold Water	CWR	Chilled Water
CWS	Chilled Water		Return
	Supply	CR	Ceiling Register

D	Depth, Diameter Differential	dB DOUB	Decibels Double
DB	Dry Bulb	DC	Direct Current
DCW	Domestic Cold Water	DD DDC	Direct Drive Direct Digital Control
DET	Detail		
DF	Drinking Fountain	DG	Door Grille
DHW	Domestic Hot Water	DHWR	Domestic Hot Water Return
DI	Double Inlet		
DIA	Diameter	DIFF	Diffuser
DIM	Dimension	DISC	Disconnect
DISCH	Discharge	DL	Door Louver
DN	Down	DP	Double Pole
DS	Downspout	DT	Double Throw
DW	Double Width	DWG	Drawing
DWH	Domestic Water Heater	DWV	Drain, Waste and Vent
DR	Drain	DHBC	See HBC
E	East	EA	Each, Entering Air
EER	Energy Efficiency Ratio	EF	Exhaust Air Exhaust Fan
		EGW	Ethylene Glycol/ Water Mixture
EL	Elevation		
ELEC	Electric	EMD	End of Main Drip
EMER	Emergency	ENTR	Entrance
ENT	Entering	EQUIP	Equipment
EQ	Equal, Equivalent	ET	Entering Temperature
EVAP	Evaporative		Expansion Tank
EW	Eye Wash	EWC	Electric Water Cooler
EWH	Electric Wall Heater		
EWT	Entering Water Temperature	EXH EXIST	Exhaust Existing
EXP	Expansion, Exposed, Explosion	EXT	Exterior, External, Extruded
EDB	Entering Dry Bulb	EAT	Entering Air Temperature
EWB	Entering Wet Bulb	ESP	Ext.Static Pres.
F	Fahrenheit Temperature	FCU FD	Fan/Coil Unit Floor Drain
FDN	Foundation		Fire Damper
FE	Fire Extinguisher	FEC	Fire Extinguisher Cabinet
FF	Fouling Factor	FH	Fire Hydrant
FHC	Fire Hose Cabinet	FIG	Figure
FIN	Finish	FL, FLR	Floor
FLA	Full Load Amps	FLEX	Flexible
FLUOR	Fluorescent	FOR	Fuel Oil Return
FOS	Fuel Oil Supply, Suction	FP FPF	Fire Protection Fins Per Foot

FPH	Frost-Proof Hydrant	FPM	Feet Per Minute
FPT	Female Pipe Thread	FPS	Feet Per Second
FTR	Finned Tube Radiation	FR	Frame
FCV	Flow Cont. Valve	FT	Feet
		FVC	Fire Valve Cabinet
		FSD	Fire/Smoke Damper
GA	Gauge	GAL	Gallon
GALV	Galvanized	GI	Grease Interceptor
GL	Glass	GND, GRD	Ground
GPD	Gallons Per Day	GPH	Gallons Per Hour
GPM	Gallons Per Minute	GR	Grade, Grille
H	Height, Horizontal	HB	Hose Bib
HT, HGT	Height	HD	Head
HIGH	Height	HDWE	Hardware
HEX	Hexagonal	HOA	Hand/Off/Automatic
HORIZ	Horizontal	HP	High Pressure
HPR	High Pressure Steam Condensate Return		Horsepower
		HPS	Heat Pump
HI	High		High Pressure Steam
HR	Hour	HS	Hair Strainer
HTG	Heating	HTR	Heater
HUH	Horizontal Unit Heater	HVAC	Heating, Ventilating and Air Conditioning
HVY	Heavy		Air Conditioning
HW	Hot Water	HWR	Heating Hot Water Return
HWS	Heating Hot Water Supply	HZ	Hertz = CPS = Cycles/Sec.
		HWH	Hot Water Heater (Domestic)
ID	Inside Diameter, Inside Dimension	ID	Identification
ICC	International Code Council	IDENT	Identification
IN	Inches, Input	IFB	Integral Face and Bypass Damper
IN.Hg	Inches of Mercury	INCAND	Incandescent
INJ	Injection, Injector	INSUL	Insulation
IND	Indirect Drain	IN.W.C.,	Inches of Water column
IR	Infrared	IN.W.G.	Invert
IMC	International Mechanical Code	INV	
JT	Joint		
KIT	Kitchen	KV	Kilovolt
KVA	Kilovolt Amps	KW	Kilowatt
KWH	Kilowatthour	IBC	In.. Bldg. Code

L	Long, Louver, Latent	LB, #	Pound
LFS	Low Fire Start	LG	Length
LAT	Leaving Air Temperature	LAV	Lavatory
	Latent	LIQ	Liquid
LP	Low Pressure	LPR	Low Pressure
	Liquified Petroleum (Gas)		Steam Condensate Return
LPS	Low Pressure Steam	LT	Light, Leaving Temperature
LTG	Lighting		
LWT	Leaving Water Temperature	LVG	Leaving
		LDB	Leaving Dry Bulb
LWB	Leaving Wet Bulb	LO	Low
MA	Milliampere	MACH	Machine
MAN	Manual	MATL	Material
MAV	Manual Air Vent	MAX	Maximum
MBH	Thousand BTU Per Hour	MD	Manual Damper
		MECH	Mechanical
MET	Metal	MEZZ	Mezzanine
MFR	Manufacturer	MH	Manhole
MIN	Minimum, Minute	MISC	Miscellaneous
MK	Mark	MO	Motor-Operated
MOD	Motorized Damper Modulating		Month
		MPH	Miles Per Hour
MPR	Medium Pressure Steam Condensate Return	MPS	Medium Pressure Steam
		MPT	Male Pipe Thread
MS	Motor Starter	MT	Mount
MTD	Mounted	MTG	Mounting
MV	Millivolt	MW	Megawatt
MCC	Motor Control Ctr.		
N	North, Neutral	NC	Noise Criteria
NEUT	Neutral		Normally Closed
NIC	Not In Contract	NO	Normally Open
NOM	Nominal		Number
NPSH	Net Positive Suction Head	NTS	Not To Scale
O2	Oxygen	OA	Outside Air
OBD	Opposed Blade Damper	OD	Outside Diameter Outside Dimension
OC	On Center (s)	OPN	Operation
OPP	Opposite	OPNG	Opening
OVHD	Overhead	OZ	Ounces
P	Pressure, Pump	PD	Pressure Drop
PERF	Perforated	PH	Phase
PIV	Post Indicator	PL	Plate,

	Valve		Property Line
PLBG	Plumbing	PNEU	Pneumatic
PNL	Panel	PPM	Parts Per Million
PR	Pair	PRELIM	Preliminary
PRES	Pressure	PRI	Primary
PRV	Pressure	PSC	Permanent Split Capacitor
	Regulating Valve		
PSF	Pounds Per Square Foot	PSI	Pounds Per Square Inch
PSIG	Pounds Per Square Inch, Gauge	PT	Plaster Trap Point
PVC	Polyvinyl chloride	∅	Phase
PCR	Pumped Condensate Return	POC	Point of Conn.
QT	Quart	QTY	Quantity
QUAL	Quality	QX	Heat Exchanger
R	Thermal or Electrical Resistance, Radius	RA RAD RCP	Return Air Radius Reinforced Concrete Pipe
RD	Roof Drain		
RECIRC	Recirculating	RECOV	Recovery
RED	Reducing	REG	Register
REINF	Reinforced		Regulator
REQD	Required	REV	Revised, Revision
RH	Relative Humidity	RM	Room
RND, ∅	Round	RPM	Revolutions Per Minute
RPS	Revolutions Per Second	RWC, RWL	Rainwater Conductor
RG, RAG	Return Air Grille	RPZ	Reduced Pressure Zone (BFP)
RF	Return Fan		
RECT	Rectangular		
S	South, Sensible	SA	Supply Air
SAN	Sanitary	SCH	Schedule
	SCHED	Schedule(d)	
SCR	Silicon-Controlled Rectifier	SD	Smoke Detector Storm Drain
SEC	Secondary	SECT	Section, Sector
SENS	Sensible	SERV	Service
SF	Square Feet Supply Fan	SGL SG, SAG	Single Supply Air Grille
SH	Sheet	SHT	Sheet
SING	Single	SIM	Similar
SOL	Solenoid	SP	Static Pressure
SPEC(S)	Specification(s)		Space
SP.GR.	Specific Gravity		Single Pole
SQ	Square	STRUCT	Structural
SS	Stainless Steel Sanitary Sewer	ST	Sound Trap, Single Throw

	or Storm Sewer (See Legend)	SWP	Steam Working Pressure
STD	Standard	STL	Steel
STM	Steam	STOR	Storage
STR	Straight	STRL	Structural
SUP	Support(ed)	SUSP	Suspend(ed)
SW	Switch	SYS, SYST	System
T	Temperature, Total	T&B	Top and Bottom
TAB	Testing Adjusting & Balancing	TOT	Testing & Balancing Total
TD	Temperature Difference	TDH	Total Dynamic Head
TEFC	Totally Enclosed Fan Cooled	TEMP	Temperature Temporary
TERM	Terminal	THK	Thick
THRU	Through	TYP	Typical
TG, TAG	Transfer Grille		
U	Overall Heat Transfer Coefficient	UC	Undercut
UH	Unit Heater	UGND	Underground
UTIL	Utility, Utilities	UR	Urinal
		UV	Ultraviolet Unit Ventilator
V	Volts, Vent Vertical, Velocity	VAC	Vacuum
VCP	Vitrified Clay Pipe	VEL	Velocity
VERT	Vertical	VENT	Ventilat(or), (ion), (e)
VOL	Volume	VSP	Vitrified Sewer Pipe
VTR	Vent Thru Roof	VSD, VFD	Variable Speed Drive
VUH	Vert. Unit Heater		
W	Waste, Water Watt, West, Width	W/	With
WC	Water Column Water Closet	WB	Wet Bulb
WG	Water Gauge	WOG	Water, Oil or Gas
WL	Water Level	WH	Wall Hydrant
W/O	Without	WO	Waste Oil
WSHP	Water Source Heat Pump	WP	Working Pressure
		WT	Weight
		WTR	Water
XFMR	Transformer	XBRA	Cross Bracing
XT	Expansion Tank	XFER	Transfer
XA	Transfer Air		
YD	Yard	YH	Yard Hydrant
YR	Year		

Z Impedence

C. Organizational Acronyms:

AABC	Associated Air Balance Council
AAF	Association of Air-Conditioning of Argentina
AAMP	American Association of Meat Processors
ABC	Air Balance Consultants
ABMA	American Boiler Manufacturers Association
ACCA	Air Conditioning Contractors of America
ACEC	American Consulting Engineers Council
ACEEE	American Council for an Energy Efficient Economy
ACGIH	American Conference of Governmental Industrial Hygienists
ACPA	American Concrete Pipe Association
ADC	Air Diffusion Council
ADDA	American Design Drafting Association
ADI	Air Distribution Institute
AEE	Association of Energy Engineers
AESP	Association of Energy Services Professionals
AFBMA	Antifriction Bearing Manufacturers Association
AFE	Association for Facilities Engineering
AFEAS	Alternative Fluorocarbons Environmental Acceptability Study
AFFI	American Frozen Foods Institute
AFSA	American Fire Sprinkler Association
AGA	American Gas Association
AGAR	American Gas Association Research
AGCA	Associated General Contractors of America
AGCC	American Gas Cooling Center, Inc.
AHAM	Association of Home Appliance Manufacturers
AIA	American Institute of Architects
AIAQC	American IAQ Council
AIC	American Institute of Contractors
AIM/R	Association of Industry Manufacturers Representatives
AISETF	Association of Independent Scientific, Engineering, and Testing Firms
AMCA	Air Movement and Control Association International
AMCA-HVI	Home Ventilating Institute Division
ANSI	American National Standards Institute
APEC	Automated Procedures for Engineering Consultants, Inc.
APFA	American Pipe Fittings Association
ARDM	Association of Refrigerant Desuperheaters Manufacturers/Trevor-Martin Corp.
AREMA	Air-Conditioning and Refrigeration Equipment Manufacturers Association
ARI	Air-Conditioning and Refrigeration Institute
ARW	Air Conditioning & Refrigeration Wholesalers International
ASA	American Subcontractors Association
ASA	American Supply Association
ASC	Associated Specialty Contractors
ASE	Alliance to Save Energy
ASES	American Solar Energy Society

ASGE	American Society of Gas Engineers
ASHI	American Society of Home Inspectors
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASIC	American Society of Home Inspectors
ASME	American Society Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASPE	American Society of Professional Estimators
ASSE	American Society of Safety Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials
AUCA	American Underground Construction Association
AWS	American Welding Society
AWT	Association of Water Treatment
AWWA	American Water Works Association
BHCC	Better Heating-Cooling Council
BIASC	Building Industry Association of Southern California
BOCA	Building Officials & Code Administration International, Inc. (ICC)
BOMA	Building Owners & Managers Association
CABA	Continental Automated Buildings Association
CBAC	Commercial Building Air Conditioning Center
CCPI/AEE	Cogeneration & Competitive Power Institute, Div. of AEE
CDA	Copper Development Association Inc.
CERI	Clean Energy Research Institute, University of Miami
CIBSE	Chartered Institution of Building Services Engineers
CIDC	Construction Industry Development Council
CIMA	Cellulose Insulation Manufacturers Association
CMAA	Construction Management Association of America
CISPI	Cast Iron Soil Pipe Institute
COBRA	Cogeneration Boilers Stationary Engineers Association
CPPA	Corrugated Polyethylene Pipe Association
CRC	Chemical Rubber Co. (Handbook)
CRMA	Commercial Refrigerator Manufacturers Association
CS	Commercial Standards (sometimes known as commodity standards') produced by the U.S. Department of Commerce
CSA	Cryogenic Society of American, Inc.
CSI	Construction Specifications Institute
CTI	Cooling Technology Institute
EC	Envirosense Consortium, Inc.
ECI	Evaporative Cooling Institute, Inc.
EEL	Edison Electric Institute
EIA	Environmental Information Association, Inc.
EIC	Energy Ideas Clearinghouse
EPRI	Electric Power Research Institute
EREC	Energy Efficiency & Renewable Energy Clearinghouse
ESC	EnviroSense Consortium — IAQ
FM	Factory Mutual System
FMI	Food Marketing Institute
FPMSA	Food Processing Machinery and Supplies Association
FS	Federal Specification
GAMA	Gas Appliance Manufacturers Association

GEA	Geothermal Energy Association
GHPC	Geothermal Heat Pump Consortium, Inc.
GHPC NIRC	Geothermal Heat Pump Consortium National Information Resource Center
GRI	Gas Research Institute
HA	Heating Alternatives, Inc.
HAA	Home Automation Association
HI	Hydronics Institute Division of GAMA
HPA	Hearth Products Association
HRAI	Heating, Refrigeration and Air Conditioning Contractors
HVCA	Heating and Ventilating Contractors' Association
HVI	Home Ventilating Institute Division of AMCA
IAFIS	International Association of Food Industry, Supplies
IAPMO	International Association of Plumbing & Mechanical Officials
IAQA	Indoor Air Quality Association
IARW	International Association of Refrigerated Warehouses
IBR	Hydronics Institute
ICA	Independent Contractors Association
ICA	Insulation Contractors of America
ICARMA	International Council of Air-Conditioning and Refrigeration Manufacturers' Associations
ICBO	International Conference of Building Officials
ICC	International Code Council
ICRA	International Compressor Remanufactures Association
ICS	Industrial Computing Society
ICT	Institute of Gas Technology
IDEA	International District Energy Association
IEC	Independent Electrical Contractors Inc.
IEEE	The Institute of Electrical and Electronic Engineers
IEQA	Indoor Environmental Quality Alliance
IESNA	Illuminating Engineering Society of North America
IFMA	International Facility Management Association
IGA	International Geothermal Association
IGSHPA	International Ground Source Heat Pump Association
IGT	Institute of Gas Technology
IHACI	Institute of Heating & Air Conditioning, Inc.
IJAR	International Institute of Ammonia Refrigeration
IIEC	Sustainable Energy Guide
IRI	Industrial Risk Insurers (Formerly FIA)
ISA	International Society for Measurement and Control
ISB	Institute for Sick Buildings
ISES	International Solar Energy Society
ISO	International Standards Organizations
LIA	LonMark Interoperability Association
MACS	Mobile Air Conditioning Society
MACSW	Mobile Air Conditioning Society Worldwide
MANA	Manufacturers' Agents National Association
MCA	Mechanical Contractors Association
MCAA	Mechanical Contractors Association of America, Inc
MHANA	Masonry Heater Association of North America
MICA	Midwest Insulation Contractors Association Home Page

MSCA	Mechanical Service Contactors of America
MIL	Military Specifications
MSS	Manufacturer's Standardization Society of the Valves and Fitting Industry
NACE	NACE International, the Corrosion Society
NADCA	National Air Duct Cleaners Association
NAEIR	National Association for the Exchange of Industrial Resources
NAESCO	National Association of Energy Service Companies
NAESP	National Association of Energy Services Companies
NAFA	National Air Filtration Association
NAFEM	North American Association of Food Equipment Manufacturers
NAHB	National Association of Homebuilders
NAHBRC	National Association of Home Builders Remodelors Council
NAIMA	North American Insulation Manufacturers Association
NAOHSM	National Association of Oil Heating Service Managers
NAPCA	National Association of Pipe Coating Applicators
NAPE	National Association of Power Engineers
NAPF	National Association of Pipe Fabricators
NAPH	National Alliance of Plumbing-Heating-Cooling Contractors
NARI	National Association of the Remodeling Industry
NASM	National Association of Service Managers
NATE	North American Technician Excellence, Inc.
NAW	National Association of Wholesaler-Distributors
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors
NBS	National Bureau of Standards
NCIAQ	National Coalition on Indoor Air Quality
NCRSA	National Commercial Refrigeration Sales Association
NCSBCS	National Conference of States on Building Codes and Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code (NFPA 70)
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NEMI	National Energy Management Institute
NESEA	Northeast Sustainable Energy Association
NFPA	National Fire Protection Association
NFSA	National Fire Sprinkler Association, Inc.
NGWA	National Ground Water Association
NHRAW	North American Heating, Refrigeration & Air Conditioning Wholesalers Association
NIBS	National Institute of Building Sciences
NIST	U.S. National Institute of Standards and Technology
NMA	National Mining Association
NPGA	National Propane Gas Association
NRA	National Restaurant Association
NRCA	National Refrigeration Contractors Association
NRCA	National Roofing Contractors Association
NSAE	National Society of Architectural Engineers
NSPE	National Society of Professional Engineers
NUCA	National Utility Contractors Association
NWSA	National Welding Supply Association
OMA	Oil Heat Manufacturers Association

OSHA	Occupational Safety and Health Administration or Occupational Safety and Health Act
PAG	Pipe Association Global
PEC	Piping Education Council, A Division of MSA
PEPP	Professional Engineers in Private Practice
PFI/US	Pipe Fabrication Institute (USA)
PHCC	National Association of Plumbing-Heating-Cooling Contractors
PMI	Plumbing Manufacturers Institute
PPI/HTPD	Plastic Pipe Institute, High Temperature Plastics Division
PS	Product Standard, produced by U.S. Department of Commerce
PTA	Pipe Trades Association
RCA	Remodeling Contractors Association, Inc.
RETA	Refrigerating Engineers & Technicians Association
RPA	Radiant Panel Association
RSES	Refrigeration Service Engineers Society
SDMA	Spiral Duct Manufacturers Association
SFPE	Society of Fire Protection Engineers
SIPA	Structural Insulated Panel Association
SMACNA	Sheet Metal and Air-conditioning Contractor's National Association
SMWIA	Sheet Metal Workers International Association
SPI	The Society of the Plastics Industry, Inc.
SRCC	Solar Rating & Certification Corp.
STFDA	Specialty Tools & Fasteners Distributor Association
STI	Steel Tank Institute
TABB	Testing Adjusting and Balancing Bureau
TIEQ	Total Indoor Environmental Quality Coalition
TRRF	Refrigeration Research Foundation
UACA	United American Contractors Association
UAJAP	United Association of Journeymen & Apprentices, Plumbing/Pipe Fitting Industry
UL	Underwriters Laboratories, Inc.
USECRE	United States Export Council for Renewable Energy
VMA	Valve Manufacturers Association of America
WDA	Wholesaler Distributors Association
WEEA	World Energy Efficiency Association Home Page
WOHMA/HA	Waste Oil Heating Manufacturers Association/Heating Alternatives

D. Technique:

1. HVAC Metal Duct Standards - SMACNA
2. Industrial Duct Construction - SMACNA
3. Industrial Ventilation - ACGIH
4. Welding Pressure Piping - ASME

1.5 SUBMITTALS

- A. Refer to Division 01 for submittal procedures and references.
- B. Otherwise, submit 8 to 12 copies of information to the Engineer for approval. Check each Specification Section for all items to be included

- C. Submit all required items within sixty (60) days of Contract date or Notice to Proceed, whichever is later, unless otherwise specifically instructed. Approval of the Engineer must be obtained to submit later on any item.
- D. Submittals are required for all items of mechanical equipment and products provided by the Contractor which are called out in individual sections of the specifications. In general, do not submit product data on pipe, pipe fittings, sheet metal, sleeves, lubrication or packing unless specifically directed in these Contract Documents, but do submit schedules listing materials to be used.
- E. All drawings or other material submitted on sheets larger than 8 1/2" X 11" (or 11" X 17" foldout) shall be submitted as one set of paper sepia or mylar sepia reproducibles and one set of blue line prints. Corrections and approvals will be indicated on the sepias and returned to the Contractor for copying and distribution.
- F. Submittals shall be referenced correctly to the appropriate Sections of the Specifications.
- G. Manufacturer's catalog cuts, instead of complete shop drawings, may be submitted for all standard cataloged equipment, provided that the item required to meet the project specifications is not modified in any way from the standard catalog version of said item. Cuts shall be clearly marked to indicate the version of said item, including the exact size, type, rating, capacity, accessories, etc., of the item to be furnished. Any cut sheets showing multiple items, multiple dimensions, multiple performance figures, multiple accessories and/or multiple options shall be legibly marked to indicate the exact item to be provided and its associated information. Failure to do this will result in rejection of the submittal without further review or comment. Do not use the term "furnished by others" or similar designations, as this may imply that the item is not being provided in the Contract.
- H. No faxed (Facsimile Transmitted) material will be accepted for submittals and all drawings and text shall be clear original printed material or low-generation copies with no blurred, blotched or unreadable areas. Submittals with any illegible portions or materials not suitable for permanent record will result in rejection of the submittal for cause, without further review or comment.
- I. Bind shop drawings/catalog cuts in folders with a title sheet and identification on front of the folder. Allow space for Contractor, Architect and Engineer review stamps.
- J. All submittals must bear the dated, handwritten signature of the Contractor and his stamp of approval before being considered for review.
- K. See additional requirements in individual Sections of these Specifications.

1.6 SAMPLES AND MOCK-UPS

- A. Samples of any product called for by individual sections of the specifications shall be delivered to the Engineer at the time of submittal on that item. Submittals, in those cases, will not be approved until the samples have been examined.

- B. Where called for in the specifications, the Contractor shall construct a sectional mock-up of equipment installations using actual equipment or equipment cabinets of the type to be used for purposes of checking appearance, fit of piping, ductwork, controls or structural elements. Mock-ups shall be inspected and approved by the Engineer prior to release for shipment of the material in question.

1.7 CERTIFICATES, LICENSES AND FEES

- A. The Contractor shall pay all fees, stand all required inspections, obtain all necessary licenses, and obtain all required certificates for the work at his own expense.
- B. Certificates requiring display shall be suitably framed and mounted in the mechanical room or other appropriate location. Copies of the certificate shall be included in each copy of the maintenance and operating manuals.
- C. Certificates not requiring display shall be delivered to the Engineer for transmittal to the Owner, and copies of the certificate shall be included in each copy of the maintenance and operating manuals.

1.8 PROJECT RECORD DOCUMENTS

A. Record Drawings

1. Comply with Division 01 for record document procedures and requirements.
2. Maintain and protect one complete set of drawing prints on job site to record any deviations from Contract drawings.
3. Neatly and correctly enter with multicolored pencils any deviations on drawings and keep drawings available for inspection.
 - a. Record locations of concealed ducts, piping and valves.
 - b. Record Addendum and Change Order items.
4. Record deviations made necessary to incorporate equipment different from base equipment specified.
5. Drawings shall be available at the site at all times for inspection by the Engineer during normal project working hours.
6. At completion of Project and before final approval, make any final corrections to drawings, certify to the accuracy of each print by signature thereon and deliver same to Engineer for approval and drafting.
7. Underground site utilities shall be located by survey. Actual inverts and elevations shall be recorded.

1.9 MAINTENANCE AND OPERATING MANUALS

- A. Submit in accordance with Division 01 specification requirements to the Engineer for review and obtain receipt for delivery.
- B. Format of the manual shall be as follows:

1. First page, Each Volume: Title of Project, Owner, Address, Date of Submittal, Name and Address of Contractor, Name of Engineer.
 2. Second page, Each Volume: Index of manual contents.
 3. First section: A copy of each shop drawing and reviewed submittal with an index at the beginning of the section. Include operating and maintenance instructions, wiring/control diagrams, spare parts lists for each type of equipment.
 4. Second section: A list of all major equipment used on the job, together with supplier's name and address and servicing agency's name and address.
 5. Third section: Copies of Contractor and manufacturer warranties.
 6. Fourth section: Test and balance reports, construction test reports, start-up reports, water treatment reports.
 7. Fifth section:
 - a. Include a list of any special keys, tools and wrenches required for operation.
 - b. Include a list of all lubrication procedures, special lubricants and equipment.
 - c. Include a list of all tagged valves with tag number, valve description, location, and function. Include a revised flow chart, obtained from the Engineer to show valve identification.
- C. No faxed (Facsimile Transmitted) material will be accepted for Maintenance and Operating Manual submittals and all drawings and text shall be clear original printed material or low-generation copies with no blurred, blotched or unreadable areas.
- D. Final payments cannot be made and Project cannot be closed out until Maintenance and Operating Manuals have been approved.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Arrange deliveries of products in accordance with construction schedules to avoid conflict with work and site conditions.
1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 2. Immediately on delivery, inspect shipments to assure compliance with the requirements of the Contract Documents and approved submittals, and that products are properly protected and undamaged.
 3. Provide equipment and personnel to handle products by methods to prevent soiling and damage to products or packaging.
- B. Store products in accordance with manufacturer's instructions with seals and labels intact and legible.
1. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
 2. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specific conditions, and free from damage or deterioration.

3. Provide substantial coverings as necessary to protect installed products from damage. Remove when no longer needed.

1.11 ENVIRONMENTAL REQUIREMENTS AND EXISTING CONDITIONS

- A. Locate existing utilities prior to beginning work. Reroute or replace existing utilities where necessary to permit installation of the work. Provide adequate means of protection during work operations. Repair existing utilities damaged during work operations to the satisfaction of the utility owner and at Contractor's expense.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during work operations, notify the Engineer immediately for procedure directions. Cooperate with utility companies in maintaining active utilities in operation.
- C. Contractor shall not remove or disturb any known or suspected existing hazardous materials in buildings, above ground or underground, except work performed in compliance with EPA requirements, as instructed in this Contract, including, but not limited to, asbestos, lead-based paints, PCB's and radioactive materials. If such materials are encountered during the course of the Work, the Engineer shall be immediately notified and the materials shall be avoided.
- D. All materials removed from the site including scraps, construction materials, excavated or demolished materials shall be disposed of in a legal manner.

1.12 WARRANTY

- A. The Contractor shall guarantee all work, both labor and products against defects and failure under normal use for the period of one year from the official date of Substantial Completion. The Contractor shall leave the entire installation in complete working order and free from any and all defects in materials, workmanship or finish. He shall repair or replace at his own expense any part that may develop defects due to faulty material or workmanship during construction and the warranty period and shall guarantee also to repair or replace with like materials any existing work of the building or equipment which is damaged during the repairing of such defective apparatus, materials or workmanship. The signing of the Contract for this Work, covered by these Documents of which they shall become a part, shall become a written guarantee on the part of the Contractor to carry out all the provisions of this Division of these Specifications.
- B. Refer to Division 01 for other specific requirements.
- C. Refer to each Section of Division 23 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS, STANDARD PRODUCTS AND SUBSTITUTIONS

- A. All material and equipment shall be new and in good condition. Refer to Division 01 for additional requirements.

- B. Design is based upon a specific make and model of equipment. However, except where noted, the specifications are not intended to limit competition or the Contractor's option to use alternate products of equivalent concept, quality, and performance.
- C. Products of alternate manufacturers listed may be substituted without approval prior to the Bid, if they are regularly catalogued items and meet the criteria of equivalence in concept, quality, and performance in the opinion of the Engineer. It is recommended that the opinion of the Engineer be solicited prior to the bid if there are any questions. This opinion does not guarantee approval of the submittals at a later time. In the case where the equipment is unfamiliar to the Engineer, all vendors desiring to furnish equipment other than that specified must submit, in addition to ordinary shop drawings, a complete verification specification for the substituted equipment along with catalogs, literature, wiring diagrams, piping diagrams, and a list of similar sized installations where the proposed equipment is installed. This information may be required to be presented immediately after the Bid and lack of information or of qualifications, as judged by the Engineer, may result in a Bid not being accepted.
- D. All products which require submittals, whether design basis or otherwise accepted, must be formally approved by the Engineer before shipment to the job.
- E. The Contractor is responsible for any and all costs for changes to the mechanical work or the work of other trades necessitated by the optional substitution of approved alternate equipment. Approval of alternate equipment or modifications to the plans by the Engineer are not to be construed as relief from this responsibility. In the case of significant modification to the design, the Contractor may also be required to pay for the cost of design review and/or redesign by the Engineer.
- F. Listing: The successful bidder shall furnish to the Engineer within one hour of the Bid opening, or as indicated in bidding instructions, a list of all major items of mechanical equipment to be provided, indicating the manufacturer and the general type. List shall include all items of major equipment such as boilers, chillers, towers, pumps, tanks, air handlers, packaged equipment, controls, plumbing fixtures, or other items to which whole Sections of Specifications are devoted. Do not include piping, sheet metal, small specialty items or the like unless specifically requested. In addition, a list of all Subcontractors to be involved in the project shall be furnished to include, in addition to the prime mechanical contractor, as a minimum, the plumbing, pipe fitting, sheet metal, controls, water treatment, thermal balancing, insulating, fire protection and asbestos removal subcontractors, as utilized in the project. Any list of required items included in the Bid Form, Instructions to Bidders or other Bid documents shall supercede these items. Changing manufacturers or subcontractors after the listing will not be acceptable, unless initiated by the Owner or the Engineer. Final acceptance of the bids is contingent upon submission and approval of these lists.

2.2 QUANTITIES AND COMPLETENESS

- A. Items may be referred to as singular or plural on drawings and specifications. Contractor is responsible for determining quantity of each item.
- B. All components required for the complete installation and legal, proper and safe operation of equipment and systems indicated in the Documents shall be provided by the Contractor. Optional accessory items shall be included only as specified.

2.3 TESTING AND CERTIFICATION

- A. Conduct tests and adjustments of equipment as specified and necessary to verify performance requirements. Submit test data to the Engineer. Pay all fees involved in required testing of equipment.
- B. Provide necessary personnel and testing instruments required to perform test(s) of installation.
- C. Refer to individual Sections for additional requirements.
- D. Submit copies of all test reports, manufacturer's certifications and inspection reports to the Engineer. Include copies of each in each copy of the Maintenance and Operating Manual (Section 230100).

2.4 NOISE AND VIBRATION

- A. Equipment shall be free of unusual or excessive noise and vibration in the opinion of the Engineer. No amount of rattling of loose, improperly isolated or ill-fitting parts will be acceptable. Vibration transmitted to the structure shall be reasonable and within recognized and specified limits.

2.5 HAZARDOUS MATERIALS

- A. No materials or products containing known regulated hazardous materials shall be used in the Project, including asbestos, paint containing lead or products containing PCB's in amounts greater than current standards allow.
- B. No solder containing lead shall be used on the Project.
- C. Chemical products used in the construction process or for water treatment purposes shall be used in a manner in complete compliance with all OSHA and EPA regulations and guidelines. Formal Material Safety Data (MSD) Sheets shall be provided for each product used and shall be posted in the work area most accessible to the place of use of the product. In addition, MSD sheets shall accompany and be attached to water treatment products from the time they arrive on site through the end of Warranty.

PART 3 - EXECUTION

3.1 TEMPORARY SERVICES

- A. Refer to Division 01 for specific requirements, responsibilities and methods for temporary water service, sanitation, heat and ventilation.

3.2 COORDINATION

- A. The Contractor is responsible for sequencing of the work and coordination with all trades to prevent delays in the project. No extras will be allowed for changes made necessary by interference of work between trades.
- B. Carefully check and coordinate location and level of all pipes, ducts, etc. Run preliminary levels and check with all trades so that conflicts in all locations may be avoided. Contractor shall rough sketch sections through the corridors or other tight mechanical/electrical spaces when requested to do so, in order to show that any possible conflicts have been resolved among all the trades. Where conflicts occur, if any, the following preference schedule shall be followed:
 - 1. Recessed electrical light fixtures.
 - 2. Sanitary and storm drainage piping on critical grade.
 - 3. Ductwork.
 - 4. Large HVAC or domestic water mains.
 - 5. Sprinkler piping.
 - 6. Communications wireway
 - 7. Small HVAC piping.
 - 8. Domestic water piping.
 - 9. Electric and communications conduits.
- C. Ductwork or Heating Main: No ductwork or heating main shall have preference over plumbing lines below plumbing fixtures, or over electrical conduits above or below electric switchgear and panels. No piping conveying fluids shall be installed directly over electrical equipment.
- D. Unless otherwise indicated, coordinate all work with the arrival of materials on the site to prevent unnecessary delays between demolition or other preliminary phases of work and the installation of new materials. Periods of abandonment of work area, once work has begun shall be avoided unless necessary to allow other trades to complete their work.
- E. The storage of materials on site shall be minimized. Materials delivered to the site far in advance of construction, and/or exposed to weather, mud or construction abuse for long periods, will not be eligible to be included in pay requests, and will be accepted for use in the project at the time of construction based upon condition at that time. Generally, rusted, beat-up products, including large equipment, will not be accepted for use.

3.3 INSPECTIONS

- A. The Engineer or his representative may inspect the work at any time and for any reason, but, generally, inspections will be arranged to coordinate with phasing of the work and with regularly scheduled Project meetings. The Engineer will attempt to accommodate the Contractor where possible, but in general, it is the Contractor's responsibility to schedule the work in such a manner that inspections are not required more often than the regular meetings, except for substantial completion and final inspections.
- B. No work shall be permanently concealed (underground, behind drywall or masonry, or any other inaccessible location) without being inspected by the Engineer or his representative, unless specific permission is granted to do so by the Engineer.

- C. In general, piping and ductwork must be inspected by the Engineer or his representative before insulation is applied, unless specific permission to do otherwise is given by the Engineer.
- D. The Contractor shall supply lights, ladders, tools, equipment and assistance to the Engineer, as required, for performing inspections and verifying the operation of mechanical systems.

3.4 CONCRETE WORK

- A. Provide all concealed concrete work required for Division 23, including but not limited to pipe and duct anchors, foundations and encasement, inertia bases, and pads. Coordinate with other divisions.
- B. Equipment pads, slabs and bases exposed to view and not part of the building structure (see architectural/structural plans) shall be provided by the Contractor. Coordinate with other divisions. The Contractor shall locate, dimension and furnish sleeves and anchors as required.
- C. Concrete shall conform to Division 03 requirements.

3.5 PROTECTION

- A. Protect equipment and materials during construction from damage from water, dirt, welding and cutting, spatters, paint droppings, etc., by use of shield and drop cloths. Damaged equipment or materials shall be repaired or replaced by the Contractor. Rusting, corroded or damaged materials or equipment is not acceptable, whether installed or not.
- B. Products stored outside or in unheated spaces shall be covered with water-proof drop cloths or tarpaulins. Condensation shall be prevented by heating and ventilating. Method shall be acceptable to the Engineer (see Section 230100).
- C. During construction, maintain all materials and equipment in an orderly manner.
- D. Protect floors from soiling and damages caused by tools, chips, cutting oil, pipe compound, paint and the like.
- E. The Contractor shall use OSHA-approved ladders and lifts for Division 23 work. Workmen shall not be allowed to stand or sit on the unprotected surfaces of insulation, equipment jackets, conduit, control panels or any other location not intended for traffic.

3.6 CUTTING AND PATCHING

- A. Avoid cutting of concrete, masonry and other finished work by use of sleeves and inserts.
- B. Perform cutting and patching required for installation of the work. Methods and procedures shall be acceptable to the Engineer. Obtain written permission before any cutting.
- C. Cut holes through concrete, brick, tile, etc., when necessary, by rotary core drilling or masonry saw.

- D. Damages, patches, or work in areas previously finished under the work of other Divisions shall be repaired at the expense of the Contractor and to the satisfaction of the Engineer.

3.7 CLEANING

- A. Upon completion, ductwork, piping and equipment shall be thoroughly cleaned of dirt, grease, rust and oil, primed where necessary, and left ready for painting. Vacuum clean the inside and outside of fan plenums, air handling units and equipment cabinets. Vacuum clean coils and comb out damaged fins.
- B. Clean galvanized piping and ductwork in exposed areas with diluted acetic acid.
- C. Clean copper piping in exposed areas with emery cloth and solvent.
- D. Clean gauges, thermometers, traps, strainers and fittings.
- E. Install new filters in throwaway and replaceable filter frames. Properly clean permanent filters.
- F. Upon completion of Work, the Contractor shall remove all resulting rubbish, debris, and surplus materials from the premises, together with all disused instruments and equipment and shall leave the site in a neat, clean, and acceptable condition as approved by Engineer. Contractor shall maintain Work areas of existing facilities in a reasonably clean condition on a daily basis, and shall not allow debris to create operational or safety problems for the Owner.

3.8 PAINTING AND FINISHING

- A. Painting shall meet the requirements of Division 07, when included in the Specifications. No painting or coating shall be done on surfaces already rusting without proper surface preparation.
- B. Exterior insulation and coverings shall be cleaned and painted per Division 09 or coated as specified and left ready for service identification. Consult Engineer for color to be used.
- C. Ferrous metal exposed to weather shall be cleaned, primed, and painted per Division 09. Consult Engineer for color to be used.
- D. All ferrous fasteners, hardware, hangers, hanger rods exposed to weather shall be stainless steel, galvanized or cadmium plated. Plating must include threads and all other surfaces. Other fasteners shall be properly prepared and coated immediately after installation with black asphaltum.
- E. Non-ferrous metals, stainless steel and plastic materials shall not be painted unless indicated in other Sections or Divisions or in the Drawings.
- F. Factory finished equipment which has rusted or been damaged shall be replaced. Only after approval by the Engineer, may it be cleaned, primed, and entirely repainted the original color by the Contractor.

- G. Interior insulation coverings shall be cleaned, sized if necessary, painted white and left ready for service identification. Exposed insulation inside finished areas shall match colors of nearby finishes, or color selected by the Architect.
- H. Interior uninsulated ferrous piping, supports and hangers exposed to view shall be painted per Division 09 in areas not finished under other Divisions of the Specifications. All items shall be painted white except for pipe designated to be color coded in other Sections. In finished areas, color shall be selected by Architect.
- I. Clean interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers and cover with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- J. Paint insulated and uninsulated duct and piping, cabinets, louvers, boxes, hangers, brackets, collars, and supports where exposed to view in finished areas, except when prefinished or where painted under other Divisions.
- K. Contractor is responsible for any damage to building or contents from painting process. Do not allow paint over any existing or new name or identification plates or tags. Mask off any warning or instructional stickers or tags on equipment while painting.
- L. Wall mounted plumbing fixtures shall be caulked between fixture and wall or floor with caulking compatible with finish surfaces.

3.9 ACCESS

- A. Equipment has been chosen to properly fit into the physical spaces provided and indicated, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with Code requirements. Physical dimensions and arrangements of equipment to be installed shall be subject to Engineer approval. Submit shop drawings of equipment layout for approval where it does not comply with plans.
- B. Space Requirements: In the preparation of Drawings, a reasonable effort has been made to include all equipment manufacturer's recommendations. Since space requirements and equipment arrangement vary according to manufacturer, the responsibility for initial access and proper fit rests with the Contractor. The final arrangement of equipment and service connections shall allow the unit to be serviced. This shall include space to pull motors, filters, coils, tubes, etc. Contractor shall demonstrate that proper access has been provided to inspectors.

3.10 CONSTRUCTION DIRT, DUST AND NOISE CONTROL

- A. All cutting or drilling of concrete, masonry, steel or wood shall be performed with absolute control of dirt and dust resulting from the cutting or drilling operation. Workers performing operations or in the immediate vicinity shall wear OSHA approved protective equipment.
- B. The Contractor is required to minimize construction noise levels in all locations adjacent to or in occupied areas.

- C. The Owner reserves the right to prevent use of any tools which cause detrimental vibration or noise.

3.11 TRAINING

- A. Training and instruction to the Owner shall be provided for all Division 23 equipment, systems and controls. See individual Sections for additional specific requirements. Contractor shall submit a training agenda to the Engineer for approval, prior to Substantial Completion, including a proposed schedule, all items to be covered and who is to make the presentations. If the Owner chooses to decline training, or any part thereof, the Contractor will credit the Project for the cost of any unused hours of training and instruction. Contractor shall keep record of attendance at the training sessions and submit to the Engineer upon completion.
- B. Instruction shall be based upon material in the Maintenance & Operating Manuals, described above, which shall be approved by the Engineer, prior to the training. Any supplemental information required shall be provided by the Contractor.
- C. Training and instruction to the Owner shall be videotaped at the Contractor's expense, in DVD format, and the original and one copy shall be submitted to the Engineer for approval, prior to Project Closeout. Video is not required to be made by professional videographers, but shall show technical competence, with clear pictures and sound, and useable for future personnel training by the Owner.

3.12 LEAKS

- A. During the time period from date of Contract until termination date of the guarantee, Contractor shall be responsible for damages to the building, grounds, walks, roads, piping systems, insulation, electrical systems, refrigeration, heating, ventilating and air conditioning systems, building equipment, furniture, and other building contents caused by leaks in piping systems or equipment being installed or having been installed by him. All repair work shall be done as directed by, and in a manner satisfactory to the Engineer and at no cost to the Owner.

END OF SECTION 220100

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SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING 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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

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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. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.

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.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

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.
- 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 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate 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 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.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 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. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. 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.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. 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.
- 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. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. 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.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. 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.
- O. 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.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and 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.

3.3 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).

3.4 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. Touchup: Clean and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 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 carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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.

K. 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).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- M. 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-joint 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.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. 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.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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.
 - 3. Domestic recirculating hot-water piping.

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 insulation application at pipe expansion joints for each type of insulation.
 - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 4. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 5. Detail application of field-applied jackets.
 - 6. 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.

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. Products: Subject to compliance with requirements, provide the following:
 - a. Pittsburgh Corning Corporation; Foamglas.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- H. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.

- d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Ramco Insulation, Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Ramco Insulation, Inc.; Thermokote V.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 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. Products: Subject to compliance with requirements, provide the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 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. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
 3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.

5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 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.

2.5 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.

- c. Vimasco Corporation; 713 and 714.
- 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.

2.6 SEALANTS

A. Joint Sealants:

- 1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
- 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.
- 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
- 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.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 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: White.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 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.

2.8 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.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

2.9 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
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.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

- a. Sheet and roll stock ready for shop or field sizing.
- b. Material, finish, and thickness are indicated in field-applied jacket schedules.
- c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
- d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
- e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 - 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.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches (50 mm).
 3. Thickness: 6 mils (0.15 mm).
 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches (50 mm).
 3. Thickness: 3.7 mils (0.093 mm).
 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.11 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.

- B. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

2.12 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers, :
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Company.
 - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing.
 - d. Plumberex.
 - e. Truebro; a brand of IPS Corporation.
 - f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 - 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, provide products by one of the following:
 - a. Truebro; a brand of IPS Corporation.
 - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 - 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.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies

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 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.

3.10 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- 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.

3.11 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 two locations of straight pipe, two locations of threaded fittings, two locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, two locations of threaded valves, and two 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.

3.12 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.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inch (38mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:
 - a. Cellular Glass: 1 inch (25mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inch (38mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inch (38mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 2 inches (50 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

3.15 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, Concealed:
 - 1. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.
 - 2. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
 - 3. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
- D. Piping, Exposed:
 - 1. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.
 - 2. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
 - 3. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) thick.

3.16 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, Concealed:
 - 1. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.
 - 2. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
 - 3. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
- D. Piping, Exposed:
 - 1. PVC: 20 mils (0.5 mm) thick.
 - 2. Aluminum, Smooth with Z-Shaped Locking Seam: 0.020 inch (0.51 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 1 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.
- 2. Encasement for piping.

- B. Related Requirements:

- 1. Division 2 Section "Facility Water Distribution Piping" for water-service piping 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, Construction Manager. Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Owner'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. 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) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) 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.

2.3 STAINLESS-STEEL PIPING

- A. Potable-water piping and components shall comply with NSF 61.
- B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 40.
- C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.
- D. Appurtenances for Grooved-End, Stainless-Steel Pipe:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Shurjoint Piping Products.
 - d. Victaulic Company.

2. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
3. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:
 - a. AWWA C606 for stainless-steel-pipe dimensions.
 - b. Stainless-steel housing sections.
 - c. Stainless-steel bolts and nuts.
 - d. EPDM-rubber gaskets suitable for hot and cold water.
 - e. Minimum Pressure Rating:
 - 1) NPS 8 (DN 200) and Smaller: 600 psig (4137 kPa).
 - 2) NPS 10 and NPS 12 (DN 250 to DN 300): 400 psig (2758 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600): 250 psig (1725 kPa).

2.4 CPVC PIPING

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40.
 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.5 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.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
 1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the

Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.6 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.

2.7 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, provide products by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc.; a Sensus company.
 - g. Viking Johnson.

- D. Plastic-to-Metal Transition Fittings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
- 2. Description:
 - a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket end.

- E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO Inc.
 - c. Spears Manufacturing Company.
2. Description:
 - a. CPVC four-part union.
 - b. Brass or stainless-steel threaded end.
 - c. Solvent-cement-joint or threaded plastic end.
 - d. Rubber O-ring.
 - e. Union nut.

2.8 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, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International.
 - e. Matco-Norca.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
 2. Standard: ASSE 1079.
 3. Pressure Rating: 150 psig (1035 kPa).
 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Watts; a division of Watts Water Technologies, Inc.
 - e. Wilkins; a Zurn company.
 2. Standard: ASSE 1079.

3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 150 psig (1035 kPa)
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig (1035 kPa).
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Matco-Norca.
 - d. Precision Plumbing Products, Inc.
 - e. 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 Division 2 Section "Earthwork" 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. 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 Division 15 Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 15 Section "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 15 Section "Domestic Water Piping Specialties."
- H. Install domestic water piping level and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Division 15 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. 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.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. 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.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Division 15 Section "Meters and Gages for Plumbing Piping."
- T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 15 Section "Domestic Water Pumps."
- U. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Division 15 Section "Meters and Gages for Plumbing Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 15 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 15 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 15 Section "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," "Braze 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. 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.
- G. 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.

- H. 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.
- I. 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 or unions.

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 unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100). Use dielectric nipples.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Division 15 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Division 15 Section "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.

- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- E. 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.
- F. Install supports for vertical copper tubing every 10 feet (3 m).
- G. 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.
- H. 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.
- I. 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.
- J. 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. Comply with requirements for connection sizes in Division 15 plumbing fixture Sections.
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 Division 15 Section "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. Hard 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) wrought-copper, solder-joint fittings; and soldered joints.
 2. CPVC, Schedule 40; socket fittings; and solvent-cemented 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 valves for piping NPS 2 (DN 50) and smaller.
 - 2. 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

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. Temperature-actuated, water mixing valves.
6. Strainers.
7. Hose stations.
8. Hose reels.
9. Hose bibbs.
10. Wall hydrants.
11. Water-hammer arresters.
12. Air vents.
13. Trap-seal primer systems.
14. Flexible connectors.
15. Water meters.
16. Solenoid Valves.

- B. Related Requirements:

1. Section 221116 "Domestic Water Piping" for water meters.
2. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 1. Include diagrams for power, signal, and control wiring.

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 and NSF 14. Mark "NSF-pw" on plastic piping components.

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. Ames Fire & Waterworks.
 - c. Cash Acme.
 - d. Conbraco Industries, Inc.
 - e. FEBCO.
 - f. Rain Bird Corporation.
 - g. Toro Company (The).
 - h. Watts; a Watts Water Technologies company.
 - i. 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.

- B. Hose-Connection 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. Arrowhead Brass Products.

- b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Legend Valve & Fitting, Inc.
 - e. MIFAB, Inc.
 - f. Prier Products, Inc.
 - g. Watts; a Watts Water Technologies company.
 - h. Woodford Manufacturing Company.
 - i. Zurn Industries, LLC.
- 2. Standard: ASSE 1011.
 - 3. Body: Bronze, nonremovable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 5. 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. Ames Fire & Waterworks.
 - c. Conbraco Industries, Inc.
 - d. FEBCO.
 - e. Flomatic Corporation.
 - f. Watts; a Watts Water Technologies company.
 - g. 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. Size: Varies..
- 6. 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.
- 7. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
- 8. Configuration: Designed for horizontal, straight-through flow.
- 9. 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.
 - d. Strainer.

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. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts; a Watts Water Technologies company.
 - e. 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. 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab inc.
 - c. ITT Corporation.
 - d. NIBCO INC.
 - e. Schneider Electric USA, Inc.
 - f. TACO Incorporated.
 - g. Watts; a Watts Water Technologies company.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass or 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. Cast-Iron Calibrated Balancing Valves:

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. Armstrong International, Inc.
 - b. Flo Fab inc.
 - c. ITT Corporation.
 - d. NIBCO INC.
 - e. Schneider Electric USA, Inc.
 - f. Watts; a Watts Water Technologies company.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
 3. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).
- C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

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. Armstrong International, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Honeywell Water Controls.
 - e. Legend Valve & Fitting, Inc.
 - f. Leonard Valve Company.
 - g. Powers.
 - h. Symmons Industries, Inc.
 - i. TACO Incorporated.
 - j. Watts; a Watts Water Technologies company.
 - k. Zurn Industries, LLC.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.

B. Manifold, Thermostatic, Water Mixing-Valve Assemblies:

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. Leonard Valve Company.
 - b. Powers.

c. Symmons Industries, Inc.

2. Description: Factory-fabricated, exposed-mounted, thermostatically controlled, water mixing-valve assembly in single-valve arrangement.
3. Large-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
4. Intermediate-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
5. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
7. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
8. Cabinet: Factory fabricated, stainless steel, for [surface] mounting and with hinged, stainless-steel door.
9. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
10. Piping Finish: Copper.

C. Individual-Fixture, Water Tempering Valves:

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. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Lawler Manufacturing Company, Inc.
 - e. Leonard Valve Company.
 - f. Powers.
 - g. Watts; a Watts Water Technologies company.
 - h. Zurn Industries, LLC.
2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

2.8 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: 0.020 inch (0.51 mm).
 - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm).
 - c. Strainers NPS 5 (DN 125) and Larger: 0.10 inch (2.54 mm).
6. Drain: Factory-installed, hose-end drain valve.

2.9 HOSE STATIONS

- 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. ARCHON Industries, Inc.
2. Armstrong International, Inc.
3. Cooney Brothers, Inc.
4. DynaFluid Ltd.
5. Leonard Valve Company.
6. Strahman Valves, Inc.
7. T & S Brass and Bronze Works, Inc.

- B. Single-Temperature-Water Hose Stations:

1. Standard: ASME A112.18.1.
2. Cabinet: Stainless-steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
3. Hose-Rack Material: Stainless steel.
4. Body Material: Bronze with stainless-steel wetted parts.
5. Body Finish: Rough bronze.
6. Mounting: Wall, with reinforcement.
7. Supply Fittings: NPS 3/4 (DN 20) gate, globe, or ball valve and check valve and NPS 3/4 (DN 20) copper, water tubing. Omit check valve if check stop is included with fitting.
8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 50 feet (15 m) long.
9. Nozzle: With hand-squeeze, on-off control.
10. Vacuum Breaker:
 - a. Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.10 HOSE REELS

- A. Hose Reel: Samson, Reel Master 506 series or approved equal.

1. Aluminum construction. Minimum 50 foot hose length and shall have automatic hose retraction. Reel shall have hose stop. Guide arm shall be adjustable on site. Reel shall include all accessories needed to mount to wall or horizontal structure.

B. Hose Reel Mounting Kit

1. Pivoting bracket Samson 360 121, or approved equal.

C. Hose

1. Buna-S (SBR) with one steel braid. Maximum temperature 300 degrees F and maximum pressure 2500 psi. Minimum of 50 feet of hose length.

2.11 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze, chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.12 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

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. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. Tyler Pipe; a subsidiary of McWane Inc.
 - f. Watts; a Watts Water Technologies company.
 - g. Woodford Manufacturing Company.

- h. Zurn Industries, LLC.
- 2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
- 3. Pressure Rating: 125 psig (860 kPa).
- 4. Operation: Loose key.
- 5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
- 6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
- 7. Box: Deep, flush mounted with cover.
- 8. Box and Cover Finish: Nickel bronze.
- 9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
- 10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
- 11. Operating Keys(s): Two with each wall hydrant.

2.13 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. AMTROL, Inc.
 - b. Jay R. Smith Mfg. Co.
 - c. Josam Company.
 - d. MIFAB, Inc.
 - e. Precision Plumbing Products.
 - f. Sioux Chief Manufacturing Company, Inc.
 - g. Tyler Pipe; a subsidiary of McWane Inc.
 - h. Watts; a Watts Water Technologies company.
 - i. Zurn Industries, LLC.
- 2. Standard: ASSE 1010 or PDI-WH 201.
- 3. Type: Copper tube with piston.
- 4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 AIR VENTS

A. Welded-Construction Automatic Air Vents:

- 1. Body: Stainless steel.
- 2. Pressure Rating: 150-psig (1035-kPa) minimum pressure rating.
- 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.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

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. Zurn Industries, LLC.
2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water tubing.
4. Cabinet: Recessed-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
 - 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.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Eight.
8. Size Outlets: NPS 1/2 (DN 15).

2.16 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. Flex-Hose Co., Inc.
3. Flexicraft Industries.
4. Flex-Weld, Inc.
5. Hispan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex Company (The).
8. Proco Products, Inc.
9. Tozen Corporation.
10. Unaflex.
11. Universal Metal Hose.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.17 WATER METERS

A. Displacement-Type Water Meters:

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. AALIANT.
 - b. ABB.
 - c. Carlon Meter.
 - d. Mueller Co.
 - e. Schlumberger Limited.
 - f. Sensus.
2. Description:
 - a. Standard: AWWA C700.
 - b. Pressure Rating: 150-psig (1035-kPa) working pressure.
 - c. Body Design: Nutating disc; totalization meter.
 - d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
 - e. Case: Bronze.
 - f. End Connections: Threaded.

2.18 SOLENOID VALVES

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. ASCO Valves
2. Approved equal.

B. Description:

1. Action: Either normally open or normally closed in the event of electrical power failure as required by the application.
2. Size to close against the system pressure.
3. Manual override capable.
4. Heavy-duty assembly.
5. Body: Brass or stainless steel.
6. Seats and Discs: NBR or PTFE.
7. Solenoid Enclosure: NEMA 250, Type 4.
8. Line size valve.
9. Voltage: 120V, 1 phase.

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 and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve and backflow preventer.
- G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs.
- H. 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.
- I. Install water-hammer arresters in water piping according to PDI-WH 201.
- J. Install air vents at high points of water piping.
- K. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Secondary Grounding."

- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "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.
 - 4. Calibrated balancing valves.
 - 5. Primary, thermostatic, water mixing valves.
 - 6. Manifold, thermostatic, water mixing-valve assemblies.
 - 7. Primary water tempering valves.
 - 8. Outlet boxes.
 - 9. Hose stations.
 - 10. Trap-seal primer systems.
- 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.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each reduced-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.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

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SECTION 221123 - DOMESTIC WATER PUMPS

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. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.5 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

- 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. Armstrong Pumps, Inc.
 - 2. Bell & Gossett; a Xylem brand.
 - 3. PACO Pumps; Grundfos Pumps Corporation, USA.
 - 4. TACO Incorporated.
- B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
- C. Pump Construction:
 - 1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 3/4 (DN 20) pipe connections.
 - 2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
 - 3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
 - 4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
 - 5. Bearings: Oil-lubricated; bronze-journal or ball type.
 - 6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
- D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.
- E. Capacities and Characteristics:
 - 1. Casing Material: Bronze.
 - 2. Impeller Material: ASTM B 584, cast bronze or stainless steel.
 - 3. Minimum Working Pressure: 125 psig (862 kPa).
 - 4. Maximum Continuous Operating Temperature: 225 deg F (107 deg C).
 - 5. Inlet and Outlet Size: 3/4 NPS (20 DN).
 - 6. Pump Control: Thermostat.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
 - 1. 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.

2.3 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - 1. Type: Water-immersion temperature sensor, for installation in piping.
 - 2. Range: 50 to 125 deg F (10 to 52 deg C).
 - 3. Enclosure: NEMA 250, Type 4X.
 - 4. Operation of Pump: On or off.
 - 5. Transformer: Provide if required.
 - 6. Power Requirement: 120 V, ac.
 - 7. Settings: Start pump at 105 deg F (41 deg C) and stop pump at 120 deg F (49 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft(s) horizontal.
- C. Install continuous-thread hanger rods of size required to support pump weight.
 - 1. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- D. Install thermostats in hot-water return piping.

3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Horizontally mounted, in-line, close-coupled centrifugal pumps.

- D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.
 - 1. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gageappings where provided or install pressure-gage connectors in suction and discharge piping around pumps.
- E. Connect thermostats to pumps that they control.
- F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Set thermostats for automatic starting and stopping operation of pumps.
 - 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 7. Start motor.
 - 8. Open discharge valve slowly.
 - 9. Adjust temperature settings on thermostats.
 - 10. Adjust timer settings.

3.5 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Combination units.

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.
- B. Shop Drawings: Diagram power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.
- B. 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. 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. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
- D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities" 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. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or equal product by one of the following:
 - a. Acorn Safety; a division of Acorn Engineering Company.
 - b. Bradley Corporation.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Sellstrom Manufacturing Company.
 - g. Speakman Company.
 - h. WaterSaver Faucet Co.
 - 2. Piping: See Plumbing Fixture schedule
 - 3. Shower: See Plumbing Fixture schedule
 - 4. Eye/Face Wash Unit: See Plumbing Fixture schedule

2.2 SOURCE QUALITY CONTROL

- A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste 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 shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. 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 Division 22 Section "Domestic Water Piping."
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment.
- G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Division 23 Section "Vent Piping."
- H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Division 23 Section "Vent Piping."
- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations.
- J. Fill self-contained fixtures with flushing fluid.

3.3 CONNECTIONS

- A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with

requirements for hot- and cold-water piping specified in Division 22 Section "Domestic Water Piping."

- B. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping.
- C. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.
- D. 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 Division 22 Section "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 and water-tempering equipment 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 235123 - GAS VENTS

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. Listed double-wall vents.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.
- B. Shop Drawings: For vents.
 - 1. Include plans, elevations, sections, and attachment details.
 - 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. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Sample Warranty: For special warranty.

1.5 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 D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.
- B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.1 LISTED TYPE B AND BW VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hart & Cooley Inc.
 - 2. Heat-Fab, Inc.
 - 3. M&G DuraVent, Inc.; a member of the M&G Group.
 - 4. Metal-Fab, Inc.
 - 5. Selkirk Corporation.
- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F (248 deg C) continuously for Type B or 550 deg F (288 deg C) continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch (6-mm) airspace.
- D. Inner Shell: ASTM B 209 (ASTM B 209M), Type 1100 aluminum.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Listed Type B and BW Vents: Vents for certified gas appliances.

3.3 INSTALLATION OF LISTED VENTS

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

- C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- E. Lap joints in direction of flow.

3.4 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 235123

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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 he/she 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, utility connection fees, 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, except where a new motor is to be provided for an item of existing equipment (a replacement motor), then it shall be provided under this Division of the Specifications.
- 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. Reconnect lighting.
 - 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. Abandon and remove all existing wiring and materials not to be reused in the renovated plant, as shown on the Contract Drawings.
 - 8. Furnish and install shower/eye wash alarm, devices, and wiring.
- J. All raceways and wiring shall be fire stopped where required by code and/or indicated in the Contract Drawings.

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 electronically for this Division. All Shop Drawings shall be submitted electronically. Written operation and maintenance manuals shall be submitted as required by owner.
- 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. Wiring devices.
 - 5. Device plates.
 - 6. Metal framing system (aluminum framing channel).
 - 7. Conduit fittings, expansion joints, support hardware.
 - 8. Motor control equipment - including individually mounted items.
 - 9. Power distribution equipment - including individually mounted items.
 - 10. Adjustable speed equipment and accessories.
 - 11. Miscellaneous spare parts and hardware, i.e. terminators, lugs, etc.
 - 12. Wire - all types and sizes.

- 13. Wire markers, signs and labels.
- 15. Lightning/transient suppressors.
- 16. Motors.

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 generally 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 than 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 and 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.	Instrument Society of America	ISA
11.	Institute of Electrical and Electronic Engineers, Inc.	IEEE
12.	American National Standards Institute, Inc.	ANSI
13.	Anti-Friction Bearing Manufacturers Association, Inc.	AFBMA
14.	Joint Industry Council	JIC
15.	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.	ASHRAE
16.	Federal Communications Commission	FCC

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 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.

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 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, he/she 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 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/repared 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.

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 his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests.

- B. Before energizing the system, the Contractor shall check all connections and set all relays and instruments for proper operation. He shall obtain all necessary approvals and instructions from the 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.

1.13 CLEANUP

- A. Cleanup shall be completed as soon as possible after the electrical installation is complete. All outlets, switches, starters, motor control centers, 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. 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 he 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 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.

1.16 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.

1.17 TRAINING

- A. All manufacturers supplying equipment for this division shall provide the Owner’s operations staff with training in the operation and maintenance on the equipment being furnished. The training shall be conducted at the project site by a qualified representative of the manufacturer.
- B. The cost of this training shall be included in the bid price.
- C. The required training shall consist of both classroom and hands-on situation. Classroom training shall include instruction on how the equipment works its relationship to all accessories and other related units, detailed review of shop drawings, detailed presentation of written O & M instructions, troubleshooting and record-keeping recommendations. Hands-on-training shall include a review of the manufacturer’s O & M instructions, check out of each operator to identifying key elements of the equipment, tear down as appropriate, calibration, adjustment, greasing and oiling points, and operating manipulations of all electrical and mechanical controls.
- D. The training shall be scheduled through the Contractor with the Owner. The timing of the training shall closely coincide with startup of the equipment, but no training shall be conducted until the equipment is operational.
- E. The minimum number of hours to be provided by manufacturers supplying equipment on this project shall be in accordance with the following table:

Item	Training Hours	
	Classroom	Hands-on
Variable Speed Systems	3	3
Automatic Level/Pressure Control System	1	1
Solid State Motor Control	2	2

- F. The Owner reserves the right to record all training sessions.

1.18 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.

1.19 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 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.

1.20 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.

1.21 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 08 – Openings

Division 09 – Finishes

Division 22 – Plumbing

Division 23 – Heating, Ventilating, and Air Conditioning

Division 41 – Material Process and Handling Equipment

Division 46 – Water and Wastewater Equipment

1.22 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.

1.23 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. Seismic Anchorage & Qualification of Electrical Components
 - 1. Refer to the structural drawings for seismic design criteria, including seismic design accelerations, Seismic Design Category and structure Risk Category.
 - 2. All electrical components shall be anchored to resist seismic forces in buildings with seismic design category D, E, or F except when ALL of the conditions exist:
 - a. The component is not required for life safety.
 - b. The component is not needed for continuing operation of a Risk Category IV structure.
 - c. The component is positively attached to the structure.
 - d. The component is flexibly connected to associated conduit and is one of the following:
 - 1) The component weighs less than 400 lb and has a center of mass less than 48 in above the adjacent floor level OR
 - 2) The component weighs less than 20 lb or less than 5 lb/s.f. if distributed.
 - 3. All electrical components required for life safety shall be anchored to resist seismic forces in buildings with Seismic Design Category C, D, E or F.
 - 4. All electrical components required for continued operation of a Risk Category IV structure shall be anchored to resist seismic forces in buildings regardless of the Seismic Design Category.
 - 5. Where anchorage to resist seismic forces is required, the following shall be submitted:
 - a. Designs of all connections of electrical components to the structure, either supplied and certified by the manufacturer; or by a licensed professional engineer qualified and experienced in such design – FOR APPROVAL prior to installation.
 - b. Certifications by manufacturers of electrical equipment in accordance with 13.2.2.1 of ASCE 7 – FOR APPROVAL prior to purchase.
 - c. Special Inspection Reports verifying that the electrical components were installed in accordance with the seismic anchorage designs – FOR RECORD after installation.

1.24 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 (power, TV, Comm)	16"	To bottom
3.	Wall type buzzers, horns, etc.	8'-0" Max.	Top 2" below ceiling
4.	Push-button or control stations	4'-0"	
5.	Top of panelboards or control panels	6'-6"	Maximum (except for handicapped areas)
6.	Top of switch handle on motor control center	6'-6"	Maximum
7.	Top of local motor controller	6'-0"	Maximum
8.	Top of local disconnect switch	6'-0"	Maximum

In situations where there appears to be a conflict with Americans with Disabilities Act (ADA) legislation, utilize the ADA requirements.

1.25 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 his 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.

1.26 BUY AMERICAN

- A. The Contractor is responsible for compliance with any "Buy American" legislation that may apply to this project due to State, Federal, and local laws or funding agency requirements. Necessary certifications of the sourcing of materials shall be part of the submittals.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 260000

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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. All electrical work (power and controls) for the existing belt filter press.
 - 2. All electrical work (power and controls) for the oldest polymer processing system. The existing active system shall be used as a backup for the new polymer processing system.
 - 3. All electrical work (power and controls) for the existing conveyor belt.
 - 4. All electrical equipment and material in the Square D MCC buckets to be reused for new equipment. All new equipment is to be served from new bucket equipment and material.
 - 5. All enclosures, conduits, conductors, etc. for the existing BFP control cabinet. Wall patch and paint by others.
 - 6. All electrical work (power and controls) for the existing shower/eye wash station. A new shower/eye wash station with alarm will be installed in this contract.
- 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. Disconnect or arrange for disconnection of service connections to equipment and areas to be demolished before starting demolition.
- B. 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. Maintain the continuity of the existing branch circuits serving all existing light fixtures that are to remain, whether indicated or not on the drawings.
- B. All existing walls, ceilings, floor slabs, etc., being cut or damaged under this Contract shall be patched back to match existing by General Contractor.
- C. All existing enclosures, receptacles, control equipment, and switches being removed shall be disposed of by the Contractor. Refer to 260000 for more details.
- D. Remove exposed ground conductor back to source or point of contact with slab. Cut conductor off below slab and abandon with hole being patched back to match existing surface (floor, wall or ceiling). If reusable, simply disconnect ground conductor.
- E. Conduits, wire, and wood products that are not salvageable shall be disposed of legally.
- F. Primary work shall be completed with all facilities kept in service or with short periods of scheduled momentary outages.

- G. Holes in slabs or into classified areas to be patched to provide a gas, vapor and watertight barrier.

3.4 STORAGE AND HANDLING

- A. The Owner reserves the right to save materials that are a part of the demolition work. 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

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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 degrees C temperature rise. Building wire larger than #1 may be applied at its 75 degrees 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 (type THHN/THWN) – Southwire or equal.
- B. Flexible Cords and Cables (Types SO (600V), SJO - 300V) – American, Carol, Collyer, or equal.
- C. Control Cables (Shielded or unshielded) 600V max. – Belden or equal.
- D. Instrumentation Cables (Shielded) 600V mx. – Belden 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 THHN/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 equipment that has special requirements.

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.
2. Conductors shall be color coded in accordance with the following schedule:

	208/120V 3 Phase
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Grounding	Green
Control	Per NFPA 79

3. Conductors shall be pulled into raceways in strict accordance with manufacturer's recommendations.
4. Ample conductor slack 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.
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 shall be full sized (same size as phase conductors) and may not be shared.

B. Low Voltage Feeders

1. All low voltage feeders shall be 208/120 volts as noted in the Contract Drawings - three phase, four (4) wire. The Contractor shall furnish and install all feeders from the MCC or control panels to each piece of equipment.
2. Wire shall be factory color coded for each phase and neutral, with green used for the ground conductor. All feeders shall be continuous from origin to panel termination without splices.

C. Control Cable

1. Control cable shall be the size and have the number of conductors shown on the control system drawings. Control cable shall be used for motor controls and monitoring only. Color coding shall be ICEA, Method 1. Cabling shall provide a minimum of 25 percent spare conductors. Voltage rating shall be 600 volts.

D. Instrument Cable

1. General
 - a. All signal lines should be constructed of individually twisted pairs (6 to 10 twists per foot), including thermocouple extension leads. Cables should be made of twisted pairs, with all lays and pairs twisted in the same direction for maximum flexibility.
 - b. Wire size is #16 AWG minimum for single pair runs under 5,000 feet in length. Wire size shall be #16 - #20 AWG for multi-pair cable runs under 5,000 feet in length.
 - c. Stranded tinned copper conductor shall be used for all wiring other than thermocouple extension leads.
 - d. Insulation resistance at 68 degrees Fahrenheit between conductors and between conductors and ground should be at least 500 megohms per 1,000 feet.
 - e. Multi-pair cable should be jacketed with poly-vinyl-chloride, polyethylene or Teflon at least 0.045 inch thick. Voltage rating shall be 600 volts.

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 Thomas and Betts or equal.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

- A. The grounding system shall be continuous with all structures, enclosures, panels, etc. 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.
- B. All grounding shall be as required by the NEC, Article 250.

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, 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. Aluminum framing channel shall be Unistrut, Kindorf, or equal.

2.2 MATERIALS

- A. All mounting brackets and framing material shall be aluminum. Fasteners used to mount equipment shall be stainless steel.
- B. Fasteners used to mount equipment to concrete shall be stainless steel.
- C. Stainless steel (non-magnetic) or fiberglass resin strut shall be used in chemical areas and areas exposed to chlorine gas.

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 aluminum angle, aluminum channel, or aluminum framing with stainless steel accessories to support or brace electrical equipment including safety switches, enclosures, panels, 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. 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 raceways for electrical conductors, 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.
- C. All raceways and fittings shall be painted to match existing or surrounding surfaces.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Tubular Raceways
 - 1. Rigid Metal Conduit (RMC) - Allied Tube & Conduit Corp., Triangle, Wheatland Tube Co., or equal.
 - 2. Electric Metallic Tubing (EMT) – Allied Tube & Conduit Corp., Triangle, VAW, or equal.
 - 3. Rigid Aluminum Conduit - Alcoa, Reynolds, VAW, or equal.
 - 4. Polyvinyl Chloride (PVC) - Schedule 40 – Carlon or equal.
 - 5. Liquidtight Flexible Metal Conduit – Carol Cable Co., Inc., OZ Gedney, Superflex, or equal.
- B. Raceway Fittings
 - 1. Conduit fittings – Appleton, Crouse-Hinds, OZ Gedney, or equal.
 - 2. Non-metallic conduit fittings – Carlon or equal.
 - 3. Flexible conduit fittings – OZ Gedney, Raco, T & B, or equal.

2.2 MATERIALS

- A. Aluminum Conduit
 - 1. Rigid 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 Metal Conduit (RMC)

1. Rigid metal conduit and fittings shall be of mild steel piping, galvanized inside and out, and shall conform to UL standards. The conduit and fittings shall 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. Polyvinyl Chloride (PVC) Conduit

1. PVC conduit and fittings shall be Schedule 40 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 C minimum UL rated, have a tensile strength of 7,000 psi @ 73.4 degrees F, 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 electro-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. Conduit Fittings

1. Rigid Metal Conduit (RMC) 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 (EMT) 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 Carbolite 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. 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.
7. 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.

8. Motor control centers, panels, switchgear, etc., mounted in a building with a basement or pipe gallery below, shall have the conduit opening left in the slab sealed to prevent moisture, dust, etc., from entering the panel. The type of seal to be used shall be silicone elastomer foam, as manufactured by Dow-Corning, Chase-foam as manufactured by Chase Technology Corporation, T & B, or equal.
9. All conduit to be added to an existing structure shall be exposed in unfinished and process areas. Where new devices are shown in existing walls in finished spaces, every attempt shall be made to conceal the conduit, by fishing flexible conduit through walls from ceiling cavities.
10. 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.
11. 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.
12. All metal raceway systems shall be grounding conductive, solidly bonded throughout and grounded in accordance with NEC requirements. In addition, all raceway systems shall be provided with separate grounding conductors.
13. 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.
14. All conduits entering or leaving enclosures shall be sealed around the wires with silicone caulk.
15. Areas of use for each type of conduit:

<u>Buildings – Interior</u>	<u>Schedule 40 PVC</u>	<u>EMT</u>	<u>RMC</u>	<u>Aluminum</u>
Process Building Floors Above Grade (Exposed)			X	X
Process Building Floors Above Grade (Concealed)	X		X	X
Non Process Building Floors Above Grade (Exposed)			X	X
Non Process Building Floors Above Grade (Concealed)	X	X	X	X
Building Interior (Concealed)	X	X	X	X
Building Interior (Exposed)		X	X	X

16. All conduit shall have an insulated ground wire pulled to all equipment and receptacles.
17. EMT conduit fittings shall be compression type.
18. 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.

19. 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.
20. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
21. Conduit may be run inside concrete slabs as long as the slab is at least 6-inches thick and conduit will have at least 2 inches of cover on both sides.
22. Flexible conduit used in mechanical rooms 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 – Appleton, Raco, Crouse-Hinds, Hoffman, Carlon, 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 NEC, 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.

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 his work may fit the other work required by these Specifications. When necessary, the Contractor shall relocate outlets so they will not interfere with other work or equipment.
2. All supports for outlet boxes shall be furnished and installed by the electrical trades.

B. Exposed Work

1. Outlet or junction boxes for use with exposed conduit shall be cast steel or cast aluminum.

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.

C. Pull Boxes

1. Interior pull boxes are not shown but shall be used as needed. Pull box types are as follows:
 - a. 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.

D. 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

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 EQUIPMENT LABELING

- A. All starters, feeder units, panels, motor control centers, disconnects, instruments, etc., shall be marked to indicate the motor, outlet, circuit, 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 end. In no way shall the mounting screws void the NEMA enclosure rating. If there is more than one identical unit, they shall be given consecutive numbers or other descriptions as designated by the Engineer. Nameplate background color shall be black, with white engraved letters, unless otherwise noted.

- B. Motor control centers, individual wall mounted starters, panels, and disconnect switches shall be labeled with vinyl self-adhesive signs that warn of "High Voltage" (state the specific voltage). Other major equipment such as 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.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION 260553

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SECTION 262419 - MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Contractor shall furnish and install new bucket equipment in the existing Square D Motor Control Center for each new piece of equipment.

1.2 SUBMITTALS

- A. The existing Motor Control Center is Square D and all new equipment installed in the MCC shall be new Square D equipment. Contractor shall submit descriptive literature and Shop Drawings for review of all components.
- B. Shop drawings, including layout drawings, complete schematic and composite wiring diagrams, control circuit wiring diagrams and descriptive literature shall be submitted to the Engineer for review. Service manuals shall be submitted on all equipment and shall be bound in three ring binders. The manuals shall also include information on accessories, such as timers, etc., built in the controls.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bucket Equipment - Breakers
 - 1. Square D.

2.2 MOTOR CONTROL CENTER (MCC) COMPONENTS

- A. General
 - 1. Quality of MCC components shall be consistent with existing equipment.
 - 2. MCC components shall meet the requirements of Underwriters' Laboratory publication UL-845, NEMA publication number ICS-2-322, the 2014 National Electrical Code.
 - 3. New MCC components shall be UL listed and labeled for the application. All new components shall bear UL labels.
- B. Bucket Construction
 - 1. Combination starter units shall consist of Size 1 minimum full voltage magnetic starters, autotransformer reduced voltage starters, molded case magnetic-only circuit breakers, and auxiliary control devices, as required and/or shown on the one-line and elementary diagrams. Pilot light assemblies (push-to-test) shall be transformer type. All auxiliary

equipment, except that which is specified for mounting on the door, shall be mounted within the compartment. All units shall be provided with unit doors, unit support pans, unit saddles and unit disconnect operators as outlined in this Specification. Each unit compartment shall be enclosed and isolated from adjacent units, buses and wireways except for openings for conductor entrance into units. Units shall be designed and constructed so that any fault will be localized within the compartment. All units shall be UL listed for minimum of 22,000 amperes RMS symmetrical fault withstand ability.

2. Plug-on combination starter units of the same NEMA size and branch feeder units of the same trip size shall be readily interchangeable with each other. It shall be possible to withdraw each plug-on unit to a de-energized position with the unit still being supported by the structure. It shall be possible to lock the unit in this position with one padlock.
3. Full voltage non-reversing combination starter units shall have the following minimum space factor requirements, shall be provided with plug-on connections and shall be provided with ample space for customer wiring room:

	Circuit Breaker Space Factor
Size 1	1
Size 2	1
Size 3	1-1/2
Size 4	2

4. Unit Saddles
 - a. Each plug-on unit shall have a saddle of 14 gauge hot rolled steel designed and constructed to physically isolate the unit from the bus compartment and adjacent units. Saddlers shall be equipped with captive, self-aligning mounting screws which shall hold the unit securely in place during shipment. Flanged edges shall be provided on each saddle to facilitate unit removal.
5. Disconnect Operators
 - a. An external operator handle shall be supplied for each switch or breaker. This mechanism shall be engaged with the switch or breaker at all times regardless of unit door position to prevent false circuit indication. The operator handle shall be color coded to display red in the "ON" position and black in the "OFF" position. The operator handle shall have a conventional up-down motion and shall be designed so that the down position will indicate the unit is "OFF". For added safety it shall be possible to lock this handle in the "OFF" position with up to three padlocks. The operator handle shall be interlocked with the unit door to prevent switching the unit to "ON" while the unit door is open. A defeater mechanism shall be provided for the purpose of defeating this interlock by a deliberate act of an electrician should he desire to observe the operation of the operator handle assembly or the unit components. Operators shall not be higher than 6'-6" above finished floor elevation, as installed.
6. Wiring
 - a. The motor control center wiring shall be NEMA Class II, Type B.
 - b. All wiring to the terminal strips from outside the MCC shall be made with spade type terminals of the proper size and rating for the wire used. Pull apart terminal

blocks shall be provided in unit spaces of motor starters that contain field wiring energized from a remote source to comply with NEC Article 430-74.

7. Finish
 - a. The finish shall be manufacturer's standard gray enamel applied over a rust inhibiting phosphate primer.
8. Optional Modifications and Accessories
 - a. Additional modifications and accessories shall be as listed and specified on the Contract Drawings.
9. Identification
 - a. A control center identification nameplate describing section catalog numbers and characteristics shall be fastened on the vertical wire trough door of every section. Each control center unit shall have its own identification nameplate fastened to the unit saddle. These nameplates shall have suitable references to factory records for efficient communication with supplier. Each control center unit shall also have an engraved Bakelite nameplate fastened to the outside of each unit door inscribed as written on the Contract Drawings for ease in identification and for making changes when regrouping units. An overall structure nameplate is also required.

C. Starters and Overcurrent Protective Devices

1. Magnetic Starters
 - a. Magnetic starters shall be furnished in all combination starter units unless otherwise indicated on Contract Drawings. Starter Sizes 1 through 4 shall employ the use of a bell-crank lever design to transform vertical action of the armature into horizontal action of the contact carriers and thus minimize contact bounce and produce extra long contact life. Thermal overload relays on starters shall be ambient temperature compensated bimetallic type with selector for either auto or manual reset. Overload heater units shall be provided in each starter unit. Overload relay heater schedules shall be provided on each starter unit.
2. Circuit Breakers
 - a. Type FA, KA, LA, MA and PA molded case circuit breakers shall be furnished in all starter and branch feeder units using circuit breakers as a disconnect means. All circuit breakers will have a push-to-trip test feature for testing and exercising the circuit breaker trip mechanism.
3. Control Devices
 - a. Provide selector switches, push buttons, relays, timers, etc, as shown in the control circuits in the Drawings.
 - b. Provide properly sized control transformer.
 - c. Pilot light assemblies shall be LED type.

D. Panels

1. Lighting panelboards shall be as specified in other section of this Division. Lighting panelboard unit doors shall be held closed with captive latches that may easily be operated without the use of tools, i.e., wing nuts, handle, etc.

PART 3 - EXECUTION

3.1 EXTRA STOCK/SPARE PARTS

A. Provide the following spare parts:

- 10 fuses of each type/amperage used
- 1 LED pilot light for each five (5) pilot light assemblies provided
- 1 control transformer for each size utilized

B. Recondition MCC – all sections

1. Contractor shall replace all existing LED's and provide spares for each.

END OF SECTION 262419

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.

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. The Belt filter press control panel shall be as manufactured by Andritz or the manufacturer of the belt filter press. Panel construction shall comply with OSHA and other code requirements as applicable and be listed and labeled by UL as an assembly for the intended use. 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 manufacturer 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 operator devices accessible without opening the enclosure door. All relays, timers, terminal strips, etc., shall be mounted to a subpanel inside the enclosure. All control 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 shall have operator devices mounted on an inner door with an outer door that is blank.
5. All terminal strips and lugs shall be UL listed and labeled to terminate the size and quantity of wires encountered. Where conduits enter the control panel enclosures 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 manufacturer 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 red “on” lights, control transformers, and auxiliary contacts to operate as defined on the control circuits of the manufacturer 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 shall be NEMA 4X stainless steel.
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 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 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 panel power shall be 208Y/120 VAC. Control conductors shall be provided in accordance with the indicated requirements.
14. Control panels shall be freestanding, floor-mounted, pedestal-mounted, or 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 freestanding control panels shall include full height rear and side subpanels, where enclosure layout permits. All wall, pedestal, and floor-mounted enclosures shall include full height rear subpanels.
17. Freestanding and floor-mounted panels shall be provided with switched fluorescent back-of-panel lights. One light shall be provided for every 4-feet of panel width and shall be mounted inside and in the top of the back-of-panel area.
18. Freestanding and floor-mounted panels shall be provided with a 20 amp, 120 volt, service outlet circuit within the back-of-panel area. The circuit shall be provided with 3 wire, 120 volt, 20 ampere, GFCI type duplex receptacle, one for every 4-feet of panel width (one minimum per panel), spaced evenly along the back-of-panel area.
19. Wall mounted or pedestal mounted panels shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel.
20. Provide enclosure mounting supports, bases, or legs as required for floor, pedestal, or wall mounting and for free standing enclosures.
21. Belt Filter Press control panel shall contain hardware selector switches. One switch shall be included for selection between one of two sludge pumps. Another switch shall be included for selection between one of two polymer pumps. Switches shall be clearly labeled and mounted as described elsewhere within these Specifications.

B. Construction Features

1. Control panel enclosure sizing shall be by supplier in accordance with appropriate standards and codes.
2. Panels enclosures shall be NEMA 4X stainless steel.
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. NEMA 4X Stainless Steel Control Panels

1. The enclosure(s) will meet or exceed the requirements of a NEMA 4X rating and shall be UL listed.
2. Panels shall be Type 304 stainless steel construction with a minimum 14-gauge for wall or pedestal-mount and minimum 12-gauge for floor-mount or freestanding enclosures.
3. Floor-mount enclosures shall be provided with 12-gauge stainless steel floor stand kits bolted to the bottom of the enclosure and sealed and gasketed to maintain NEMA 4X rating. Floor stands shall be mounted on concrete housekeeping pads using anchor bolts and/or expansion anchors.
4. 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.
5. 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.
6. 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.
7. Panels shall be provided with oil-resistant gasket attached with oil-resistant adhesive and shall form a weathertight seal between the cabinet and door.
8. All external hardware shall be 316L stainless steel.
9. Wall and pedestal-mount enclosures shall be constructed with rolled flanges around three sides of door and all sides of enclosure opening prevent infiltration of liquid or contaminants.
10. Freestanding and floor-mount enclosures shall be provided with body flange trough collar to prevent infiltration of liquid or contaminants.
11. Door restraints shall be provided on all exterior panels to prevent door movements in windy conditions.
12. All bolt holes shall be gasketed.
13. Light and/or alarm brackets shall be provided where indicated.
14. 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.

E. 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.

F. Cabinet Mounting

1. Pole or Wall Mounted Enclosure

- a. Enclosures intended for pole or 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.

2. Pedestal Mounted Enclosure

- a. Enclosures intended for pedestal mounting shall be provided with a reinforced base plate. If the enclosure is fabricated from 0.125 inch thick aluminum, the base plate will be a thickness of 0.250 inch thick aluminum.
- b. All mounting holes must be gasketed.

3. Pad Mounted Enclosure

- a. A solid plate shall be bolted and gasketed in place on the bottom of the enclosure to provide a weathertight seal.

G. 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 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.
 - 3) 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. Surge Suppression

- a. A surge protection device shall be installed on the power supply feeder to each panel. The power surge protector shall be rated for 208Y/120VAC.
- b. The power surge protection devices shall have the following performance characteristics:
 - c. Maximum Continuous Operating Voltage (MCOV): 150VAC
 - d. Maximum Discharge Current (8x20 μ s, I_{max}): 40kA
 - e. Nominal Discharge Current (8x20 μ s, I_n): 20kA
 - f. Protection Level (Up): 0.9KV
 - g. 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.

1.3 SYSTEM DESCRIPTION

A. General

1. The systems description section of these Specifications is supplementary to the descriptions in other Divisions of the Specifications and to the Contract Drawings. Refer also to the equipment specifications and controls shown on the Contract Drawings.

B. Systems Common to All Structures/Basins

1. Monitoring and Instrumentation

- a. The instrument panels and instruments that require power shall be served by molded case circuit breaker subfeeds from the 208Y/120 volt, three phase panel as indicated in the Drawings. Voltages shall be as shown on the Contract Drawings. The conduit and all power, control, and signal wiring shall be furnished and installed under this Division and as shown on the Contract Drawings.
- b. Several points shall be monitored by the existing SCADA system. Monitored points shall be as enumerated by the owner. The existing SCADA panel is located on the first floor of the Lumela Building.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 262716

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 208Y/120 volt circuits, use general-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 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 4X stainless steel unless noted otherwise.
- G. Provide dual-element Bussman type FRN (250 volt) fuses for any fusible safety switch serving a motor circuit.
- H. For non-motor loads, provide dual element Bussman type LPN (250 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 labeled for the intended purpose and shall conform to NEMA Standards. NEMA 4X enclosed safety switches shall be stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide non-fusible switches at remote motor locations as required.
- B. Provide fusible disconnects as required.
- 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 264313 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

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) (208Y/120 Volts)
 - 1. Type 1 Surge Protective Devices shall be furnished and installed on all control equipment.
- E. Type 2 SPD (208Y/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.

1.2 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 SPD system and what impact the fusing has on the performance of the device with respect to surge capacity and clamping levels.
- C. 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 recommended wire and breaker sizes.

1.4 STANDARDS

- A. Underwriters laboratories 1449 - (UL 1449 3rd edition or current safety standard for surge protective devices)
 - 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 SPD in panelboard)
- B. National electrical code latest edition - (2014 NEC Article 285, SPD installation practice and 2014 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 μ sec 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 μ sec test
 - 2. IEEE C62.45 – 2002 rev. - (system shall be tested to meet the C62.45)
 - 3. Category A & B - (0.5 μ s x 100 kHz ring wave)
 - 4. Category B3 bi-wave - (8 x 20 μ s at 3,000 amperes and 1.2 x 50 μ s at 6,000 volts)
 - 5. Category C3 bi-wave - (8 x 20 μ s at 10,000 amperes and 1.2 x 50 μ s 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 (surge protective devices)
 - 1. Advanced Protection Technologies, Atlantic Scientific Corporation, Current Technology, LEA International, or equal.

2.2 EQUIPMENT

A. Type 1 SPD (Secondary Power Arrestors)

1. The arrester 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 arrester 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 arrester 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

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 listed and labeled for the intended purpose 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 listed and labeled for the intended purpose 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 3 rd Edition Voltage Protection Ratings (VPR)				
System Voltage	Mode of Protection			
	L-N	L-G	N-G	L-L
208Y/120	700	700	500	700

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. 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 208Y/120. See one line 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.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

- A. Where the SPD 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 SPD. It shall be capable of electrically isolating the SPD 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 250VAC. If fuses are included with this switch, the fusing shall not effectively lower the rating of the SPD unit and shall have a minimum interrupt rating of 200 kAIC. Connection means utilizing breakers shall be sized at 30A/3P for switchboard/switchgear and branch panelboard units unless otherwise recommended by manufacturer.
- B. The specified SPD system shall be installed with #10 AWG minimum copper conductors 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 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 SPD system inductance.
- C. The SPD shall be installed following SPD manufacturer 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 written installation instructions, UL listing requirements and the National Electrical Code.

END OF SECTION 264313

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SECTION 265110 LED LIGHTING

PART 1 - GENERAL

The existing linear fluorescent lighting shall be replaced with new LED luminaires. Each existing linear fluorescent luminaire shall be removed and a new LED luminaire installed at the same location. Existing conduit, wiring, and controls shall remain and be reused. The new luminaires shall be mounted as pendants to clear existing conduits and other existing obstructions. Contractor shall coordinate mounting height with new and existing equipment.

All luminaires shall be new and unused. All luminaires shall be listed and labeled by an independent testing laboratory.

1.1 REFERENCE STANDARDS

- A. National Energy Policy Act of 2005, Public Law No. 109-58.
- B. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.
- C. NFPA 70 – 2014 National Electrical Code.
- D. IESNA LM-79-08 IESNA - Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products; 2008
- E. IESNA LM-80-08 IESNA - Approved Method for Measuring Lumen Maintenance of LED Light Sources
- F. IESNA TM-21-2011 – Projecting Long Term Lumen Maintenance of LED Light Sources
- G. UL 1310 and 8750 – Light Emitting Diode (LED) Equipment for Use in Lighting Products
- H. OSHA 29CFR1910.7 – luminaires shall be listed by national recognized testing laboratory approved by United States Department of Labor, Occupational Safety and Health Administration (OSHA)
- I. ANSI/IES RP-16-10 – Nomenclature and definitions for illuminating engineering
- J. ANSI C62.41 – Recommended practice in low power circuits
- K. IEC 61347-1 – General and safety requirements for control gear
- L. IEC 61347-2-13 – Particular requirements for electronic control gear for LED modules
- M. IEC 62384 - DC or AC supplied electronic control gear for LED modules – performance requirements
- N. IEC 61000-3-2 - Harmonic current emissions

- O. IEC 61547 - EMC immunity requirements
- P. IEC 62386-101/102/207 – Digital addressable lighting interface (DALI)
- Q. Federal Communications Commission (FCC) rules – Part 15 Class B: Radio Frequency Devices.
 - 1. Commercial rated
- R. Entertainment Services and Technology Association
 - 1. ESTA E1.3 - Entertainment Technology - Lighting Control System - 0 to 10V Analog Control Protocol

1.2 DEFINITIONS

CALiPER	DOE Commercially Available LED Product Evaluation and Reporting program for the testing and monitoring of commercially available LED Luminaires and lights.
CCT	Correlated Color Temperature: The temperature in units of Kelvin of a blackbody whose chromaticity most nearly resembles that of the light source in question.
cd	Candela: SI Unit of luminous intensity, equal to 1 lumen per steradian (lm/sr)
Chromaticity	The property of color of light defined by the dominant or complementary wavelength and purity aspects of the color taken together
CRI	Color Rendering Index – measure of the degrees of color shift of reference objects when illuminated by the light source as compared to a reference source of comparable color temperature.
fc	Footcandle: Unit of illuminance, equal to 1 lm/ft ²
L70	The extrapolated life in hours of the luminaire when the luminous output depreciates 30 percent from initial values.
LED	Light Emitting Diode
METS	Material Engineering and Testing Services of the Translab
MacAdam	Shape on the CIE chromaticity diagram that illustrates how much one can “stray” from the target before perceiving a difference from the target color
NEMA	National Electrical Manufacturers Association
NRTL	Nationally Recognized Testing Laboratory
NVLAP	National Voluntary Laboratory Accreditation Program - A program under the US DOE to accredit independent testing laboratories to qualify
PF	Power Factor - The ratio of the real power component to the total (complex) power component.
Rated power	Power consumption that the luminaire was designed and tested for at ambient temperature (70 degrees F or 21 degrees C)
RoHS	Compliance aims to restrict certain dangerous substances commonly used in electronic equipment, including Lead, Cadmium, Mercury and others.
SPD	Surge Protective Device - A subsystem or component(s) that can protect the unit against short duration voltage and current surges

SSL	Solid State Lighting
THD	Total Harmonic Distortion - The amount of higher frequency power on the power line.

1.3 SUBMITTALS

- A. Shop drawings: Clearly indicate luminaire type, name of the job, and Architect. Contractor shall endeavor to submit all luminaire, driver, and integral controls shop drawings at one time, in one package. Any re-submittals shall include all luminaire, driver and integral controls previously rejected or requiring further information. Specialty SSL, custom, or modified luminaires may be submitted as a separate package. Each item to be furnished shall be clearly marked on each sheet.
- B. Shop Drawings: Reproductions of the contract drawings are not acceptable as shop drawing.
- C. Product Data: Provide dimensions, ratings, specific catalog number, identification of items, accessories, and performance data.
- D. Shop Drawings: Indicate dimensions and components for each luminaire.
- E. Wiring Diagrams – as needed for special operation or interaction with other system(s).
- F. Photometric Data: Where indicated below or for substitutions, supply complete photometric data for the luminaire, including optical performance, rendered by NVLAP approved laboratory developed according to the methods of the Illuminating Engineering Society of North America. Submit electronically, in IESNA LM-63 standard format.
- G. Submit photometric data for all substitute luminaires. Photometric reports are not required from specified manufacturer.
- H. Specification Sheets: If lacking sufficient detail to indicate compliance with contract documents, standard specification sheets will not be accepted. This includes, but is not limited to, luminaire type designation, manufacturer's complete catalog number, voltage, LED type, CCT, CRI, specific driver information, system efficacy, L70 life rating, and any modifications necessary to meet the requirements of the contract documents.
- I. Substitutions shall include complete photometric data and point by point calculations for the specific conditions on the project. Samples shall be required for consideration of any substitutions.
- J. Working Samples of all substitutions: Samples shall be 120 volt with cord and plug attached, and shall include specified LEDs and all modifications necessary to meet the requirements specified in the Contract Documents.

PART 2 - PRODUCT REQUIREMENTS

2.1 MANUFACTURERS

- A. Approved Manufacturers: Provide products of firms regularly engaged in the manufacture of luminaires and components of type and rating required whose products have been in satisfactory use in similar service for not less than 5 years. The manufacturer of luminaires and components shall comply with the provisions of the appropriate code and standards. All luminaires shall be tested before shipping.
- B. Conformance: Luminaires shall be manufactured in strict accordance with the Contract Drawings and Specifications.
- C. Codes: Materials and installation shall be in accordance with the 2014 National Electrical Code and any applicable Federal, State, and local codes and regulations.
- D. UL or CSA US Listing: All luminaires shall be manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL 8750 or others as they may be applicable. A listing shall be provided for each luminaire type and the appropriate label shall be affixed to each luminaire in a position concealing it from normal view.
- E. Luminaire shall be DLC Certified (Design Lights Consortium). Low lumen decorative luminaires are excluded.
- F. Specifications and scale drawings are intended to convey the salient features, function and character of the luminaires only, and do not undertake to illustrate or set forth every item or detail necessary for the work.
- G. Base Bid Manufacturers: Are listed on luminaire schedule and specification. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards and photometric distribution set by the specified product.
- H. Alternate Manufacturers: Identification by means of manufacturer's names and catalog numbers is to establish basic features, quality, and performance standards. Any substitutions must meet or exceed these standards.
- I. Luminaire shall carry the Lighting Facts label, verified based on LM-79 test reports.

2.2 LUMINAIRES

- 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 degrees Celsius.
- C. The operating temperature range shall be zero degrees Celsius to plus 25 degrees Celsius.

- D. Each luminaire shall meet all parameters of this specification throughout the minimum operational life of 50,000 hours when operated at the average operating temperature.
- E. Nominal luminaire dimensions:
1. As specified in luminaire descriptive literature
- F. 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 LED driver for the luminaire shall be integral to the unit.
 3. Luminaires shall be fabricated from fiberglass or other non-metallic housing.
 4. Optics – Engineered optical system of high performance lens.
 5. Polymeric materials (if used) of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. Luminaire lenses are excluded from this requirement.
 6. Suspension shall be tubular with total suspension length as specified.
 7. The assembly and manufacturing process for the SSL luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
- G. Led Sources
1. LED's shall be manufactured by a manufacturer who has produced commercial LEDs for a minimum of five (5) years.
 2. Lumen Output – minimum initial delivered lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-360 degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
 3. Lumen output shall not decrease by more than 20 percent over the minimum operational life of 50,000 hours at the rated ambient operating temperature.
 4. 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
 5. LED drivers shall be suitable for field maintenance and have plug-in connectors. LED drivers shall be upgradable.
 - a. Correlated Color temperature (CCT) range as per specification between 3000 K, 3500 K, and 4000 K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
 - b. Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM80 report.
 - c. The color rendition index (CRI) shall be 80 or greater.
 - d. LED drivers to be tested for color consistency and shall be within a space of 2.5 MacAdam ellipses on the CIE chromaticity chart.
- H. Drivers
1. Driver: Acceptable manufacturer: eldoLED, Sylvania, or Philips that meet or exceed the criteria herein:

2. Ten year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
3. Driver shall be listed and labeled by an independent testing laboratory. Driver shall be modular for simple field replacement.
4. Electrical characteristics: 120 – 277 volts, CSA Certified, Sound Rated A+. Driver shall be greater than 80 percent efficient at full load across all input voltages. Input wires shall be 18 AWG copper minimum.
5. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 1 percent to 100 percent of rated lumen output with a smooth shut off function.
6. Dimming shall be controlled by a 0-10V signal.
7. Driver shall include ability to provide no light output when the control signal drops below 0.5 V, and shall consume 0.5 watts or less in this standby.
8. Driver shall be capable of configuring a linear or logarithmic dimming curve.
9. Drivers shall track evenly across multiple luminaires at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range regardless of the controller type.
10. Flicker: Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index, ANSI/IES RP-16-10. At all points within the dimming range from 100-0.1 percent luminaire shall have:
 11. Less than 1 percent flicker index at frequencies below 120 Hertz.
 12. Less than 12 percent flicker index at 120 Hertz, and shall not increase at greater than 0.1 percent per Hertz to a maximum of 80 percent flicker index at 800 Hertz.
13. Driver disconnect shall be provided where required to comply with codes.
14. Driver enclosure shall be internal to the SSL luminaire and be accessible per UL requirements.
15. The surge protection which resides within the driver shall protect the luminaire from damage or failure from transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A. Failure does not mean a momentary loss of light during the transient event.

I. Electrical

1. Efficiency shall be:
 - a. A minimum of 110 lumens per watt.
2. Operation Voltage - The luminaire shall operate at 60 Hertz \pm 3 Hertz at AC line voltage over a range from 120 VAC to 277 VAC. Fluctuations of line voltage of plus or minus 10% shall have no visible effect on the light output.
3. Power Factor: The luminaire shall have a minimum power factor of 90%.
4. 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 and meet ANSI C82.11 maximum allowable THD requirements.
5. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A. To reduce nuisance breaker tripping due to inrush the luminaire shall meet NEMA inrush recommendations.
6. RF Interference - the luminaire and associated on board circuitry must meet Class A emission limits as per Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-consumer requirements for EMI/RFI emissions.

7. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
8. Adjustment of forward LED voltage, supporting 3V through 60V.
 - a. Adjustment of LED current from 200 mA to 100 percent control input point in increments of 1 mA.
 - b. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
9. 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 luminaire from the ceiling.
10. All electrical components shall be RoHS compliant.

J. Emergency Battery Pack

1. Shall be factory installed and provide 1400 lm of light output for 90 minutes.

K. 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.
 - d. The ratio of the peak-to-zenith maximum candela ratios shall be – 1.94:1 @ 127.5 degrees.
2. The luminaire may be determined to be compliant photometrically, if:
 - a. The initial minimum illuminance level is achieved in 100 percent of the area of the specified lighting pattern
 - b. The measurements shall be calibrated to standard photopic calibrations.

L. 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 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.

M. Optics

1. Optics shall consist of a high performance lens, diffusers and metal reflector.
2. Optics shall eliminate source image.

N. Luminaire Identification

1. Each luminaire shall have the manufacturer's name, trademark, model number, serial number, date of manufacture (month-year), and lot number as identification permanently marked inside the each unit and the outside of each packaging box.
2. The following operating characteristics shall be permanently marked inside each unit: rated voltage and rated power in Watts and Volt-Ampere.

O. Quality Assurance

1. The luminaires shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of the modules built to meet this specification. These tests shall include: CCT, CRI, Lumen output and wattage. Tests shall be recorded, analyzed and maintained for future reference.
2. LED luminaire designs not satisfying design qualification testing and the production quality assurance testing performance requirements described below shall not be labeled, advertised, or sold as conforming to this specification.

P. Design Qualification Testing

1. Design Qualification Testing shall be performed by a National Voluntary Laboratory Accreditation Program (NVLAP) testing facility. Such testing may be performed by the manufacturer or an independent testing lab hired by the manufacturer on new luminaire designs, and when a major design change has been implemented on an existing design. A major design change is defined as a design change (electrical or physical) which changes any of the performance characteristics of the luminaire, results in a different circuit configuration for the power supply, or changes the layout of the individual LED's in the module.
2. A quantity of two units for each design shall be submitted for Design Qualification Testing.
3. Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but not limited to):
 - a. Maximum power in Watts
 - b. L80 in hours, when extrapolated for the worse case operating temperature (section 2.2.3). TM21 report shall be submitted to demonstrate this.
 - c. Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products.
4. Luminaire shall be tested per IESNA LM 79-08.

2.3 WARRANTY

- A. The manufacturer shall provide a single source, 5 year limited warranty against loss of performance and defects in materials and workmanship for all components of the luminaire. Warranty is from the time of acceptance of the Luminaires. All warranty documentation shall be provided to customer prior to the first shipment.
- B. Provide manufacturer's warranty covering 5 years on drivers from date of purchase.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 501.
- B. Luminaire to be suspended by aircraft wire to the mounting height specified. Adjustable cable gripper shall be provided as per specification. Luminaires shall be mounted straight and plumb. Contractor shall verify ceiling type and shall obtain all required mounting hardware for specific ceiling type.
- C. Install all required hardware and mounting brackets to secure luminaires to structure per local code requirements.

3.2 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with the specifications.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- C. Test and calibrate all controls associated with luminaires, i.e. integral photo cells and occupancy sensors.

3.3 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from lens and enclosures
 - 1. For cleaning acrylic lenses or diffusers, use a feather duster or dry cotton cheesecloth to rid the lens/diffuser of any minor dust. For fingerprints, smudges, or other dirt present, use an ammonia-based cleaner (such as Windex) and wipe carefully with cotton cheesecloth (so as to avoid injury from any prismatic texture of the lens).
 - 2. Job site contamination may not necessarily be removed using the above recommendations. In that case the lens would need to be replaced.
- C. Clean photometric control surfaces as recommended by manufacturer.

3.4 CLOSEOUT ACTIVITIES

- A. Replace any luminaire components or associated controls which is not function per specifications.

END OF SECTION 265100

DIVISION 41

**MATERIAL PROCESS & HANDLING
EQUIPMENT**

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SECTION 412222 – BELT CONVEYOR

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment and service required to furnish and install the belt conveyor equipment specified herein and as shown on the Drawings.
- B. The belt conveyor shall be as manufactured by Keystone Engineering Corporation, Elk River, Minnesota, or approved equal.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Shop Drawings, Product Data and Samples: Section 013323
- B. Operations & Maintenance Manuals: Section 017823
- C. Metals: Division 05
- D. Painting: Section 099600
- E. Belt Filter Press: Section 467621
- F. Electrical: Division 26

1.3 SUBMITTALS

- A. Descriptive literature, catalog cuts, dimension prints, shop drawings, installation, operation and maintenance instructions shall be submitted to the Engineer for review before shipment. The data shown on the shop drawings shall be completed with respect to dimensions, materials of construction, wiring diagrams, and the like, to enable the Engineer to review the information as required.
- 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.
- C. Comply with the provisions of Section 013323.

1.4 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 expense, 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.

1.5 DESIGN CRITERIA

- A. The conveyor shall be designed to handle up to 5 TPH of partially dewatered sewage sludge at approximately 20 to 25 percent solids.
- B. Belt conveyors shall be a horizontal configuration, 24-inch wide, troughed slider bed design for reversing operation.
- C. The conveyor shall operate at a speed of 60 feet per minute and be capable of conveying 5 TPH of sludge cake from the belt filter presses to the discharge point in a clean efficient manner.

PART 2 - PRODUCTS

2.1 BELT CONVEYOR SYSTEM

- A. Belt
 - 1. The belt conveyor is to incorporate a 24-inch minimum width, 3-ply synthetic carcass belt with RMV (rubber modified vinyl) top cover and friction surface bottom cover. The belt shall have a tension rating of 150 PIW.
 - 2. The belts shall be provided with a factory installed, stainless steel, hinged mechanical fastener.
- B. Drive
 - 1. The conveyor shall be driven by a 208 volt, 3 phase, 1.5 HP minimum, 1800 RPM, severe duty motor with 1.15 SF and Class F insulation.
 - 2. The drive motor shall be directly connected to a shaft mounted, AFMA Class II, helical gear reducer at the conveyor head shaft.
 - 3. The drive package is to provide a 60 FPM final belt speed.
- C. Bearings
 - 1. All bearings to be 1-7/16" dia. minimum, anti-friction bearings.
 - 2. Tail pulley bearings to be supported by screw type take-ups with a minimum travel length of 2% of the conveyor belt centers.
- D. Shafting
 - 1. Shafting shall be designed to exceed all torsional, bending and shock loads imposed by the conveyor operation. Combined shock and fatigue factors of 1.5 shall be applied to torsion and bending moments, maximum shearing stress shall

be 6,000 PSI for combined loading conditions, and 12,000 PSI maximum bending stress for non-driven shafts.

2. Pulley shafting shall not be less than 1-7/16" dia. and all drive shafts to be keyed.

E. Pulleys

1. Drive and tail pulleys to be engineered class, positive crowned drum type, 2-inch wider than the belt. The drive pulley is to have 1/4" thick minimum vulcanized rubber lagging to resist belt slip.
2. Pulleys shall be a minimum of 6-inch diameter.

F. Belt Support

1. The belt shall be supported on the carrying run by a #10 ga. minimum, troughed slider bed that is an integral part of the conveyor frame. The bed will include full length, 1/4" minimum thickness, UHMWP liners to reduce friction between the belt and the slider bed.
2. The return run of the belt shall be supported by 1.9" minimum diameter polymeric rollers on 10'-0" maximum centers.

G. Framework

1. The belt conveyor frame, supports and spreaders will be ASTM, A36 mild steel, sized as required to limit deflection to 1/360 at the longest support span. The conveyor frame will include the integral troughed slider bed. The conveyor frame shall be a minimum of #10 ga. with spreaders as required. The conveyor supports shall be fabricated from mild steel shapes and plates, with bracing and base plates, for support of the conveyor from the floor.

H. Belt Wiper

1. A spring loaded belt wiper shall be furnished at each discharge pulley. Each wiper assembly shall include an adjustable, replaceable, 1/2" thick #80 durometer neoprene wiper blade and adjustable spring tensioners.

I. Skirting

1. The belt conveyor is to be provided with #12 ga. type 304 stainless steel skirting continuous through the load point to guide and contain the product on the belt. The skirting shall have adjustable, 1/4" minimum thickness solid rubber seal strips at the belt surface. Skirting shall be supported from the conveyor frame by galvanized steel support legs.

J. Drip Pan

1. The conveyor is to be provided with a #16 ga. minimum, type 304 stainless steel, center pitched drip pan 6" wider than the overall belt width. The drip pan shall be as shown on the plans and shall be supported from the conveyor frame by galvanized steel hardware.

K. Discharge Hood

1. The conveyor shall have a #12 ga. stainless steel discharge hood at each end. Hoods to be complete with 12" x 18" minimum inspection door with handles and quick release clamps.

L. Discharge Chute

1. Each discharge of the conveyor shall have a #12 ga. stainless steel stub-type discharge chute to contain the product and wiper tailings, directing them to the existing thru-floor chutes.

M. Safety Stop Switch

1. The conveyor is to be provided with a NEMA-4, 115V., safety pull cord stop switch. A continuous orange vinyl coated galvanized cable shall fully surround the conveyor. The cable shall be supported from the conveyor frame on 10 foot maximum centers.

L. Zero Speed Switch

1. The conveyor is to be provided with a NEMA-4, 115V., zero speed switch located at the tail pulley. The speed switch shall be of the non-contacting magnetic-disc and sensor type with galvanized steel mounting bracket.

O. Construction

1. All mild steel fabricated items of the conveyor shall be hot dip galvanized after fabrication. Stainless steel shall remain unfinished
2. All welding to be in accordance with the latest AWS standards.
3. All component items shall be provided with manufacturer's standard finish. Shafting and other exposed machined surfaces shall be coated with a rust inhibitive compound.
4. All exposed, accessible rotating parts as well as the drive mechanism to be covered with as OSHA type guard to prevent accidental injury.
5. All nuts, bolts and washers used for assembly to be stainless steel and installed using an anti-seize compound.

2.2 WORK COORDINATION

- A. Layout and design of the belt conveyor shall be coordinated with layout of the Belt Filter Press Section 467621.

2.3 SPARE PARTS

- A. The following spare parts shall be provided with the belt conveyor system:

1. One (1) return idler rolls.
2. Two (2) belt wiper blades.

2.4 CONTROLS

- A. General Requirements: The conveyor system control panel that will contain the necessary control devices and equipment for controlling the dewatering process shall be integral to the Belt Filter Press control panel as described in specification Section 467621 – Belt Filter Press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The belt conveyor equipment shall be installed and placed into service in accordance with the manufacturer's recommendations.

3.2 MANUFACTURERS SERVICES

- A. The belt conveyor equipment will be factory operated and inspected prior to shipment.
- B. The Contractor shall include with his bid the services of the Equipment Manufacturer's field service technician.
- C. This service shall be for the purposes of check-out, initial start-up certification, and instruction of plant personnel.
- D. A written report covering the technician's findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

END OF SECTION 412222

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SECTION 412223 - TROLLEY HOIST EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment, and service to furnish, install, and place into service all hoisting equipment as shown on the Drawings and Specified herein.

1.2 RELATED WORK

- A. Section 051200 – Structural Steel.

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
Trolley & Hoist	X	X		X		X		X		X		
Electrical Components	X	X				X						
Lifting Beam	X	X		X				X		X		
Pallet Lifting Bars	X	X		X				X		X		

1.4 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 expense, 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 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.

PART 2 - PRODUCTS

2.1 MOTORIZED TROLLEY AND HOIST

A. Trolley Hoist

One (1) Motorized Trolley and Hoist, Model #GA3M02-040S20-2, as manufactured and supplied by Yale or approved equal. This Hoist shall be installed in the Residual Handling Building as shown on the Drawings. The motorized Trolley and Hoist shall conform to the following criteria.

1. Motorized Trolley and Hoist shall be rated for two (2) tons.
2. The minimum distance from the bottom of the monorail beam to the bottom of the hook throat opening for the Hoist shall not be less than 16" and shall have a capability of 40 feet of vertical lift.
3. The Motorized Trolley and Hoist shall be completely electric operated with a 50 feet long power supply cord with a cable reel.
4. A 40 feet long wire rope shall be provided with the Motorized Trolley and Hoist.
5. An electric cable reel shall be provided to handle the hoist electric cable.

2.2 ADJUSTABLE FOUR-POINT LIFTING BEAM

A. Features

The Adjustable Four-Point Lifting Beam shall consist of a steel main beam and two (2) steel cross arms at each end of the beam. The Four-Point Lifting Beam shall be Model #27SD-3-84/60 as manufactured by The Caldwell Group, Rockford, IL, or approved equal. The Four-Point Lifting Beam shall consist of the following features:

1. Low head room design – less than or equal to 30-inches.
2. Main beam minimum dimension of 36-inches and maximum dimension of 84-inches.

3. Cross arms minimum dimension of 24-inches and maximum dimension of 60-inches.
4. Swivel hooks with standard latches.
5. Adjustable spreads on 1-foot increments.
6. Faspins for easy cross arm adjustment.
7. 3-ton lifting capacity.
8. Multi-leg steel chain slings to connect to pallet lifting bars.

B. Standards

The Adjustable Four-Point Lifting Beam shall comply with ASME B30.9, ASME B30.20 and BTH-1.

2.3 PALLET LIFTING BAR

A. Features

The Pallet Lifting Bars shall consist of the following features:

1. Steel beam construction
2. Sized appropriately to fit standard pallets.
3. Fitted with sliding keepers to ensure stability under load.
4. Locking hooks at each end.
5. 2-ton lifting capacity.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Furnish and install per manufacturer's recommendations.

END OF SECTION 412223

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DIVISION 46

WATER AND WASTEWATER
EQUIPMENT

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SECTION 462010 - INTERIOR PROCESS PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services required to furnish and install all plant process piping as shown on the Drawings and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Interior Process Valves: Section 462012
- C. Plumbing Piping: Division 22
- D. Piping furnished with equipment is included in the specific equipment item.

1.3 SUBMITTALS

- A. The Contractor shall comply with the requirements of Section 013323 of these specifications.
- B. A notarized certification shall be furnished for all pipe and fittings which verifies compliance with all applicable specifications.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE/DUCTILE IRON FITTINGS

- A. Unless otherwise noted or required, all inside ductile iron piping shall be flanged pipe with threaded flanges in accordance with AWWA C 115. All piping flanges shall have ring gaskets, 1/8-inch thick.
- B. All exposed iron pipe to be field painted shall be furnished with an external coating of rust inhibitive primer, such as Tnemec Series 1 OmniThane, Sherwin-Williams Corothane I GalvaPac, or equal. Pipe manufacturer shall be responsible for compatibility of shop applied coatings with the field paint systems and products specified in Division 09, Section 09 96 01. Do not apply asphalt or bituminous coatings on pipe to be painted.
- C. The interior of all ductile iron pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C 104. Thickness of the lining shall be as set forth in Section 4.8.1 of the aforementioned specification unless otherwise directed by the Engineer.
- D. Ductile iron fittings shall conform to AWWA C 110 with flanges faced and drilled 125-pound. Fittings shall have interior lining and exterior coating same as the pipe.

2.2 POLYVINYL CHLORIDE (PVC) PLASTIC PRESSURE PIPE

- A. PVC Pressure Pipe, 3" and Smaller: Polyvinyl chloride plastic pipe shall be ASTM D 1785 Schedule 80 or F441 CPVC, 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 CHLORINATED POLYVINYL CHLORIDE (CPVC) PLASTIC PRESSURE PIPE

- A. CPVC Pressure Pipe, 3" and Smaller: Chlorinated polyvinyl chloride plastic pipe shall be ASTM F441 CPVC Schedule 80 with solvent weld joints. Fittings shall be ASTM D 2846 Schedule 80 socket type. All socket type connections shall be made with CPVC solvent cement complying with ASTM F 493 CPVC solvent cement shall be furnished from the same supplier as the CPVC pipe. Provide socket-threaded adapters for connection to threaded appurtenances where required.

2.4 COPPER PIPING

- A. Copper piping shall be ASTM B 88 Type L 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.

2.5 STAINLESS STEEL

- A. Stainless steel pipe shall be ASTM A 312, AISI Type 316. Schedule 40, threaded. Stainless steel fittings shall be AISI Type 316, 150-lb., threaded, as manufactured by Camco Fittings Company, Hamden, Connecticut, or equal.

2.6 WALL PIPE AND SLEEVES

- A. All wall pipe shall be furnished with cast or welded collar water stops in the positions shown on the Drawings. Welding of water stop collars on pipe shall be accomplished by the wall pipe manufacturer in their shop. All centrifugally cast wall pipe shall be ductile iron meeting the requirements of AWWA C151 for the pipe barrel, conforming to the pressure rating of the pipeline in which installed, and in no case be lighter than Class 53.
- B. All statically cast wall pipe shall be ductile iron meeting the requirements of AWWA C110 for fittings. Mechanical joint end and cast-on flange end wall pipe shall conform to AWWA C110 and threaded flange wall pipe shall conform to AWWA C115. Where flanged or mechanical joint bell ends are flush with the wall, they shall be drilled and tapped for stud bolts which are to be of 300 Series stainless steel.
- C. The length of all wall pipe shall be not less than the thickness of the wall in which installed. Wall pipe shall have the same pressure rating as connecting pipe. All wall pipe shall be cement-mortar lined per AWWA C104. The outside of wall pipes shall be left uncoated and

shall be field primed for painting on the portion exposed, uncoated where embedded and field coated with standard bituminous coated where buried.

- D. Contractor may have the option to install wall pipe flush face-to-face of wall in lieu of the dimensioned length wall pipe shown on the Drawings, in order to eliminate form penetrations. This option will be subject to Engineer's review at each wall pipe location and covers both flanged and mechanical-joint bell-end wall pipe. Embedded flanged and M.J. bell-end bolt holes shall be tapped for stud bolts; tapped bolt holes in embedded flanges shall be plugged for protection during concrete pouring.
- E. All pipe wall sleeves shall be plain end galvanized steel pipe of diameter noted on Drawings and length to fit flush face-to-face of wall.

2.7 INTERLOCKING LINK PIPE SEALS

- A. In all locations indicated on the Drawings, interlocking link pipe seals shall be used in lieu of lead packing a pipe wall sleeve. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. Seals shall be "Link-Seal" as manufactured by Thunderline Corporation, Wayne, Michigan, or approved equal.
- B. The Contractor shall determine the required diameter of each individual wall opening according to the manufacturer's recommendations before ordering and installing the seal. Pipe shall be accurately centered in the sleeve and the link seals shall be sized, installed and tightened in accordance with the manufacturer's instructions.

2.8 COUPLINGS AND ADAPTERS

- A. Flexible couplings shall be of the sleeve type with a middle ring, two round-wedge shaped rubber gaskets at each end, two following rings together and compress the gasket against the pipe. 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:

1. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe -

Dresser	Smith-Blair
Style 253 (2"-15")	411
Style 38/138 (18" & above)	

2. Transition couplings for joining pipe of different outside diameters-

Dresser	Smith-Blair
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")
	433 cast (2"-16")
	435 cast (2"-12")

3. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Smith-Blair
Style 227 cast (3"-12")	912 cast (3"-12")
Style 128 steel (3"-48" D.I. Pipe)	913 steel (3"-24" D.I. Pipe)
Style 128 steel (2"-96" steel pipe)	

2.9 FLANGED JOINTS

A. Flange bolts and nuts shall be ASTM A 307, Grade B and shall have hexagonal heads. All bolts, nuts and studs for flanged pipe in submerged locations shall be of 300 Series stainless steel. The flanges shall be drawn together until the joint is perfectly tight, with bolts of a length such that they will not project greater than 1/4-inch from the nut nor fall short of the end of the nut when drawn up. No washers shall be used. Gaskets shall be carefully fabricated prior to installation and must be suitable for pressure rating for the pipe for which it is used.

B. All flanges (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 125-pound for ductile iron and ANSI B16.5 150-pound for steel.

C. At the Contractor's option, and at no additional expense to the Owner, the following patented SBR flange gaskets or approved equal may be substituted for standard sheet packing ring gaskets in ductile iron flanged pipe:

1. TORUSEAL by American Cast Iron Pipe Company
2. FLANGE-TYTE by United States Pipe & Foundry Company

When using such gaskets, flange bolts shall be torqued to manufacturer's recommended torque values.

2.10 METAL PIPE SUPPORTS AND HANGERS

- A. The Contractor shall furnish and install all pipe hangers, inserts, brackets, plates, anchors, and other supports not specifically included under other items. Generally pipe supports are not shown on the Drawings, but shall be supplied as specified herein. However, any bracing or support details shown on the Drawings shall be followed.
- B. Prior to installation, the Contractor shall submit to the Engineer for review, manufacturer's data sheets on all catalogued items to be used and sketches covering all specially designed hanger and support assemblies and fabrications.
- C. Supports and hangers shall be as manufactured by Grinnell, Elcen, or Fee & Mason, or equal or fabricated by the Contractor. Field fabricated supports may be used only for special conditions where manufactured items may not be suitable. In such cases, details of proposed supports shall be submitted to the Engineer for review. All such supports shall be galvanized.
- D. Except as shown on the Drawings or as directed by the Engineer, supports and hangers shall be as follows:
 - 1. Pipes with centerlines less than 24 inches from a wall shall be supported by a typical wall support bracket. Pipes with centerlines less than 6 feet above a floor shall be supported from below. All other pipes shall be hung from above. Piping shall be supported at no greater than 10 feet 0 inches on centers.
 - 2. Pipe supported from underneath shall have adjustable pipe saddle supports on properly sized pipe stanchions. The saddle assembly shall be of cast iron. Standard pipe stanchions with hold-down "U" bolts shall be Grinnell Fig. 259, Elcen Fig. 49, Fee & Mason Fig. 2595, or equal.
 - 3. Hangers are to be suspended from concrete work. Hangers shall be supported from approved metal inserts placed in concrete before the concrete is placed. Standard concrete inserts shall be Grinnell Fig. 281 or 282, Elcen Fig. 86 or 65, Fee & Mason Fig. 186 or 2570, or equal. If special support from overhead concrete is necessary due to unusually heavy loads, support shall be as detailed on the Drawings. In no case shall standard concrete inserts be used where pipe load exceeds the manufacturer's recommended load for the insert, or where the hanger rod exceeds 7/8" diameter.
 - 4. All pipe hangers, inserts, clamps, supports and other like items shall be submitted for review by the Engineer prior to installation.
 - 5. All inside horizontal flanged piping shall be supported with approved split ring type adjustable hangers of malleable iron with suitable hanger rods unless shown otherwise on the Drawings. Special supports shall be constructed in accordance with details shown on the Drawings. Wall supports and/or hangers shall be placed not over 10 feet apart. All piping shall be rigidly supported to prevent loosening under vibration.
 - 6. Pipe, valve operating stems, fixtures and conduits shall be bracketed or suspended from walls, ceilings, and beams at or near valves and fittings and where needed for firm support, by standard brackets, rods, turnbuckles, and rings made especially for pipe of sizes supported. Perforated strap iron and/or copper will not be acceptable.
 - 7. Clevis hangers for "iron pipe size" O.D. pipe shall be Grinnell Figure 65, Elcen Figure 12, Fee & Mason Figure 239, or equal. Clevis hangers for Cast Iron O.D. pipe shall be Grinnell Figure 260, Elcen Figure 12C, Fee & Mason Figure 104, or equal. All clevis hangers shall be galvanized.
 - 8. Turnbuckles shall be forged steel. Rods shall be of black steel, machine threaded of following sizes:

<u>Pipe Size</u>	<u>Rod Diameter</u>
1/2" - 2"	3/8"
2 1/2" - 3"	1/2"
4" - 5"	5/8"
6"	3/4"
8" - 12"	7/8"
14" - 16"	1"
18"	1 - 1/8"
20" - 24"	1 - 1/4"

9. Brackets shall be of standard castings of fabricated steel and shall be reviewed by the Engineer. Standard catalogued bracket shall be medium duty Grinnell Fig. 195, Elcen Fig. 57, Fee & Mason Fig. 151, or equal, galvanized, size as noted on Drawings. Provide light or heavy duty brackets if specifically noted on Drawings. "U" bolts shall be Grinnell Fig. 137, Elcen Fig. 68 or 68A, Fee & Mason Fig. 176, or equal.
10. Column type pipe supports shall consist of pipe columns of size required to carry the full pipe and standard cast iron bases and saddles as required. Saddles shall be of proper size to fit the pipe being supported.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

- A. Materials shall be new and of the best grade and quality; workmanship shall be first class in every respect.
- B. Each piece of iron pipe and each fitting shall be plainly marked at the foundry with class number and weight.
- C. Where indicated on the Drawings, plain-end pipe shall be joined by means of flanged adapters or flexible couplings which shall be Rockwell, Dresser, or equal.
- D. All pipe couplings shall be designed to safely withstand the operating pressure of the lines in which they are installed. All couplings shall be shop primed with an approved rust inhibitive primer.
- E. Taps and connections to piping shall be made as required to connect equipment, sample lines, etc., and where otherwise shown on the Drawings.
- F. 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.
- G. All piping, fittings, valves and other accessories shall be thoroughly cleaned of dirt, chips and foreign matter before joint connections are made.

- H. All plastic pipe shall be adequately supported and braced. Support spacing shall not exceed the recommendations of the Plastics Pipe Institute.
- I. Teflon tape shall be used on all plastic pipe threaded connections.
- J. Field cut male threads on plastic pipe shall be made with plastic pipe threading dies.
- K. The annular space of plain wall sleeves shall be packed tight with lead wool to within 3/4" of wall face and then patch grouted flush to wall face with non-staining nonshrink grout, Masterflow 713 by Master Builders, SonogROUT by Sonneborn-Contech, or equal.
- L. All pipe sleeves passing through walls or floors of chlorine feed and storage areas shall be provided with gas tight seals.
- M. All pipe threads shall conform to ANSI B2.1.
- N. Piping shall be erected to provide for expansion and contraction.
- O. Screwed or soldered unions shall be provided in all small piping as required to permit convenient removal of equipment, valves and piping accessories from the piping system.
- P. Dielectric insulating couplings or brass adapters shall be used whenever the adjoining materials being connected are of dissimilar material such as connections between copper tubing and steel pipe.
- Q. All inside piping shall be color coded, stenciled and label tagged for identification as specified in Section 099600.

END OF SECTION 462010

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SECTION 462012 - INTERIOR PROCESS VALVES – SANITARY

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services required to furnish and install all new valves as shown on the Drawings and/or specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Interior Process Piping: Section 462010
- B. Domestic Water Piping: Section 221116
- C. Domestic Water Piping Specialties: Section 221119
- D. Emergency Plumbing Fixtures: Section 224500
- E. Valves furnished with equipment are included with equipment specifications.

1.3 SUBMITTALS

- A. 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. Comply with provisions of Section 013323.
- B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.1 BALL VALVE

- A. PVC ball valves (shut-off valves) shall be Hayward TB Series 250 psi threaded true union ball valves as manufactured by Hayward Manufacturing Co., Inc., Elizabeth, New Jersey; or equal, NSF listed for potable water.
- B. Valves for PVC shall be manufactured of PVC material. Install so indicator arrow is in direction of flow.

2.2 PLUG VALVES

- A. All plug valves shall be eccentric plug valves unless otherwise specified.
- B. Valves shall be of the non-lubricated eccentric type with flanged ends faced and drilled per ANSI B16.1 125 lb.
- C. Valve bodies shall be flushing body type and made of ASTM A126 Class B cast iron. Valves shall be furnished with a 1/8" welded overlay seat of not less than 95% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.
- D. Plugs shall be made of ductile iron and have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.
- E. Valves shall have replaceable sleeve type bearings and grit seals at the upper and lower journals.
- F. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.
- G. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.
- H. Manually operated valves 4-inch and larger shall have a worm gear actuator, stainless steel input shaft and handwheel operator. Manually operated valves 3-inch and smaller shall have a lever operator. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft shall be stainless steel and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be stainless steel.
- I. Any cylinder actuators shall be equipped with 2-inch square operating nuts to allow manual valve operation in case of supply failure. Electric motor actuated valves shall comply with specification.
- J. Valves shall provide drip tight shutoff up to the full pressure rating. Valves shall be provided with adjustable limit stops and rotate 90 degrees from fully opened to fully closed.
- K. Valves located 6 feet or more above the floor shall be furnished with chain wheel operators.
- L. Valves shall have rectangular port openings for throttling service, and shall open to 100% of the corresponding pipe diameter.

- M. Plug valves shall be as manufactured by DeZurik, or approved equal,

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All valves shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION 462012

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SECTION 463305 - POLYMER 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 the polymer feed system as described in the Drawings and Specifications.
- B. The polymer dilution/feed unit shall be capable of automatically metering, diluting, activating and feeding a liquid polymer with water.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Interior Process Piping: Section 462010
- B. Interior Process Valves: Section 462012
- C. Belt Filter Press: Section 467621
- D. Electrical: Division 26
- E. Plumbing: Division 22

1.3 SUBMITTALS

- A. Submit product literature, material specifications, dimension prints, and installation recommendations for Engineer review. Comply with all provisions of Section 013323.

1.4 POLYMER FEED TAP LOCATIONS

- A. Refer to Drawings for all locations of polymer feed tap locations.

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 expense, 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 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.

PART 2 - PRODUCTS

2.1 POLYMER FEED SYSTEM DESCRIPTION

- A. The polymer feed system shall consist of mixing/holding tank, mechanical mixer, polymer feed pump and all required piping and valves. The system shall be capable of mixing dry polymer with the water and pumping the wet solution to the in-line polymer injectors. The mechanical mixer shall be capable of placing the dry polymer to solution, but not aggressive to the point of destroying the polymer molecular strands.

<u>Equipment Required</u>	<u>Quantity</u>
Mixing Tank (225 gallon)	1
Aging Tank (450 gallon)	1
Mechanical Mixers	1
Polymer Feed Pumps	2

- B. Under this item, the contractor shall furnish and install to the manufacturer's recommendations, a dry polymer preparation system as shown on the plans and specified hereafter.
- C. The system shall be designed with the capability for dispensing and wetting up to 2 pounds per minute of dry polymer and shall be sized for a usage of 2.6 to 3.1 pounds per hour at a 0.17 to 0.2 percent solution, aged for 45 minutes to 2 hours.
- D. The dry polymer feeding and preparation system shall be designed for dispensing the polymer into a wetting chamber for complete wetting of each polymer particle. Immediately after the dry polymer has initial contact with water, it shall be pumped from the wetting chamber to a mix tank.
- E. The use of polymer preparation systems that utilize eductors or gravity fall of polymer into water as the sole means of wetting will not be considered equal or acceptable.

2.2 POLYMER FEED SYSTEM QUALITY ASSURANCE

- A. The dry polymer preparation system, including the mixing and aging tanks, shall be furnished by a single supplier, with all manufacturing and assembly of the equipment and controls carried out in the supplier's facilities.
- B. The supplier shall have a minimum of 35 years of experience in providing dry polymer systems in municipal installations.
- C. The polymer feed system shall be a Model 515 as manufactured by Acrison, Inc., Moonachie, NJ, or approved equal.

2.3 DRY POLYMER FEEDER

- A. The feeder shall employ a dissimilar speed, Double Concentric Auger Metering Mechanism mechanically geared together in a specific ratio to each other that produces uniform product density for accurate and continuous material feed without flooding, bridging or voids. The larger conditioning auger (Intromitter) shall be 6 inch OD minimum and the smaller metering auger shall be 1-3/8 inch OD minimum.
- B. The feeder shall be heavy-duty, dust-tight and designed to provide easy cleaning without the need for removing the feeder from the module, or disassembling flexible connectors, hoppers, etc. Construction shall provide complete access to the feeder internals by simply removing the feeder's discharge spout.
- C. The feeder and all parts in contact with the material shall, at minimum, be constructed of 11 gauge, 304 stainless steel. The seals shall be heavy-duty synthetic packing glands.
- D. The feeder's discharge spout shall be provided with a hydraulically activated gate (seal) to prevent moisture from entering the feeder while the unit is not operating.
- E. The feeder shall be driven by a 1/2 HP, totally enclosed variable speed motor, with the motor controller mounted inside the control panel. The feeder shall be controlled by an adjustable timer accessed through the touchscreen display.
- F. The feeder shall have a metering accuracy of ± 1 to 2% (error) based on a given number of consecutive one-minute weightments.
- G. The feeder shall be equal to the Model W-105 as manufactured by Acrison, Inc., Moonachie, New Jersey, or approved equal.

2.4 FEEDER HOPPER

- A. The feeder hopper shall have a capacity of 2 cubic feet excluding the feeder's feed chamber.
- B. The hopper shall be constructed of 11 gauge, 304 stainless steel and be provided with a gasketed, hinged cover, with handle and quick-clamps.

2.5 HOPPER LOW LEVEL SWITCH

- A. A low level switch shall be included and installed in the feeder's hopper to energize a visual and audible alarm in the control panel when material reaches a predetermined low level.

2.6 WETTING CHAMBER

- A. The wetting chamber shall incorporate a mixing action which utilizes swirling turbulent water and a multitude of converging water jets to completely and thoroughly wet the polymer. Wetted polymer shall drop directly into the suction of a transfer pump. Unwetted polymer is not acceptable.

- B. No restrictive orifices (1-1/2 inches or less) shall be utilized in the wetting chamber.
- C. All surfaces that come into contact with the wetted polymer shall be constructed of 316 stainless steel.

2.7 WETTING CHAMBER CONTAINMENT RESERVOIR

- A. The wetting chamber shall be mounted in a containment reservoir to prevent spillage in the event of an overflow condition.
- B. A conductance type level probe shall be mounted in the containment reservoir to immediately shut down the preparation module and signal an alarm.
- C. The containment reservoir shall have a clear synthetic cover to allow for visual inspection.

2.8 TRANSFER PUMP

- A. A transfer pump shall be attached directly to the outlet of the wetting chamber for transferring the wetted polymer to the mixing tank.
- B. The transfer pump shall be 316 stainless steel in construction, shall have a mechanical shaft seal, and be directly coupled to a 3/4 HP, totally enclosed, constant speed motor.
- C. The transfer pump shall have a minimum capacity of 30 gpm at 40ft. TDH.
- D. A check valve shall be mounted on the discharge side of the pump to prevent backflow of polymer solution. Connection between pump outlet and check valve shall be clear to allow for visual inspection of the process.

2.9 WATER CONTROL COMPONENTS

- A. The water supply line of the wetting system shall be sweated copper and shall include the following items:
 - 1. Pressure reducing valve, 1" in size, with an adjustable range of 10-35 psi, and brass in construction.
 - 2. Pressure switch with high and low pressure contacts and stainless steel wetted parts. Switching elements shall be single pole double throw snap-action.
 - 3. Solenoid valve, 1" in size, normally-closed and brass in construction.
 - 4. Pressure gauge, 2-1/2" in diameter, with black painted steel case and polycarbonate window.
 - 5. Visual Flow Meter with spring-retained movable piston, and constructed of polysulfone and stainless steel.
- B. Minimum water supply shall be 20 gpm at 25 psig.
- C. All wetting system components shall be pre-assembled, piped and wired.

2.10 MIXING TANK

- A. The mixing tank shall be rectangular in shape, and have a capacity of 225 gallons.
- B. The tank shall be constructed of 11 gauge, 304 stainless steel, complete with a (full) cover on which the level transmitter, and a slow speed mixer shall be installed.
- C. Plastic or fiberglass tanks will not be acceptable. Open-top tanks will also not be considered acceptable.

2.11 MIXER

- A. The mixing tank shall be complete with a 1 ½ HP, slow speed mechanical mixer.
- B. The mixer impeller speed shall not exceed 400 RPM and the impeller shall be positioned no less than one and one half impeller diameters from the bottom of the tank.
- C. The mixer assembly shall include an angle riser support, right angle gear-reducer, and a TEFC motor.
- D. The impeller and shaft shall be 316 stainless steel. The unit shall be heavy-duty in construction and capable of operation at varying tank levels. The mixer shaft diameter shall be 7/8 inch minimum.

2.12 TRANSFER VALVE

- A. The transfer valve shall be sized for quick gravity transfer of the mixed polymer to the aging tank on a demand signal from the level transmitter in the aging tank.
- B. The valve shall be motor operated with a manual over-ride and constructed of 316 stainless steel.
- C. The valve shall be mounted on the side of the tank for easy access, and to minimize the possibility of clogging from tramp material.

2.13 MIXING TANK SUPPORT

- A. A heavy-duty steel structure shall be provided to support the mixing tank assembly directly above the aging tank. Systems that have the mix tank supported directly on top of the age tank cover will not be acceptable.

2.14 AGING TANK

- A. The aging tank shall have a capacity of 450 gallons to provide 45 minutes up to 2 hour aging time when feeding 0.17 to 0.2 percent solution at the maximum dry polymer usage.

- B. The tank shall be 11 gauge, 304 stainless steel, furnished with a (full) gasketed cover on which the level transmitter shall be mounted.
- C. Labyrinth baffles shall be provided to promote a plug flow pattern within the tank to optimize polymer detention.
- D. Plastic or fiberglass tanks will not be acceptable. Open-top tanks will also not be acceptable.

2.15 ULTRASONIC LEVEL TRANSMITTERS

- A. Ultrasonic level transmitters shall be mounted on both the mix tank cover and the age tank cover to provide complete control of the preparation system operation, including level-alarm indication, and to provide a continuous display of the level in each tank on the control panel touchscreen display. The control and alarm set-points shall also be settable through this display.
- B. The ultrasonic level transmitters shall have a range of 0.033 to 6 feet, a resolution of 0.03 inches, 4 to 20 mA output, and simple push-button calibration. Operating frequency shall be 148 kHz.
- C. Level transmitters shall not extend more than 5 inches from the top of the tank covers.
- D. Level sensing devices that come into physical contact with the polymer solution will not be acceptable.

2.16 CONTROL PANEL

- A. The polymer preparation module shall include a NEMA 4X control panel to automatically operate the entire preparation module (system) and all components thereof.
- B. The control panel shall include an Allen-Bradley Micrologix 1100 PLC, or approved equal, with Ethernet connectivity, as standard. The panel shall be equipped with an unmanaged four port industrial Ethernet switch.
- C. Operator interface shall be a 10" Allen-Bradley PanelView Plus Compact, with 640 x 480 resolution, and a TFT 18 bit color display, or approved equal.
- D. The panel shall also include a main disconnect switch and an emergency stop push-button.
- E. The PLC program shall include an interlock to prevent feeding of dry polymer unless water is being supplied to the wetting chamber and all motors are operational. Interlocks shall trigger a visual and audible alarm.
- F. Should the system experience a loss-of-power, the PLC shall remember where in the sequence of operation the polymer preparation module was interrupted, and continue from that point when power is restored, and the start button pressed.

- G. Magnetic starters, providing overload protection, shall be provided for each motor. Starters shall be mounted in the same control panel by the equipment supplier and wired to their respective motors to the greatest extent possible.
- H. The control panel shall be mounted to the same skid as the dry polymer feeder and pre-wired to the greatest extent possible. Mixing/aging tank assembly shall be shipped separately.
- I. Power supply for motors shall 208/3/60.
- J. The color touchscreen operator interface shall provide the following capabilities at a minimum:
 - 1. "Process" screen, showing on/open status of all components during system operation.
 - 2. Continuous level displays for both the mixing and aging tanks.
 - 3. Resettable batch counter.
 - 4. Alarm acknowledge and reset buttons.
 - 5. Password protection.
 - 6. "Alarm" screen showing all possible alarms, noting which alarms are currently present.
 - 7. Alarm 'history' screen.
 - 8. "Timers" screen, allowing the operator to set feeder and mixer settings, in addition to various system delay timers.
 - 9. "Switches" screen, including H/O/A switches for all major components.
 - 10. Local/Remote capability.
 - 11. "Levels" screen, allowing the operator to set mixing and aging tank control and alarm levels.
 - 12. Screen contrast adjustment.
 - 13. Backlight-off screen saver.

2.17 POLYMER FEED PUMPS

- A. Description
 - 1. Pumps shall be positive displacement peristaltic type complete with retractable roller pumphead, self-contained variable speed drive and flexible extruded tube as specified.
 - 2. Peristaltic pumping action is created by the compression of the flexible tube between the 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.
 - 3. Pumps shall be dry self-priming, capable of being run dry without damaging effects to pump or tube, and shall have a maximum suction lift capability of up to 30' vertical water column. Maximum pressure rating: 30 psi.
 - 4. Pump shall not use check valves or diaphragms and shall not require dynamic seals in contact with the pumped fluid. Process fluid shall be contained within pump tubing and shall not directly contact any rotary or metallic components.
 - 5. Flow shall be in the direction of the rotor rotation, which can be reversed and shall be proportional to rotor speed.

B. Pump Process Schedule

Quantity	Two (2)
Model Number(s)	630RE
Fluid to be Pumped:	Polymer
Tubing Material	Marprene II
Flow (GPM)	3 GPM (183.9 GPH)
Max Pump RPM for Application	265
Tubing ID	17mm
Displacement /Revolution (Gallons)	0.01558
Min Flow Rate (GPM)	0.0016
Max Flow Rate (GPM)	4.13
Suction Head	30 PSI
Power (VAC, Frequency, Phase)	115VAC, 60 Hz, 1 Phase

C. Pump Construction

1. Pumphead

- a. Pumphead shall consist of a fixed track with tool lockable-hinged guard door with guard switch, which shall render the drive inoperable when the pump door is open. For operator safety, pumps without lockable guard, guard switch, and/or flip-top design pump heads are not acceptable.
- b. Pumphead door shall have two clear windows for viewing of rotation direction. When closed, pump door shall seal against the pump track for leak containment and controlled waste through the pumphead waste port in the event of a tube failure. For operator and environmental safety, pumps without clear viewing windows and/or waste port are not acceptable.
- c. Rotor assembly shall be equipped with two compression rollers, which shall be retractable for tube loading, SIP, or CIP flushing cycles. Compression rollers shall be located 180 degrees apart for compression of the tube against the track twice per rotor revolution. One roller shall at all times be fully engaged with the tubing providing complete compression to prevent backflow or siphoning. Occlusion gap shall come factory set to accommodate 4.0 mm wall thickness tube. To maximize pump efficiency, pumps without retractable rollers and/or more than 2 compressing rollers are not acceptable.
- d. The rotor assembly shall be close coupled to the output shaft of the drive gear motor by a 19 mm keyed shaft and shall be axially secured to the shaft by a through center retaining screw. Pumphead track shall be secured to the drive via two slotted screws and shall be self-locating.
- e. Material of Construction
 - 1) Track: Aluminum, Trimite polyester powder coat, electrostatically applied and baked
 - 2) Door:
 - i. Inner Shell: Grilamid TR55
 - ii. Outer Shell: shock resistant Polyurethane

- iii. Door Seal: Silicone
- iv. Drain Port Adapter: Acetyl
- 3) Rotor:
 - i. Hub & Roller Arms: Fortron 1140L4 (PPS)
 - ii. Hub Cover: Dupont Hytrel G5544
 - iii. Main Rollers: 304SS
 - iv. Main Roller Bearings: Carbon Steel (sealed)
 - v. Guide Rollers: Nylatron
 - vi. Hardware & leaf springs: 304SS

2. Tubing

- a. Pump shall be supplied with a Load Sure tubing element with molded fittings, which shall be self-locating when fitted into the pumphead. Tube element 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 the element fittings. The tubing shall be replaceable without the use of tools and with no disassembly of the pumphead. To achieve maximum service life, pump heads with a track angle of less than 180 degrees and/or without tube elements are not acceptable. See 1.02.
- b. Pump tubing shall be constructed of Marprene II, a thermoplastic elastomer with a 64 Shore A durometer and 4.0mm wall thickness. Pump manufacturer must manufacture Marprene tubing in-house. Pump manufacturers who purchase third party tubing are not acceptable.
- c. Pump shall readily accept tubing elements with ID's of 12.0mm and 17.0mm without pump adjustment or replacement. Tubing with a wall thickness less than 4.0mm is not acceptable. See 1.02.
- d. Molded Fittings: Polypropylene, 3/4" Male Cam & Groove
- e. Supply One (1) tube element of the specified size per pump.
- f. Supply Two (2) one-meter long flexible reinforced PVC hoses for connection of pump to suction and discharge process lines. Flexible hose shall have a 3/4" Polypropylene female cam & groove fitting for connection to the Loadsure Element and 3/4" Polypropylene male cam and groove fitting for connection to NPT adaptor for ease of maintenance and connection to process piping.
- g. Supply Two (2) 3/4" female cam & groove to 3/4" male NPT adaptors.

3. Drive

- a. Rating: Continuous 24 hour operation, 40 degrees Celsius ambient.
- b. Supply: 120 VAC, 60 Hz and 208 VAC, 60 Hz, single phase field switchable. Supply nine-foot length mains power cord with standard 120 VAC three prong plug.
- c. Max drive power consumption: 250 VA.

- d. Enclosure: NEMA 4X
- e. 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.
- f. Drive motor- brushless DC motor with integral gearbox and tachometer feedback.
- g. Speed Control Range of 2650:1 from 0.1 to 265 rpm +/- 0.1 rpm throughout the range.
- h. 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
- i. Circuitry complete with temperature and load compensation and protection.
- j. Leak Detector: Pump manufacturer shall supply float-type leak sensor mounted to the drain port of the pump head for leak detection and pump shut down in the event of a tubing failure
- k. Mounting: Drive shall be self-supporting and shall not require anchoring.

4. Manual Interface & Control

- a. Pumps must meet the following minimum requirements for operator interface functionality. Pumps not meeting this minimum functionality will not be accepted.
 - 1) 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
 - 2) Keypad for start, stop, speed increment, speed decrement, forward/reverse direction, rapid prime, and programming.
 - 3) Menu driven on screen programming of manual control, flow, and general programming.
 - 4) Programmable “Auto Restart” feature to resume pump status in the event of power outage interruption.
 - 5) Programmable “Keypad Lock” to allow operator lockout of all keys except emergency start/stop.
 - 6) Programmable “Maximum Speed” to allow operator to set the maximum speed of the pump within 0.1-265 rpm.
- b. Supply auto control features to meet the following minimum functionality requirements. Pumps not meeting this minimum functionality will not be accepted.
 - 1) Remote Control Inputs
 - i. Speed Control:

- 01. Primary Analog 4-20mA speed input, with input signal trim able and speed scalable over any part of the drive speed range.
 - 02. Provisions for alternative remote accessory potentiometer (if supplied by others)
 - ii. Start/Stop Control: via 5V TTL, 24V industrial logic, dry contact, or powered 110VAC contact as required per the process and instrumentation drawings- Configurable command sense allowing open to equal run or open to equal stopped.
 - iii. Forward/Reverse Control: via 5V TTL, 24V industrial logic, dry contact, or powered 110VAC contact as required per the process and instrumentation drawings.
 - iv. Auto/Man Mode Control: via 5V TTL, 24V industrial logic, dry contact, or powered 110VAC contact as required per the process and instrumentation drawings.
 - v. Leak Detector Run/Stop Control
- 2) Status Outputs
 - i. Four relay contacts rated for 30 VDC with a maximum load of 30W, NO or NC or four relay contacts rated for 130VAC as required by the process and instrumentation drawings software configurable to indicate the following:
 - 01. Running/Stopped status
 - 02. Forward/Reverse status
 - 03. Auto/Manual status
 - 04. General Alarm status
 - 05. Leak Detected status
 - ii. Speed output –
 - 01. Analog 4-20mA
 - iii. Accepts RS485 data protocol
 - iv. Termination: supply screw down terminals suitable for up to 18 AWG field wire and accessible through four glanded cable entry points on the pump

D. Spare Parts

- 1. Supply four (4) spare tube elements of the specified size per pump.
- 2. Supply one (1) spare pumphead assembly and rotor.

- E. Pumps shall be 630 Series Variable Speed Peristaltic Pumps manufactured by Watson-Marlow, Inc., Wilmington, MA, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. This Specification describes a complete operational polymer preparation system. Unit shall have been totally assembled and tested as a complete system prior to operation.

3.2 TESTING OF PIPING AND FITTINGS

- A. All of the piping connected with the polymer feed system shall be given a hydrostatic test to the rated working pressure of the pipe. If any leaks occur, the defective joint shall be taken apart and resealed so that no further leaking occurs.

3.3 TRAINING

- A. The equipment manufacturer shall provide one (1) trip, three (3) days total of start-up and operator training.

END OF SECTION 463305

SECTION 467621 - BELT FILTER PRESS

PART 1 - GENERAL

1.1 SCOPE OF WORK

Provide all labor, materials, equipment, and services required to furnish, install and place in service the equipment specified herein and shown on the Drawings.

- A. All equipment detailed in this section shall be furnished by the belt press manufacturer and completely assembled to comprise a complete dewatering system. Only units with a minimum actual belt width of 2.0 meter(s) will be considered.
- B. Furnish One (1) Belt Filter Press complete with control panel(s) as specified and all spare parts and other appurtenances as required in this specification.
- C. The belt filter press shall be as manufactured by Andritz Separation Inc., Arlington, TX, Ashbrook Simon-Hartley (Alfa Laval Inc.), Houston, TX, Komline-Sanderson, Peapack, NJ, or approved equal.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Interior Process Piping: Section 462010
- B. Interior Process Valves: Section 462012
- C. Polymer Feed Equipment: Section 463305
- D. Belt Conveyor: Section 412222
- E. Electrical: Division 26
- F. Metals: Division 05

1.3 CODES AND STANDARDS

Equipment specified herein shall meet or exceed the applicable sections of the following codes and standards authorities.

- A. AGMA, American Gear Manufacturers Association.
- B. ASME, American Society of Mechanical Engineers.
- C. ASTM, American Society of Testing and Materials.
- D. ANSI, American National Standards Institute.

- E. IEEE, Institute of Electrical and Electronics Engineers.
- F. NEC, National Electrical Code.
- G. U.L. Underwriters Laboratories.

1.4 SYSTEM DESCRIPTION

- A. Design Criteria: The belt filter press shall be designed to extract water from the sludge specified herein after conditioning of the sludge with a polymer solution. The process of dewatering shall produce a finished sludge product meeting the following performance requirements.
- B. Performance Requirements: The belt filter press shall operate within the design conditions based on “Conditions of Service” Section and meet the following performance criteria:
 - 1. Minimum dewatered sludge solids (% TS).....35%
 - 2. Minimum solids capture (% of TSS).....95%
 - 3. Maximum polymer dosage (active lbs/ton TS).....20 lbs/ton TS
 - 4. Maximum hydraulic loading (GPM).....135 GPM
 - 5. Maximum solids loading (lbs TS/hr).....2,000 lbs/hr
 - 6. Number of belt filter press(es).....1
 - 7. Effective working width per press.....2.0 meters
- C. Conditions of Service: Condition of sludge feed shall be based on the following design requirements as specified by the customer:
 - 1. Type of sludge.....Filter Backwash & Clarifier Sludge
 - 2. Feed solids concentrations (% TSS).....2.0-8.0%
 - 3. Solids Loading (lbs TS/hour).....2,000 lbs/hr
 - 4. Temperature (°F).....40-70°F

1.5 QUALITY ASSURANCE

- A. All components of the belt filter press equipment shall be of high quality and sized to accommodate, without failure or compromise, all forces encountered during fabrication, installation and operation. Compliance with the performance requirements of the specification shall not relieve the Contractor of his responsibility to supply equipment having the specific structural, mechanical, operational and surface corrosion protection features as specified herein.
- B. The belt filter press shall be factory assembled and tested prior to shipment to ensure proper operation of all systems.
- C. 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 expense, shall promptly repair or replace the defective equipment without any additional cost to the Owner.

- D. The guaranty period shall be a three-year mechanical warranty on all belt filter press components, not including electronic components. The guaranty period of all electronic components 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.

1.6 SUBMITTALS

A. Drawings:

- 1. Submit within 30 days of notice to proceed, drawings including weights, structural loadings & dimensions of the specified equipment. Refer to Specification Section 013323 for submittal procedures. Submit the following:
 - a. Full size dimensional drawing of belt filter press, with typical sump arrangement.
 - b. Field installation requirements and weight of each equipment item.
 - c. Detailed wiring diagrams, instrumentation and operational description of control system.
 - d. Descriptive literature, catalog cuts, technical data, performance curves & utility requirements for all auxiliary equipment i.e: pumps, compressors, etc.
 - e. Complete description of all interconnecting components. List the following:
 - 1) Number, type and size of all piping and service connections.
 - 2) Number type and size of all electrical conductors and connections.
 - 3) Number type and size of all pneumatic connections.
 - f. Control panel dimensions, mounting requirements and access restrictions.

B. Operations and Maintenance Manuals

- 1. Furnish, within 10 working days of shipment, two (2) complete copies of operations and maintenance instructions, including start-up and regular recommended maintenance schedules, complete spare parts list. Information shall include all auxiliary equipment supplied under this specification.

1.7 DELIVERY, STORAGE & HANDLING

- A. Deliver equipment to site per terms of the order.
- B. Provide manufacturer's recommendations regarding handling, storage and protection.
- C. The press shall be shipped fully assembled with the exception of the dewatering belts and the drive unit, which shall be shipped separately to prevent damage. Ancillary equipment shall be shipped separate.

1.8 WARRANTY

The belt filter press manufacturer shall warrant the following components:

- A. The manufacturer shall warrant against any defects in material or workmanship to the belt filter press framework and coating for a period of 42 months from date of delivery or 36 months from start-up.
- B. The manufacturer shall replace any bearing that fails during the prescribed warranty period, provided the owner has lubricated and otherwise maintained the bearing in accordance with the intervals and procedures set forth in the manufacturers operations and maintenance instruction manual. The complete bearing assembly as specified herein shall be warranted for a period of 42 months from the date of delivery or 36 months from start-up.
- C. The manufacturer shall replace or repair any roller or roller coating that fails during the warranty period, provided the roller or roller coating has not been damaged by external action such as impact, fire, weld splatter, etc. beyond the manufacturers control. The manufacturer shall warrant the roller and roller coating to be free from defects in material and workmanship for a period of 42 months from the date of delivery or 36 months from start-up. Neither the rollers nor coating shall require preventative maintenance during the warranty period.

1.9 SEQUENCING AND SCHEDULING

- A. As specified in paragraph 1.4 of Specification section 011410, the manufacture and delivery of equipment shall coincide with sequence of work within the anticipated plant shutdown between November 2017 through March 2018. Equipment shall be manufactured and delivered in a timely manner to avoid degradation of equipment parts. Equipment shall be delivered within thirty (30) days of the equipment installation date.

1.10 MAINTENANCE

- A. Spare Parts: The belt filter press shall be provided with the following spare parts:
 - 1. One (1) complete set of urethane containment seals for the entire belt filter press.
 - 2. One (1) set of dewatering belts.
 - 3. One (1) set of doctor blades.
 - 4. One (1) set of each size and type bearing used.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The following materials and coatings shall be provided for the belt filter press and related components unless specified otherwise herein:

Component	Material
24" Perforated "S" Roller	Hot Dip Galvanized Carbon Steel, 1/4" plate, ASTM A36
16" Perforated "S" Roller	Hot Dip Galvanized Carbon Steel, 1/4" plate, ASTM A36
Doctor Blades	U.H.M.W. Polyethylene
Doctor Blades Support Mechanism	ASTM A36 Carbon Steel
Drain Piping	PVC Schedule 40/Flex hose
Drainage & Filtrate Pans	304L Stainless Steel, Minimum 14 Gauge, ASTM A320.
Frame	HD Galvanized ASTM A36 Carbon Steel, Minimum thickness 3/8"
Gravity Zone Belt Support Structure	304L Stainless Steel with UHMW Replaceable Wear Strips
Gravity Zone Side Walls	304 L Stainless Steel, Minimum 12 gauge, ASTM A320
Camber Wedge Belt Support Structure	304L Stainless Steel with UHMW Replaceable Wear Strips
Distribution Headbox Assembly	304L Stainless Steel
Nuts, Bolts and Fasteners	316 Stainless Steel
Plow Supports	High Density Polyethylene Plows; HDG Plow Holders, Support Rods, and Support Structure
Polymer Injection Ring	High Density Polyethylene
Bearing Housings	Cast Iron Nylon Coated
Roller Coatings	Buna-N Rubber and PE
Rollers	A519 Mechanical Tubing / A-53 Pipe
Shower Housing	304 L Stainless Steel, Minimum 12 gauge, ASTM A320
Shower Pipe, Nozzles & Wire Brush	304L Stainless Steel
Splash Guards	304 L Stainless Steel, Minimum 14 gauge, ASTM A320
Venturi Mixer	316L Stainless Steel

2.2 EQUIPMENT

- A. The belt filter press shall be designed to extract water from the sludge type specified herein, after conditioning of the sludge with an appropriate flocculant. This process of dewatering shall be accomplished by the combination of chemical conditioning of the sludge, drainage of free water in the horizontal gravity zone, the gentle compression of the sludge in the wedge zone, and the compression of the stabilized solids in the pressure/shear zone. The belt filter press shall have a minimum effective dewatering width of 2.0 meters and a minimum combined effective filtration area of 294 square feet. All moving wetted parts, and all wetted parts on which moving parts contact, shall be fully corrosion resistant for the material being processed, as specified herein. All components of the belt filter press shall be designed to withstand all stresses that may occur during erection and operation.
- B. The belt filter press construction shall allow easy access to internal components, operational adjustments and routine maintenance shall be possible without taking the machine out of service. Any disassembly required for maintenance and repair shall be possible within the clearances shown on the drawings.

- C. The belt press shall be delivered to the job site as a completely assembled package and ready for service after connection of piping, wiring and utilities. All piping provided with the belt filter press shall be schedule 40 PVC or flexible hose.
- D. The overall length, width, height, of the fully assembled belt filter press shall not exceed 209", 135", and 64", respectively. Minimum dry weight of the unit shall be 20,100 pounds.
- E. The belt filter press shall be designed such that the "sludge" side of the belt does not come in contact with roller face to prevent the accumulation of material on the roller assemblies.
- F. The belt filter press shall be the 2.0 meter S8P Quantum SMX Belt Filter Press manufactured by Andritz Separation Inc., Arlington, TX, or approved equal.

2.3 COMPONENTS

Each belt filter press shall include structural frame, sludge inlet assembly, gravity drainage section, pressure/shear dewatering section, filtrate drainage system, belts, belt drive assembly, belt tracking/tensioning systems, doctor blades, belt wash stations, roller assemblies, bearings, safety devices, electrical components, and any other specified and necessary components.

A. Structural Frame

1. The structural frame shall be constructed of welded and bolted structural steel members. The frame shall be designed such that roller assemblies can be removed from the side or end of the belt press without removing structural members or repositioning more than one (1) roller assembly.
2. The structural members shall be structural tubing and plate, conforming to the standard specifications for structural steel, ASTM A36. The maximum deflection of each structural member shall not exceed $L/480$, where L is the span length. The maximum stress of each structural member shall not exceed $1/5$ the members yield point. All frame members in the running machine direction shall possess a minimum moment of inertia of 29.7 in^4 in the primary load bearing direction.
3. All belt press loads imposed on the building floor shall be vertical. All horizontal loads shall be contained within the structural frame. The belt press frame shall be designed to interface with and facilitate the installation of access platforms along each longitudinal side of the belt press.
4. The structural frame shall be provided with "welded in place" lifting eyes designed to lift the fully assembled belt press.
5. After fabrication the structural steel frame shall be sandblasted according to SSPC SP-10 standards to a near white finish then hot-dip galvanized with a minimum 2.4 ounces of zinc per sq. ft. of metal finish per ASTM A123.

B. Gravity Drainage Section

1. The belt filter press shall be provided with a sludge inlet assembly consisting of a distribution chute and underflow leveling weir designed to uniformly distribute the

conditioned feed sludge across the entire working width of the gravity section. The entire assembly and necessary supports and hardware shall be constructed of 304L stainless steel.

2. The belt filter press shall have a horizontal gravity drainage section consisting of a minimum working belt area of 92 sq. ft. Side skirts constructed of 12 gauge 304L stainless steel shall be mounted on both sides of the belt and at the sludge feed end of the gravity section. The side skirts shall be equipped with urethane seals to prevent spillage of sludge.
3. The belt, while in the gravity dewatering section, shall ride on top and be supported by a series of UHMW polyethylene replaceable wear strips held in place and supported by a 304L stainless steel support bracket with a minimum deflection of 0.06" at mid span under full sludge load. The support shall be a minimum 2" wider than the belt on each side. Wear strips shall be replaceable without removing or disassembly of gravity section sidewalls and plow assembly.
4. There shall be eight (8) rows of plows, with a total of 56 plows in the gravity section. Each plow shall continuously contact the belt and be designed such that it continually rolls the sludge. Each set of plows shall be mounted on a hot dipped galvanized steel horizontal support bar. Plows shall be liftable from the belt while the belt filter press is in operation.

C. Pressure / Shear Dewatering Section

1. The belt filter press shall have a pressure/shear dewatering zone wherein increasing pressure and shearing forces are applied to the sludge.
2. The first section of this zone is the wedge dewatering area wherein the upper and lower belts converge thus entrapping the sludge between them. This zone shall consist of a minimum 94 sq. ft. utilizing the combined surface area of each belt actually contacting the sludge while the wedge opening is in maximum position.
3. The wedge shall be designed as self-adjusting and shall apply increasing pressure to the sludge as it is conveyed through this zone. The maximum deflection in this section shall not exceed 0.060" at .75 PSI wedge pressure at mid span. The use of designs which do not support the belt, or utilize impervious pressure plates to create pressure are not acceptable. All support framework shall be 304L stainless steel.
4. Upon exiting the wedge zone the entrapped sludge shall be conveyed through a series of 8 rolls positioned to create a serpentine ("S") configured belt path. "S" rolls shall decrease in diameter in a progressive fashion. The first and second "S" rollers shall be perforated and shall be 24" and 16" diameter, respectively. The combined area in which one belt is in actual contact with a roll body shall be a minimum of 108 sq. ft. Transition area between "S" roll tangents shall not be considered in this calculation. One (1) press nip roll shall be situated after the final S-Rolls to provide high linear pressure for maximum dryness. Maximum Nip pressure shall be 110 PLI.
5. The "S" rolls in the pressure/shear zone shall be positioned such as to facilitate access to the internal working areas of the belt filter press for wash down, maintenance and process optimization.

D. Filtrate Collection / Piping

1. The belt filter press shall be provided with drainage pans and piping to collect and discharge dewatered filtrate from the gravity drainage and pressure/shear dewatering sections. All filtrate shall be captured and contained by the drainage pans without spilling to the floor. The drainage pans shall extend a minimum of 3" beyond the belt width on both sides and shall have a minimum 1" depth at any given point. The drainage pans shall be constructed of a minimum 14 gauge type 304L stainless steel. The use of fiberglass or any non-specified material of construction is not acceptable.
2. The low point of any drainage pan shall be provided with a minimum 4" dia. connection for drain piping. Drainage piping shall be Sch. 40 PVC and shall be routed from each pan and shall terminate within the confines of the filtrate sump. The drainage piping shall be adequately sized to prevent flow restrictions.

E. Dewatering Belt

1. The press shall incorporate the use of two dewatering belts (1 set). Belts shall be seamed and fabricated of monofilament polyester, wear-resistant plastic materials. The mesh design shall be selected for optimum dewatering of the sludge to be processed with minimum blinding of the filter belt.
2. Each belt and connecting splice shall be designed for a minimum tensile strength equal to five times the normal maximum dynamic tension to which the belt shall be subjected. The splice shall be designed to fail before the belt and shall be constructed of type 316L stainless steel.
3. Belts shall have a width as specified and shall have a minimum life of 2,000 hours continuous operation at the rated design conditions. Belts shall be designed for ease of replacement with a minimum of belt filter down time.

F. Belt Drive Assembly

1. The belt filter press shall be provided with one belt drive assembly. The drive assembly shall not be positioned in any area which is not readily accessible or subjects the drive assemblies to excess moisture and other undesirable environmental conditions. The drive range shall be 50% to 150% of designed operating speed based upon the required performance. The drive assembly shall be coupled to the drive rollers with shaft mounted helical gear reducers. All exposed gears and couplings shall be enclosed in safety guards.
2. The drive assembly shall consist of a speed reducer, with an integrally mounted C-face motor and panel mounted variable frequency drive controller for belt speed adjustment.
3. The belt filter press speed reducer shall be a shaft mounted, helical type gear reducer. Worm gear type reducers are not acceptable. The speed reducer housing shall be of cast iron or fabricated steel welded construction and shall be totally enclosed, dust proof, and oil tight.

4. The integrally mounted electric motor shall be rated for a minimum of 3.0 Hp and maximum speed of 1800 RPM. Motor shall provide full load torque from 10 to 100 percent of the maximum speed of the drive motor.

G. Doctor Blades and Cake Discharge

1. The belt filter press shall be provided with a doctor blade to assist the separation of cake from the belt at the point of cake discharge. The doctor blade and blade holder shall be designed with sufficient stiffness to prevent warping, bowing or distortion of the blade.
2. The doctor blades shall be reversible, replaceable, and shall be constructed of UHMW polyethylene, polyurethane, or similar material. Fiberglass reinforced plastic is not acceptable.
3. Doctor blade tensioning shall be applied by a tensioning device with provisions to adjust the force of the doctor blade against the belt. Each doctor blade assembly shall be designed to allow quick release of the doctor blade from the belt for inspection and service.
4. The belt filter press shall be equipped with a minimum 14 gauge 304L stainless steel discharge chute with a minimum 1:1 slope, to guide the discharge cake on to the sludge conveyor or disposal container. The cake discharge chute shall be mounted independently of the doctor blade assembly.

H. Belt Wash Station

1. The belt filter press shall be provided with an upper and lower belt wash station which shall clean the full width of the belts after the cake has been discharged.
2. Potable water at a minimum pressure of 120 psig shall be provided. The total washwater demand of the two belt wash stations combined shall not exceed 60 gpm. Each belt wash station shall consist of a type 304L stainless steel washwater spray pipe with replaceable spray nozzles and internal handwheel actuated wire brush to facilitate periodic cleaning of the nozzles. Belt wash spray pipe shall be manufactured by Appleton Manufacturing, or approved equal.
3. Each belt wash station shall be enclosed in a type 304L stainless steel, 14 gauge minimum, enclosure with easily replaceable urethane seals which shall contain all spray and mist.

I. Roller Assemblies

1. All rollers, except the perforated "S" rollers, shall be double separated plate stub shaft design. The stub end shafts and plates must be welded in place. Bolted in place stub end roller shafts are unacceptable. The "S" & drive roll shafts shall have a minimum diameter of 5.19" inside the roller and a minimum of 2.95" journal diameter. The minimum safety factor in relation to the rollers yield point shall be 5 at a maximum loading rate of 50 PLI belt tension and a fatigue factor of 2 or greater. All rollers shall be designed to have a maximum deflection of 0.05" at mid span when under maximum loading. Rollers shall have a minimum wall thickness of 0.5" and be constructed of A-106 pipe or A519 mechanical tubing. Maximum loading shall be based on the maximum summation of all

forces applied to the roller including, but not limited to, the forces exerted by the belt tension, drive torque and roller mass. Certified calculations shall be submitted as a part of the shop drawing submittal verifying compliance. The belt filter press manufacturer shall provide a listing of all additional loads exerted on each roll created by drive torque.

2. The perforated drum rollers shall be corrosion resistant and internally braced so as to comply with the minimum safety factor and maximum allowable deflection specified. Drum perforations shall have a diameter not less than 1.25" and provide a minimum roller face open area of 25%.
3. All rolls shall be statically balanced and machined to ensure total concentricity. Journals shall be machined to 0.01" concentricity. The final assembly process shall produce a roller journal assembly with a concentricity of 0.02".
4. All carbon steel rollers shall be covered to the point of insertion into the bearing housing. The drive roller shall be a minimum 1/4" Buna N rubber covered to a hardness of 79 shore A. All other rollers shall be surfaced with polyethylene at a thickness of 25 mils.

J. Bearings

1. The shafts of all rollers shall be supported by greaseable type, self aligning, spherical roller bearings housed in a sealed, splash proof, horizontal split case, cast closed pillow block housing. The housing for all "S" – rolls shall be two bolt base and two or four bolt cap. The bearing shall be attached to a turned journal shaft by means of an interference fit.
2. All bearings shall have a minimum L-10 life of 400,000 hours, at a minimum belt speed of 15 feet per minute, calculated by using the ANSI/AFBMA STD 11-1978 with a 1.15 capacity modification factor per ISO recommendations. The L-10 life shall be based on the summation of all forces applied to the bearings including, but not limited to, roller mass forces and drive torque induced belt tension in addition to the 50 PLI tension set by the tensioning rollers.
3. Certified calculations, based on AFBMA ISO capacity formula shall show that all bearings comply with the specified requirements for a minimum L-10 life at the maximum loadings. Bearing housings shall be Class 25 cast iron and shall conform to ASTM A48 standards. Except for where it is necessary for the shaft to extend through the housing, the outer side of the housing shall be solid without end caps or filler plugs. The seals shall be a triple lip design and rotate with the shaft. The housings shall be clean iron phosphate and coated with a heat treated thermal plastic nylon to a thickness of 8-12 mils. All hardware shall be type 316 stainless steel unless specified otherwise.

K. Pneumatic System

1. The belt filter press shall be provided with pneumatic belt tracking and tensioning systems to ensure reliable operation. The belt tracking and tensioning systems shall be of the continuous and non-incremental tracking type.
2. The pneumatic control system shall consist of a stainless steel machine mounted control console. This pneumatic station will include: loss pressure switch, filter regulators-lubricator, glycerin filled gauges, control regulators, valves and tubing as required to

provide a complete control system. The pneumatic tubing and fittings shall be 1/4" polyurethane. All tubing shall be firmly attached and routed to eliminate obstruction and terminate at a central connection point. The air compressor system shall be sized as required and provided by the belt press manufacturer. The air compressor shall be 2 HP minimum and to have a 30 gallon tank. The compressor shall provide 2-4 CFM at a pressure of 90 PSI. The compressor and receiver shall be properly sized so as not to run continuously, nor cycle on and off frequently at the maximum air usage rate.

3. Belt Tracking System

- a. The belt tracking system shall automatically and continuously align and maintain the belt position on the rollers during operation of the belt filter press. The belt position shall be monitored by a stainless steel sensing arm which shall continually contact the belt edge. The sensing arm shall be mechanically linked to a pilot valve which controls the tracking actuator.
- b. Pneumatic actuators shall be convoluted type air bellows to provide uniform non-stick movement of the actuator shaft. Cylinders utilizing pressure containment seals are not acceptable.
- c. The tracking actuator shall be connected to a pivoting belt alignment roller, which shall be continuously adjusted by the actuator to maintain proper belt alignment. No exceptions to this belt tracking system will be allowed.
- d. One (1) limit switch shall be provided on each side of the machine to detect major misalignment of the belt and relay an alarm signal. Each limit switch shall be housed in a NEMA 4X enclosure.

4. Belt Tensioning System

- a. The belt filter press tensioning system shall be capable of adjusting belt tension to a maximum of 50 lbs. per linear inch of belt width. Belt tension adjustments shall be manually controlled and shall be capable of adjustment while the belt filter press is operating.
- b. The belt tensioning system shall consist of a belt tensioning roller for both upper and lower belts equipped with pneumatic air bellow actuators on each tension roller end. The operation of the belt tensioning system shall be designed to ensure simultaneous and parallel movement of the tensioning roller ends during adjustment and to accommodate up to 3 percent belt elongation. Center pivoting type assembly with only one pressuring device per roll are not acceptable.
- c. The tensioning system shall be designed so that the actuators for each independent tension roll is mechanically interconnected so that one side of the roll cannot extend further than the other. All interconnecting parts shall be 304L stainless steel.
- d. A pressure gauge shall be provided for both upper and lower belt tension regulators. Limits of the belt tension shall be located on the face of the control panel or console.

L. Electrical Components

1. The belt filter press is supplied with the following NEMA 4X rated components: terminal box, belt tracking limit switch (one each side). Emergency stop trip cords (one each end), shall be mounted on each side of the belt filter press.
2. All components are wired complete to the terminal box including power leads for main belt drive. Wire runs are STO Cord and are firmly attached to the press frame.

M. System Controls

1. The belt filter press shall be supplied with a Nema 4X stainless steel freestanding single door control panel. The control panel shall include a through door operated main disconnect that can be locked in the off position. Main control components shall consist of; variable frequency drive controller with short-circuit and overload protection for main belt drive, motor starters with short-circuit and overload protection for air compressor. Other components include control power transformer, programmable logic controller, control relays, speed control transmitters and terminal points for interconnection with ancillary equipment. Door mounted components shall consist of Nema 4X pushbuttons, selector switches and pilot light for system control power and mushroom head emergency stop. An Operator Interface Terminal (OIT) shall be included for control and monitoring of the Belt Filter Press System. An alarm horn will be mounted for fault annunciation. The panel shall operate from a 208Y/120 VAC, three phase, 60 Hz service.

2. The control panel shall be completely pre-wired and factory tested prior to shipment. Operator control functions on front of control panel shall, as a minimum, include:

- a. Start/stop, on/off controls of
 - 1) System Control Power*
 - 2) Auto/Manual Control
 - 3) Belt Tension/Tracking
 - 4) Conveyor
 - 5) Washwater Solenoid Valve
 - 6) Washwater Booster Pump
 - 7) Main Belt Drive
 - 8) Polymer Feed Pumps
 - 9) Sludge Feed Pumps
 - 10) Alarm Control

*System Control Power and Emergency Stop will be hardwired pushbuttons.

- b. OIT status indication for:
 - 1) System Control Power "On"
 - 2) System Control Power "Reset"
 - 3) Auto Start "Pre-Wash Cycle"
 - 4) Auto Stop "Post-Wash Cycle"
 - 5) Belt Tension/Tracking "On"
 - 6) Conveyor "On"
 - 7) Washwater Booster Pump "On"
 - 8) Washwater Solenoid "On"
 - 9) Main Belt Drive "On"
 - 10) Polymer Feed Pumps "On"
 - 11) Sludge Feed Pumps "On"

- 12) Alarms:
 - Belt Limit "Fault"
 - Low Wash water Psi "Fault"
 - Main Drive VFD "Fault"
 - Machine E-Stop "Fault"
 - Conveyor Stop "Fault"

- c. OIT Digital Speed, Flow Indication of:
 - 1) Main Belt Drive speed "FPM"
 - 2) Polymer Feed "GPM"
 - 3) Sludge Feed "GPM"

- d. OIT Speed Control for:
 - 1) Main Belt Drive
 - 2) Polymer Pumps
 - 3) Sludge Feed Pumps

- e. Hardwired Selector Switches for:
 - 1) Selection between Sludge Pump 1 or Sludge Pump 2
 - 2) Selection between Polymer Pump 1 or Polymer Pump 2

N. Machine Wiring

1. The BFP machine shall be supplied with the following Nema 4X rated components: stainless steel terminal box, pull cord emergency stop (one each side), belt tracking limit switch (one each side), washwater low pressure switch, and washwater isolation solenoid valve.
2. All components shall be wired complete to the terminal box excluding power leads for main belt drive.
3. Wire runs will be in PVC coated rigid, conduit, non-metallic liquid tight flex and connectors, rigidly mounted to press frame.

O. Interface Requirements

1. Utilities
 - a. 208Y/120 VAC, 60 amperes, 3 Phase, 60 Hz service.
2. Outputs
 - a. Discrete - contact closure
 - 1) Conveyor run permit – N.O. contact, close to run
 - 2) Polymer feed pump run permit – N.O. contact, close to run
 - 3) Sludge feed pump run permit – N.O. contact, close to run
 - 4) BFP Belt run permit – N.O. contact, close for status
 - b. Analog – 4 – 20 mA signal
 - 1) Polymer feed pumps – speed / flow control
 - 2) Sludge feed pumps – speed / flow control

3. Inputs

- a. Discrete – contact closure
 - 1) Conveyor on – N.O. contact close when conveyor is on
 - 2) Polymer feed pump on – N.O. contact close when pump is on
 - 3) Sludge feed pump on – N.O. contact close when pump is on
 - 4) BFP Belt running – N.O. contact, when belt is on
 - 5) BFP system fault – N.O. contact, close on alarm for status
- b. Analog – 4-20mA signal
 - 1) Polymer feed pumps – speed /flow indication
 - 2) Sludge feed pumps – speed / flow indication
 - 3) BFP Belt – Speed

P. Description of Operation

- 1. Emergency stop pushbuttons and pull cords will be maintained type and shall provide for hard wired instant shutdown of Belt Filter Press equipment at all times.
- 2. Manual Mode: In manual mode system components can be jogged with their respective start pushbuttons without sequence interlocks being satisfied. To jog the respective motor the start pushbutton must be held in. Manual start sequencing of motors shall be allowed when interlocks are satisfied. Emergency stop, and belt limit alarms will always be active.
- 3. Auto Mode: In auto mode, start-up and shutdown can be controlled from either auto start / auto stop push buttons for an automatic sequential timed startup, or components can be controlled with their respective push buttons, interlocks must be satisfied. Operating the Auto Start pushbutton will initiate the following sequence of events:
 - a. Belt tensioning / tracking energizes (instantly)
 - b. Open washwater valve (instantly)
 - c. Start washwater booster pump (instantly)
 - d. Start sludge cake conveyor (5 second delay from auto start initiate)
 - e. Start belt drives (20 second delay from auto start initiate)
 - f. Start polymer feed pump (5 minute delay from auto start initiate)
 - g. Start sludge feed pump (15 second delay from polymer pump start

* Auto stop indicator light will flash while in progress and go on steady when complete.
- 4. Operating the Auto Stop pushbutton will initiate the following sequence of events:
 - a. Sludge feed pump stops (instantly)

- b. Polymer feed pump stops (instantly)
- c. Belt drives, washwater valve/booster pump, belt tension / tracking, and conveyor shut down (10 minute delay from auto stop initiate)
- d. Polymer system solenoid valve (normally open) closes and hot water line solenoid valve (normally closed) opens instantly and holds for 10 minutes.

Q. Alarms

- 1. Alarm conditions are indicated with amber pilot lights and will cause alarm horn to sound. Alarm lights will go on steady as long as condition is still in fault condition. Operating acknowledge pushbutton will silence horn and cause indicator light to flash if condition has been cleared. Operating reset button will clear alarm indicator and allow system start-up.
- 2. Following conditions will immediately shutdown the complete system in auto or manual:
 - a. Emergency stop
 - b. Belt limit
 - c. Belt drive fail
- 3. Following conditions will shut down polymer and sludge feed in auto mode:
 - a. Low wash water pressure
 - b. Sludge pump fail
 - c. Polymer system fail
 - d. Conveyor fail
 - e. If sludge pump is not detected “on” one minute after polymer pump run confirm.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Application:

Belt filter press and control panel shall be installed in complete accordance with the Manufacturer's recommendation.

- 1. Manufacturer's Representative for Start-up and Testing: The services of the Manufacturer's contractor's technical representative shall be provided for pre-start-up installation checks, start-up assistance, training of Owner's operating personnel,

troubleshooting and testing. Manufacturer's representative service time shall be five (5) days on site and one (1) trip.

2. Functional Test: Functional testing shall be performed for each belt filter press installed. Prior to system start-up, system components shall be inspected for proper alignment, proper connection, and satisfactory operation. The Manufacturer's representative shall inspect installation, check for lubrication and minor adjustments, provide certification that the system components have been installed correctly and are ready for operation. The performance test shall not begin until functional testing has been completed to the Owner's and Engineer's satisfaction.
3. Performance:
 - a. Performance testing shall be performed for the belt filter press installed. After plant start-up, the Manufacturer shall conduct a performance test using the Owner's sludge to determine the actual system operating conditions and verify that the unit meets the minimum requirements specified herein.
 - b. Test procedures and polymer recommendations shall be submitted to the Owner and Engineer for review thirty (30) days prior to testing. Submit performance test data and results to the Owner and Engineer.
 - c. Prior to the performance tests, the Manufacturer shall perform testing as necessary to determine and recommend the most effective type of polymer to produce the specified performance. Additional test shall be at the Manufacturer's own expense, if the prior test fails to meet the specified performance.
 - d. The Owner shall provide sludge feed, water, electrical power, and sludge cake disposal necessary to conduct the performance tests. The polymers required shall be provided by the Owner at the recommendation of the belt press manufacturer.
 - e. The cost of laboratory test necessary to confirm belt press performance for the initial test shall be borne by the Owner. If a retest is required, then the Manufacturer shall pay for the subsequent laboratory tests.
 - f. If, after a minimum of two 6-hour test runs, in the opinion of the Owner, the system meets the minimum performance requirements specified herein, the Engineer will recommend, by letter, the official acceptance of the belt filter press. If, in the opinion of the Engineer, the performance test results do not meet the requirements specified herein, the Engineer will notify the Owner and Contractor of non-acceptable performance.
 - g. In the case of non-acceptable performance, the manufacturer shall then have 60 days in which to perform at its sole expense, any supplemental testing, equipment adjustments, changes or additions and to perform a retest of the non-acceptable system.
 - h. If in the opinion of the Engineer, a performance acceptance test or retest is successful and meets the requirements specified herein, the Engineer will recommend, by letter, the official acceptance of the equipment.

3.2 FIELD QUALITY CONTROL

- A. Provide the services of an experienced Process Engineer for one (1) trip consisting of three (3) consecutive eight-hour working days to assure satisfactory installation, start-up, confirm selection of polymer type and dosage, select and optimize operating variables, and give classroom and on-site instruction to Owner's personnel in operation and maintenance of the equipment. All necessary polymers for bench screening tests and sufficient amount of selected polymer to process five (5) tons of dry sludge solids shall be provided.

END OF SECTION 467621

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