

PROJECT MANUAL



NORTHERN KENTUCKY WATER DISTRICT

TAYLOR MILL WATER TREATMENT PLANT ELECTRICAL AND BASIN IMPROVEMENTS

PROJECT NO. 184-0476
DOW LOAN NO. DWL 13060

BID SET

GOVERNING BODY

COMMISSIONERS:

DOUG WAGNER - CHAIRPERSON
FRED MACKE, JR. – VICE CHAIRPERSON
CLYDE CUNNINGHAM - SECRETARY
DAVID SPAULDING – TREASURER
PAT SOMMERKAMP - COMMISSIONER
ANDREW C. COLLINS - COMMISSIONER

RON LOVAN, PRESIDENT/CEO

JANUARY 2014

Compiled by:



The Water Division of ARCADIS



S P E C I F I C A T I O N S
FOR
NORTHERN KENTUCKY WATER DISTRICT

TAYLOR MILL
WATER TREATMENT PLANT
ELECTRICAL AND BASIN
IMPROVEMENTS
(Project No. 184-0476)
(DOW Loan No. DWL 13060)

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RON LOVAN, PRESIDENT/CEO

COMPILED BY:

Arcadis, Inc.
4665 Cornell Road, Suite 350
Cincinnati, OH 45249

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861 Corporate Drive, Suite 210
Lexington, KY 40503

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NORTHERN KENTUCKY WATER DISTRICT

TAYLOR MILL WATER TREATMENT PLANT
ELECTRICAL AND BASIN IMPROVEMENTS

PROJECT MANUAL VOLUME 1 OF 1

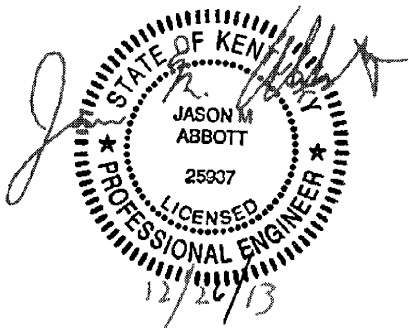
PROJECT NO. 184-0476

CERTIFICATIONS

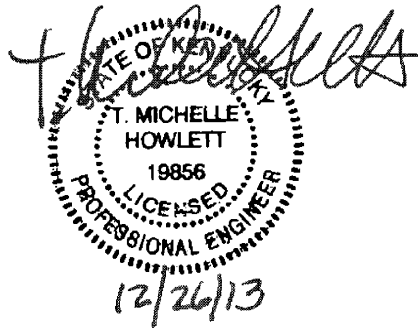
Certification of the Engineers of Record

I hereby certify these documents were prepared by me, or under my direct personal supervision, and I am a duly Licensed Professional Engineer under the laws of the Commonwealth of Kentucky.

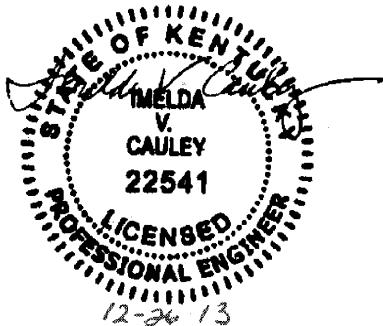
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Jason M. Abbott
KY PE Number: 25937



MAGNA ENGINEERS.
Michelle Howlett
KY PE Number: 19856



ARCADIS, INC.
Imelda Vejas Cauley
KY PE Number: 22541



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NORTHERN KENTUCKY WATER DISTRICT

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Section 00 11 13

ADVERTISEMENT TO BID

Date: January 30, 2014 and February 13, 2014

PROJECT: Taylor Mill Water Treatment Plant Electrical and Basin Improvements

SEALED BIDS WILL BE RECEIVED AT:

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

UNTIL: Date: February 25, 2014
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, but not limited to, the following:

1. Conduct structural rehabilitation on the Sedimentation Basins and Tunnel at Taylor Mill Treatment Plant;
2. Install new conduits, cable trays, four new MCCs (Pumps no. 1 – 4), and 2 new VFDs (Pumps no. 5 – 6) at Filter Building;
3. Re-roof entire Filter Building and replace skylights above the filters;
4. Complete Architectural, Electrical, and HVAC work at Filter Building;
5. Remove existing feeder, controls, and existing starters to pumps nos. 1–6. Install new feeders from new MCCs and new VFDs, and make all power and control connections;
6. Disconnect and remove existing pump nos. 1, 3, 5, and 6 and motors and appurtenances. Install new pump nos. 1, 3, 5, and 6 and motors, install new shafts, and make all power and control connections;
7. Install new control valves and required piping at pumps nos. 1, 2, and 3.
8. Drain Sedimentation Basins, remove existing tube settler modules and install new tube settler modules and protective surface grating.
9. General demolition and modifications; and
10. Other miscellaneous work as indicated in the drawings or specifications.

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, Attn: Amy Kramer, (859) 426-2734; or
- Arcadis, Inc., 4655 Cornell Road, Suite 350, Cincinnati, Ohio, 45241, Attn: Carol Lovett, (513) 860-8700; or
- Magna Engineers 861 Corporate Drive, Suite 210, Lexington, Kentucky, 40503, (859) 309-2990.

Copies of the Bidding Documents have also been provided to the following plan rooms:

- Construction News (Allied Construction Industries), 3 Kovach Drive, Cincinnati, Ohio 45215, (513) 221-8020.
- Builders Exchange 9555 Rockslide Road, Suite 300, Valley View, Ohio 44125, (216) 393-6300.
- Reed Construction Data, 30 Technology Parkway South, Suite 100, Norcross, GA 30092, (800) 424-3996.
- McGraw-Hill Construction Dodge, Kenwood Executive Center, 7265 Kenwood Road, Suite 202, Cincinnati, Ohio 45236, (513) 345-8218.

Copies of the Bidding Documents may be obtained by contacting Carol Lovett, (513) 860-8700 at Arcadis US, Inc. No documents may be picked up at this office.

Charges for all documents obtained will be made on the following basis:

Complete Set of Bidding Documents with Full Size Drawings \$290.00

Checks for Bidding Documents shall be made payable to Arcadis, Inc.

Documents will be shipped FedEx Ground unless requesting firm provides billing information for FedEx Overnight or UPS Overnight.

Neither the OWNER nor the ENGINEER will be responsible for full or partial sets of Bidding Documents, including any addenda, obtained from other sources. Return of the documents is not required and NONE OF THE AMOUNT CHARGED IS REFUNDABLE. Partial bid sets will not be available from the issuing office.

Bid security, in the form of a certified check or Bid Bond 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 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 project advertised will be funded by the Kentucky Infrastructure Authority (KIA) through a Federally Assisted Drinking Water State Revolving Fund (DWSRF) Loan and Local Funds. The Successful Bidder must comply with the related DWSRF Loan requirements as detailed in the Bidding Documents.

All Bidders must comply with the President's Executive Order 11246 (EEO) as amended.

All Bidders must comply with Title VI of the Civil Rights Act of 1964, the Anti-Kickback Act, and the Contract Work Hours Standard Act and 40 CFR, and 40 CFR 33.1016.

All Bidders, Contractors and Subcontractors must comply with 41 CFR 60-4, in regards to Affirmative Action, to ensure equal opportunity to females and minorities and will apply the timetables and goals set forth in 41 CFR 60-4 as applicable.

All Bidders must comply with OSHA (P.C. 91-596) and the Contract Work Hours and Safety Standards Act (P.E.91-54).

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.

All Prospective Bidders are strongly encouraged to attend a non-mandatory, Pre-bid conference for prospective Bidders on February 12, 2014 at 9:00 a.m. at the NKWD Central Facility located at 2835 Crescent Springs Road, Erlanger, Kentucky 41018. A site visit will follow at 10:30 a.m. at the Taylor Mill Water Treatment Plant located at 608 Grand Avenue, Taylor Mill, Kentucky 41015.

On request made at least 72-hours in advance, Owner will provide each Bidder access to the site to conduct such investigations and tests as each Bidder reasonably deems necessary for submission of a Bid. Arrangements for site visits shall be made by calling Mollie Bailey, Plant Foreman, with the Northern Kentucky Water District at (859) 991-1645.

Minority Bidders are encouraged to bid and Bidders must employ good faith effort steps to solicit participation of disadvantaged business enterprises.

Bids shall remain subject to acceptance for 120 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.

Award of the Contract will be in accordance with the Bidding Documents, including without limitation Article 18, Award of Contract, specified in the Instructions to Bidders. In part, 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.

Evaluation of Bids and the awarding of a final contract are also subject to the reciprocal preference for Kentucky resident bidders pursuant to KRS 45A.490 to 45A.494 and KAR 200 5:400, as well as the "Buy American" preference in accordance with Section 215 of the Clean Water Act (33 U.S.C. 1251 et seq.) and EPA regulations.

Richard Harrison
V.P. Engineering, Production & Distribution
Northern Kentucky Water District

+ + END OF ADVERTISEMENT TO BID+ +

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Section 00 21 13

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. *Issuing Office* – The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.
- B. *Bidder* – The individual or entity who submits a Bid directly to Owner.
- C. *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.
- D. *Bid Submittal Document* – Separately bound set of documents which must be submitted in its entirety by the Bidder with its Bid and which includes the following:
 - a. Advertisement to Bid
 - b. Instructions to Bidders
 - c. Bid Form
 - d. Supplements to Bid Form
 - e. Affidavit For Claiming Resident Bidding Status
 - f. Bid Bond

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 Contract Documents.

Owner and Engineer, in making copies of Contract Documents available, 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. Each Bidder must submit with its bid an experience record form (Attachment #4 of Section 00 41 23 – Supplement to Bid Form) with at least four projects listed that are similar to this project in size and scope. To further demonstrate qualifications to perform the Work, each Bidder must be prepared to submit within five days of Owner's request written evidence such as financial data, previous experience, present commitments, subcontractor capabilities or experience, 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 to be considered responsible Bidders will 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. If applicable, 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.

Each Bidder must be registered as a plan holder with the Issuing Office.

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 and appendices;
- 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 Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Contract Documents and confirm that the written resolution thereof by Engineer 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.

On request made at least 72 hours in advance, Owner will provide each Bidder access to the Site to conduct such explorations and tests as each Bidder reasonably deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations. Arrangements for Site visits shall be made by calling Mollie Bailey, Plant Foreman, with the Northern Kentucky Water District at (859) 991-1645.

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 the specific means, methods, techniques, sequences or procedures of construction (if any) that may be shown or indicated or expressly required by the Contract Documents, the prevailing hourly wage rates for the area in which the Project is located, that Bidder has given Engineer prompt written notice of all conflicts, errors, ambiguities, and discrepancies that the Bidder has discovered in the Contract Documents, and the written resolution thereof by Engineer is 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. 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.

6. INTERPRETATIONS AND ADDENDA. All questions about the meaning or intent of the Contract Documents are to be submitted to Engineer in writing via e-mail to Jason.Abbott@arcadis-us.com. Any interpretations or clarifications that are considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Contract Documents. Questions received less than seven days 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 Contract Documents as deemed advisable by Owner or Engineer.

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

7. BID SECURITY. Each Bid must be accompanied by Bid security made payable without condition to Owner in penal sum amount of 10 percent of Bidder's maximum Bid and in the form of a certified check or Bid Bond (on the form attached) issued by a surety meeting the requirements as set forth in the General Conditions and Supplementary Conditions.

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.

8. 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 (or incorporated therein by reference to the attached Bid Form).

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

10. SUBSTITUTE OR "OR-EQUAL" ITEMS. The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Contract Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Contract Documents that a substitute or "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 the Engineer until after the Effective Date of the Agreement. The procedure for submission of any such application by Contractor and consideration by Engineer is set forth in the General Conditions and may be supplemented in the Supplementary Conditions.

11. SUBCONTRACTORS, SUPPLIERS, AND OTHERS. Each Bidder shall submit with its Bid the name of all such Subcontractors, Suppliers, and other individuals and organizations proposed for those portions of the Work for which such identification is required. The Bidder shall not substitute any such subcontractors, suppliers, or other individuals or organizations without the written consent of Owner and Engineer. If, after due investigation, Owner or Engineer has reasonable objection to any proposed Subcontractor, Supplier, or other individual or entity, Owner or Engineer may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in the Bid. If the apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to another Bidder that proposes to use an acceptable Subcontractor, Supplier, or other individual or entity. Declining to make requested substitutions will not constitute grounds for sacrificing the Bid security of any Bidder. Any Subcontractors, Suppliers, or other individual or entity to whom the Owner or Engineer does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance as provided in the General Conditions. Preliminary acceptance of equipment listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment; final acceptance will be based on full conformity with the Contract Documents. Any Bid conditioned on furnishing equipment or materials which are not responsive to the Contract Documents will be rejected.

12. PREPARATION OF BID. The Bid Form is included with the Contract Documents and the Bid prices must be entered therein.

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 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 general 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, telephone number, and facsimile 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 or unit price basis for each item of Work listed in the Bid Form. The lump sum price shall be based on the Work as indicated in the Contract Documents. The total of all estimated prices will be determined as the sum of the products of the estimated quantity of each item and the unit price Bid for the item. The final quantities and Contract Price will be determined in accordance with the General Conditions and as amended in the Supplementary Conditions and as outlined in Article 19 below.

Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. 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 (and, if applicable, the designated portion of the Project for which the Bid is submitted), 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
2835 Crescent Springs Road
P.O. Box 18640
Erlanger, Kentucky 41018

The bound copy of the Bid Submittal Document that includes the Bid Form and Supplements to Bid Form are to be completed and submitted with the Bid Security and the following data:

1. Certification Regarding Debarment, Suspension and Other Responsibilities (EPA Form 5700-49).
2. Certification Regarding Lobbying, Certification for Contracts, Grants, Loans and Cooperative Agreements.
3. Non-Collusion Affidavit.
4. Affidavit for Bidders, Offerors, and Contractors Claiming Kentucky Resident Bidder Status
5. Bidder's Qualifications.
6. Bidder's Experience Record.
7. Proposed List of Subcontractors.
8. Proposed Major Equipment Manufacturers.

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, (ia) 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 (iib) 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 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. If the Contract is to be awarded, Owner will give Successful Bidder a Notice of Award within the number of days stated in the Bid Form. Should there be any reasons why the Contract cannot be awarded within the specified period, the time may be extended in writing by mutual agreement between the Owner and the Bidder.

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 not involving price, time, or changes in the Work 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 must be submitted. Owner may also consider operating costs, maintenance requirements, performance data, and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data are required to be submitted prior to the Notice of Award.
- 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. If the Bidder has filed for bankruptcy.
- i. The amount of the total Base Bid, exclusive of any additive or deductive alternates, if applicable. Any alternates will be considered after selection of the lowest total Base Bid. Each 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 and insurance certificates.

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 the Successful Bidder.

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

22. DRINKING WATER STATE REVOLVING FUND LOAN. A portion of the funding for this project comes from a Drinking Water State Revolving Fund (DWSRF) loan. This loan originates with the United States Environmental Protection (USEPA) and has several provisions that directly impact the Bidder. These include:

1. A certificate that the Bidder, and any subcontractors used by the Bidder, are not on the Federal List of Debarred Contractors. (CERTIFICATION REGARDING DEBAREMENT, SUSPENSION AND OTHER MATTERS – EPA Form 5700-49) addresses this item and must be executed and included with the bid
2. A certification from the Bidder that no appropriate funds were or will be used for the purposes of lobbying the legislative or executive branches of the Federal government. (CERIFICATION REGARDING LOBBYING) address this item and must be submitted with the Bid.

The DWSRF loan creates additional documentation requirements on both the Contractor and the Owner. These are set forth in the Supplemental General Conditions for Drinking Water State Revolving Fund Loans (DWSRF Supplemental General Conditions). The items identified, but not limited to, in this section must be submitted with the Bid. The remaining items identified in the DWSRF Supplemental General Conditions Section will be submitted by the low bidder within 21 days of the Bid opening. The project will not be awarded until this information is received.

DWSRF funding requires a recipient to utilize minority or women owned businesses as subcontractors where possible. Certain information and documentation is required by the funding agencies and other governing bodies prior to awarding a necessary approval for this project. The BIDDER acknowledges, through the act of submitting a Bid, a commitment to submit the following documentation or information within 7 days of bid Opening or within 5 days of the formal request to do so, whichever is greater. Failure to produce any of this documentation or information within the prescribed period will serve as grounds for rejection of the Bid. If the information is required from a subcontractor or vendor and is not produced within the prescribed, it will serve as grounds to replace the subcontractor or vendor with another company or product.

Specific items to be submitted within 7 days of the Bid opening include:

- A. EPA Form 6100-2, DBE Subcontractor Participation (Attachment 12- Section 00 73 02).
- B. EPA Form 6100-3, DBE Subcontractor Performance (Attachment 12-Section 00 73 02).
- C. EPA Form 6100-4 DBE Subcontractor Utilization (Attachment 12-Section 00 73 02).
- D. Disadvantage Enterprise Participation Policy (Attachment 12-Section 0073 02).
- E. List of DBE Bidders of Subcontractors (Attachment 12-Section 00 73 02).

23. "BUY AMERICAN" PROVISION. In accordance with Section 215 of the Clean Water Act (33 U.S.C. 1251 et seq.) and implementing EPA regulations, the Contractor agrees that preference will be given to domestic construction materials by the Contractor, subcontractors, materialmen and suppliers in the performance of the Work.

++ END OF SECTION ++

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BID FORM

Taylor Mill Water Treatment Plant Electrical and Basin Improvements

(Project No. 184-0476)

TABLE OF ARTICLES

1. Bid Recipient
2. Bidder's Acknowledgements
3. Bidder's Representations
4. Basis of Bid
5. Time of Completion
6. Attachments to this Bid
7. Defined Terms
8. Bid Submittal

ARTICLE 1 - BID RECIPIENT

1.01 This Bid is submitted to:

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

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

ARTICLE 2 - BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 120 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner. Bidder will sign the Agreement and will furnish the required contract security, and other required documents within the time periods set forth in the Bidding Documents.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

- A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, if any, and the following Addenda, receipt of all of which is hereby acknowledged.

Addendum No.	Date Received	Addendum No.	Date Received
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

- 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 carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions identified at the Site, if any, which that have been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions.
- E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may effect 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.
- F. 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.

- G. Bidder is aware of the general nature of work (if any) to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. 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.
- I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- J. 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.

K. [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:

- L. 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.

3.02 Bidder further represents that:

- A. This Bid is genuine and is 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;
- B. 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;
- C. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner; and
- D. No person or persons acting in any official capacity for the Owner are directly or indirectly interested in this Bid, or in any portion of the profit thereof.

ARTICLE 4 - BASIS OF BID

4.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s). Amounts will be shown in both words and figures. In case of discrepancy, the amount in words will govern. Unit prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.

All specified cash allowances are included in the price(s) set forth below and have been computed in accordance with Paragraph 11.02 of the General Conditions.

Bidder acknowledges that estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids, and final payment for all Unit Price items will be based on actual quantities of Unit Price Work, determined as provided in the Contract Documents.

Note: The quantities for the Unit Price items are unpredictable and the Engineer has inserted certain quantities in the proposal to be used solely for the purpose of comparison of the Bids. The Bidder shall not be entitled to any adjustment in the contract Unit Price bid items as a result of changes in any of these items from zero to any quantity. The Bidder shall make no claims for anticipated profits, or loss of profits, or for other damages as a result of changes in the quantities purchased.

<u>Base Bid Item Description</u>	<u>Unit</u>	<u>Estimated Quantity</u>	<u>Unit Price</u>	<u>Computed Totals</u>
Item 1 – For General Construction of Taylor Mill Water Treatment Plant Electrical and Basin Improvements	Lump Sum	1	\$ _____	\$ _____
Item 2 – For Wall Expansion Joint Repair	Linear Feet	600	\$ _____	\$ _____
Item 3 – For Crack Repair	Linear Feet	110	\$ _____	\$ _____
Item 4 – Surface Spall Repair	Square Feet	650	\$ _____	\$ _____
Item 5 – Contingency Allowance	Lump Sum	1	\$ 40,000	\$ 40,000

TOTAL BASE BID AMOUNT

_____ Dollars and
 _____ Cents, (\$ _____) (numerals)

4.02 ALTERNATE BID SCHEDULE

- A. The following is included for the Bidder to provide a lump sum amount for the deletion of certain Work, if desired by the Owner. All Bidders are required to complete this portion of the Bid Form.
- B. Bidder shall enter an amount for each DEDUCT Alternative. If no amount is entered, Bidder agrees to perform Alternative at no change in cost.
- C. ALTERNATIVE NO. 1 – DEDUCT NEW MEDIUM VOLTAGE VARIABLE FREQUENCY DRIVES FOR PUMPS NO. 5 AND NO. 6 AND PROVIDE SOLID STATE REDUCED VOLTAGE STARTERS.

Bidder shall indicate the amount of monies to be DEDUCTED from its Bid for Alternative No. 1, should the OWNER decide to accept Alternative No. 1 as described in Section 01 23 00, Alternatives.

No extension of time will be granted if this Alternative is accepted.

For Alternative No. 1, DEDUCT the lump sum of _____ Dollars and _____ Cents
(words)
(\$ _____).
(numerals)

- D. ALTERNATIVE NO. 2 – DEDUCT NEW VERTICAL TURBINE PUMP NO. 3 WORK.

Bidder shall indicate the amount of monies to be DEDUCTED from its Bid for Alternative No. 2, should the OWNER decide to accept Alternative No. 2 as described in Section 01 23 00, Alternatives.

No extension of time will be granted if this Alternative is accepted.

For Alternative No. 2, DEDUCT the lump sum of _____ Dollars and _____ Cents
(words)
(\$ _____).
(numerals)

E. ALTERNATIVE NO. 3 – DEDUCT NEW MODIFIED BITUMINOUS PROTECTED MEMBRANE ROOF, UNIT SKYLIGHTS, AND LIGHTING WORK AT FILTER BUILDING.

Bidder shall indicate the amount of monies to be DEDUCTED from its Bid for Alternative No. 3, should the OWNER decide to accept Alternative No. 3 as described in Section 01 23 00, Alternatives.

No extension of time will be granted if this Alternative is accepted.

For Alternative No. 3, DEDUCT the lump sum of _____
_____ Dollars and _____ Cents
(words)
(\$ _____).
(numerals)

F. ALTERNATIVE NO. 4 – DEDUCT CLEANING, PREPARATION AND PAINTING OF RAKE ARMS, CENTER CAGES, CENTER COLUMNS AND FEEDWELLS.

Bidder shall indicate the amount of monies to be DEDUCTED from its Bid for Alternative No. 4, should the OWNER decide to accept Alternative No. 4 as described in Section 01 23 00, Alternatives.

No extension of time will be granted if this Alternative is accepted.

For Alternative No. 4, DEDUCT the lump sum of _____
_____ Dollars and _____ Cents
(words)
(\$ _____).
(numerals)

ARTICLE 5 - TIME OF COMPLETION

5.01 Bidder agrees that the Work will be substantially complete and completed and ready for final payment in accordance with Paragraph 14.07.B of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

5.02 Bidder accepts the provisions of the Agreement as to liquidated damages, including Paragraph 4.03.A of the Agreement, in the event of failure to complete the Work within the required Contract Times.

ARTICLE 6 - ATTACHMENTS TO THIS BID

- 6.01 The following documents are attached to and made a condition of this Bid:
- A. Required Bid security in the form of Bid Bond.
 - B. Certification Regarding Debarment, Suspension and Other Responsibilities (EPA Form 5700-49)
 - C. Certification Regarding Lobbying, Certification for Contracts, Grants, Loans and Cooperative Agreements
 - D. Non-Collusion Affidavit of Prime Bidder
 - E. Affidavit for Bidders, Offerors, and Contractors Claiming Kentucky Resident Bidder Status
 - F. Statement of Bidder's Qualifications
 - G. Bidders Experience Record
 - H. Proposed Subcontractors
 - I. Proposed Major Equipment Manufacturers

ARTICLE 7 - DEFINED TERMS

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

ARTICLE 8 - BID SUBMITTAL

8.01 This Bid submitted on _____, 20__ by:

If Bidder is:

An Individual

Name (Typed or Printed): _____

By: _____
(Individual's Signature)

Doing business as _____

License or Registration Number: _____

Business Address: _____

Phone No.: _____ Facsimile: _____

A Partnership

Partnership Name: _____

By: _____
(Signature of General Partner - Attach evidence of authority to sign)

(Name (Typed or Printed): _____

License or Registration Number: _____

Business Address: _____

Phone No.: _____ Facsimile: _____

A Corporation

Corporation Name: _____

(State of Incorporation)

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

Name and Title (Typed or Printed): _____

(CORPORATE
SEAL)

Attest: _____
(Secretary)

License or Registration Number: _____

Business Address: _____

Phone No.: _____ Facsimile: _____

Limited Liability Company

By: _____
(Firm Name)

(State of Formation)

By: _____
(Signature of Member or Manager/Authorized to Sign)

(Printed or Typed Name and Title of Member or Manager Authorized to Sign)
(Attach evidence of authority to sign)

License or Registration Number: _____

Business Address: _____

Phone No.: _____ Facsimile: _____

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____

By: _____

(Signature of First Joint Venturer - Attach evidence of authority to sign)

Name (Typed or Printed): _____

(Title)

Title: _____

Second Joint Venturer Name: _____

By: _____

(Signature of Second Joint Venturer - Attach evidence of authority to sign)

Name (Typed or Printed): _____

(Title)

(Each joint venturer must sign. The manner of signing for each individual, partnership, corporation or limited liability company that is a party to the joint venture shall be in the manner indicated above).

Business Address: _____

Phone and Fax number and address for receipt of communications to joint venture:

Phone: _____ Facsimile: _____

++ END OF BID FORM ++

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SECTION 00 41 23

SUPPLEMENTS TO BID FORM

1. FORMS TO BE SUBMITTED WITH BID

- A. Certification Regarding Debarment, Suspension and Other Matters—EPA Form 5700-49 (Attachment No. 1)
- B. Certification Regarding Lobbying (Attachment No. 2)
- C. Non-Collusion Affidavit from Bidder (Attachment No. 3)
- D. Bidder's Qualifications (Attachment No. 4)
- E. Bidder's Experience Record (Attachment No. 5)
- F. Proposed List of Subcontractors (Attachment No. 6)
- G. Proposed Major Equipment Manufacturers (Attachment No. 7)
- H. Affidavit for Bidders, Offerors, and Contractors Claiming Kentucky Resident Bidder Status (Specification Section 00 41 33)
- I. Bid Security (Specification Section 00 43 13)

2. FORMS TO BE SUBMITTED WITHIN 7 DAYS OF BID OPENING

Certain information and documentation is required by the funding agencies and other governing bodies prior to awarding a necessary approval for this project. The BIDDER acknowledges, through the act of submitting a Bid, a commitment to submit the following documentation or information within 7 days of Bid Opening or within 5 days of the formal request to do so, whichever is greater. Failure to produce any of this documentation or information within the prescribed period will serve as grounds for rejection of the Bid. If the information is required from a subcontractor or vendor and is not produced within the prescribed, it will serve as grounds to replace the subcontractor or vendor with another company or product.

Specific items to be submitted within 7 days of the Bid opening include:

- A. EPA Form 6100-2 DBE Participation (Attachment 12 – Section 00 73 02)
- B. EPA Form 6100-3 DBE Subcontractor Performance (Attachment 12 – Section 00 73 02)
- C. EPA Form 6100-4 DBE Subcontractor Utilization (Attachment 12 – Section 00 73 02)
- D. Disadvantage Enterprise Participation Policy (Attachment 12 – Section 00 73 02)
- E. List of DBE Bidders of Subcontracts (Attachment 12 – Section 00 73 02)

EPA Form 5700-49
CERTIFICATION REGARDING DEBARMENT, SUSPENSION AND OTHER SPONSIBILITIES
Attachment Number 1

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

- (A) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency;
- (B) Have not within a three-year period preceding this certification been convicted of or had a civil judgment rendered for commission of fraud of a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.
- (C) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1) (b) of this certification; and
- (D) Have not within a three-year period preceding this certification had one or more public transactions (Federal, State or local) terminated for cause or default.

I understand that a false statement on this certification may be ground for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to \$10,000 or imprisonment for up to 5 years, or both.

Typed Name & Title of Authorized Representative

Signature of Authorized Representative Date

_____ I am unable to certify to the above statements. My explanation is attached.

**CERTIFICATION REGARDING LOBBYING Certification for Contracts, Grants, Loans, and
Cooperative Agreements
Attachment Number 2**

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriate funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriate funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Typed Name & Title of Authorized Representative

Signature of Authorized Representative Date

_____ I am unable to certify to the above statements. My explanation is attached.

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER
Attachment Number 3

STATE OF _____

COUNTY OF _____

- (1) He/She is _____
(OWNER, PARTNER, REPRESENTATIVE OR AGENT)
of, _____ the Bidder that has
submitted the attached bid;
- (2) He/She is fully informed respecting the preparation and contents of the attached Bid and of all pertinent
circumstances respecting such Bid;
- (3) Such Bid is genuine and is not a collusive or sham Bid;
- (4) Neither the said Bidder nor any of its officers, partners, owners, agents or representatives, employees or
parties in interest, including the affinity has in any way colluded, conspired, connived or agree, directly or
indirectly with any other bidder, firm or person to submit a collusive or sham Bid in connection with the
Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such
Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or
conference with any other bidder, firm or person to fix the price or prices in the attached Bid or of any other
Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other bidder, or
to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the
Owner of the Project or any person interested in the proposed Contract; and
- (5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion,
conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives,
owners, employees or parties, including this affiant.

SIGNED _____

TITLE _____

Subscribed and sworn to before me this _____ day of _____, of this year _____.

(NAME)

(TITLE)

MY COMMISSION EXPIRES: _____

STATEMENT OF BIDDER'S QUALIFICATIONS
Attachment Number 4

All questions shall be answered or the bid document will be incomplete. All data given shall be clear and comprehensive. This statement shall be notarized. If necessary, questions may be answered on separate sheets. The Bidder may submit any additional information it desires. If Bidder is a joint venture, submit previous joint venture projects. If joint venture has not completed prior projects of this magnitude then submit projects completed by joint venture partners.

1. Name of Bidder:
2. Permanent main office address:
3. When organized:
4. If a corporation, where incorporated:
5. How many years have you been engaged in operation of your business under your present firm or trade name?
6. Contracts on hand. (Schedule these, showing amount of each contract and the appropriate anticipated dates of completion.)
7. General character of work performed by your company (general contractor, electrical contractor, etc.).
8. Have you ever failed to complete any job awarded to you? If so, where and why?
9. Have you ever defaulted on a contract? If so, where and why?
10. List the more important projects completed by your firm, stating the approximate cost for each, and the month and year completed on attached sheet.
11. List your major equipment available for this work.
12. Experience in work similar in complexity, size and/or dollar value to this project. List and describe at least four on the table "Project References."
13. Background and experience of the principal members of your organization, including the officers in this type work. (Attach.)
14. Credit available: \$ _____
15. Give bank reference: _____
16. Will you, upon request, fill out a detailed financial statement and furnish any other information that may be required by the Owner? Yes No

STATEMENT OF BIDDER'S QUALIFICATIONS
Attachment Number 4
Continued

17. The undersigned hereby authorizes and requests any person, firm or corporation to furnish any information required by the Owner in verification of the statements made comprising this Statement of Bidder's Qualifications.

Dated at _____ this _____ day of _____, of this year

NAME OF BIDDER

BY _____

TITLE _____

STATE OF _____

COUNTY OF _____

_____ being duly sworn deposes and says that he is

_____ of _____
(NAME OF ORGANIZATION)

And that the answers to the foregoing questions and all statements contained therein are true and correct.

Subscribed and sworn to before me this _____ day of _____, of this year _____.

(NOTARY PUBLIC)

My commission expires _____

BIDDERS EXPERIENCE RECORD

Attachment Number 5

(PROJECTS NEED TO BE OF SIMILAR SIZE AND NATURE)

Project Name, Owner, Address, Telephone #	Architect/Engineer, Contact Name, Telephone #	Project Type, Year of Completion	Size of Project (Capacity, Contract Duration)	Contract Value	Change Order Value

**ATTACHMENT NO. 6
PROPOSED SUBCONTRACTORS**

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.

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.

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

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

Branch of Work	Name of Subcontractor
1. Concrete	
2. Electrical	

**ATTACHMENT NO. 7
PROPOSED MAJOR EQUIPMENT MANUFACTURERS**

The BIDDER'S proposed major equipment manufacturers included in its Base Bid price shall be listed below for the requested items. **For the purposes of determining low Bidder, the Bidder shall include only manufacturers named in the specifications. Substitute or "or equal" manufacturer's will be considered after the Bid.** The OWNER reserves the right to reject any equipment manufacturers not listed in the Specifications. **Unless rejected or otherwise permitted by the OWNER, no substitutions or changes to this list of the major equipment manufacturers will be allowed after opening of the Bids.**

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

Major Equipment Item	Name of Manufacturer
1. Tube Settler Modules	
2. Motor Control Centers	
3. Motors	
4. Medium Voltage Variable Frequency Drives	
5. Vertical Turbine Pumps	
6. Rotary Pump Control Valves	

++ END OF SUPPLEMENTS TO BID FORM ++

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SECTION 00 43 13

BID BOND
(Damages Form)

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

BIDDER (Name and Address):

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

OWNER:

Northern Kentucky Water District
2835 Crescent Springs Road
Erlanger, Kentucky 41018

BID:

Bid Due Date: _____

PROJECT:

Taylor Mill Water Treatment Plant
Electrical and Basin Improvements (Project No. 184-0476)
608 Grand Ave.
Taylor Mill, KY 41015

1.0 Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder any difference between the total amount of Bidder's Base Bid and the total amount of the Bid of the next lowest, responsible Bidder who submitted a responsive Bid as determined by Owner for the Work required by the Bidding Documents, provided that:

1.1 If there is no such next Bidder, and Owner does not abandon the Project, then Bidder and Surety shall pay to Owner the penal sum set forth on the face of this Bond, and

1.2 In no event shall Bidder's and Surety's obligation hereunder exceed the penal sum set forth on the face of this Bond.

2.0 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.

3.0 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 5.0 hereof).

4.0 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.

5.0 Surety waives notice of 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.

6.0 No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4.0 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7.0 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.

8.0 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.

9.0 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.

10.0 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.

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

++END OF BID BOND++

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Section 00 52 13

AGREEMENT

THIS AGREEMENT is dated as of the _____ day of _____ in the year _____, by and between the Northern Kentucky Water District, 2835 Crescent Springs Road, Erlanger, Kentucky 41018 (hereinafter called Owner) and _____
(hereinafter called Contractor).

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

ARTICLE 1 - WORK

1.01 Contractor shall at its own cost and expense furnish all labor, services, tools, materials, equipment and incidentals necessary to complete all Work as specified or indicated in the Contract Documents to construct the Taylor Mill Water Treatment Plant Electrical and Basin Improvements project. The Work is generally described in Section 01 11 13, Summary of Work.

ARTICLE 2 - PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

Taylor Mill Water Treatment Plant Electrical and Basin Improvements.
Project No. 184-0476

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by Arcadis, Inc., (Engineer), who is to perform duties assigned to Engineer in the Supplementary Conditions in connection with the completion of the Work in accordance with the Contract Documents.

3.02 The Project Construction Administration will be performed by the Engineer. As the Construction Contract Administrator, the Engineer assumes all duties and responsibilities, and has the rights and authority assigned to the Construction Contract Administrator in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIMES

4.01 Time of the Essence

- A. 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.

4.02 Days to Achieve Milestones, Substantial Completion and Final Payment

- A. Milestone No. 1: The Tunnel and Flocculator Structural Rehabilitation Work and the Structural Rehabilitation Work of one of the Basins, as described in Section 01 12 00, Suggested Sequence of Construction, shall be completed and the Basin operational and returned to service by October 31, 2014.
- B. Milestone No. 2: The Structural Rehabilitation Work in the second Basin shall be conducted while the other basin is operating. The second Basin shall be completed and the Basin operational and returned to service by December 19, 2014
- C. Milestone No. 3: Additional items that require that the plant be shut down shall be installed between January 1, 2015 and April 30, 2015
- C. The Work will be substantially completed by June 1, 2015. The Work will be ready for final payment in accordance with Paragraph 14.07 of the General Conditions by July 15, 2015.

4.03 Liquidated Damages

- A. 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 4.02.A and 4.02.B 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 \$1,500.00 for each day that expires after the time specified in paragraph 4.02.A for Milestone No. 1 until the Work is complete, Contractor shall pay Owner \$1,500.00 for each day that expires after the time specified in paragraph 4.02.B 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) \$1,000.00 for each day that expires after the time specified in paragraph 4.02.B for completion and readiness for final payment until the Work is completed and ready for final payment.

In addition to any other remedies available at law or equity or under the Contract Documents 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.

4.04 Delays and Damages

- A. 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 5 - CONTRACT PRICE

- 5.01 Owner shall pay Contractor, in current funds, for completion of the Work in accordance with the Contract Documents. All specific cash allowances are included in the above price and have been computed in accordance with Paragraph 11.02 of the General Conditions.

Total Contract Amount for Base Bid Work including allowances, a sum of:

_____ Dollars and
(words)
_____ Cents (\$ _____).
(numerals)

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

- A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed as provided in the General Conditions.

6.02 Progress Payments and Retainage

- A. Owner shall make monthly progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment as recommended by Engineer. All progress payments will be on the basis of the progress of the Work measured by the schedule of values provided for in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work, based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.

- 1. 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 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 Complete; and
- b. Ten percent 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.

- 2. Subject to any rights of setoff or similar rights granted to Owner under the Contract Documents or at law 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.

6.03 Final Payment:

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07.

ARTICLE 7 – INTEREST – (NOT USED)

ARTICLE 8 - CONTRACTOR'S REPRESENTATIONS

- 8.01 As part of the inducement for 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 Bidding 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 carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions, and (2) reports and drawings of a Hazardous Environmental Condition identified at the Site, if any, which have been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions.
 - E. Contractor has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may effect 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 expressly required by the Contract Documents to be employed by Contractor, and safety precautions and programs incident thereto.
 - F. 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.
 - G. 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.

- H. 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.
- I. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Contractor.
- J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.
- K. All representations and warranties of the Contractor contained in the Contract Documents are true and accurate in all material respects and Contractor shall indemnify and hold harmless Owner, Engineer and all officers, commissioners, employees and agents from all losses, damages, liabilities, expenses and the like including reasonable attorney's fees incurred as a result of any failure of truth or accuracy.

ARTICLE 9 - CONTRACT DOCUMENTS

- 9.01 The Contract Documents consist of the following:
- A. This Agreement (11 pages).
 - B. Performance Bond (2 pages).
 - C. Payment Bond (4 pages).
 - D. General Conditions (72 pages).
 - E. Supplementary Conditions (30 pages).
 - F. Supplemental Conditions for State Revolving Fund EPA Special Appropriations Grants (60 pages).
 - G. Wage Rates (To be provided by Addenda)
 - H. Specifications, as listed in the table of contents of the Project Manual.
 - I. The Drawings comprising a set entitled "Taylor Mill Water Treatment Plant Electrical and Basin Improvements, Project No. 184-0476", dated December 2013.
 - J. Addenda consisting of Numbers ____ to ____, inclusive.

- K. Exhibits to the Agreement enumerated as follows:
1. Contractor's Bid including Supplements to Bid Form (pages _____ to _____, inclusive).
- L. The following, which may be delivered or issued on or after the Effective Date of the Agreement, and are not attached hereto:
1. Notice to Proceed
 2. Work Change Directives
 3. Change Order(s)
- 9.02 The documents listed in Paragraph 9.01 above are attached to this Agreement (except as expressly noted otherwise above). Documents not attached are incorporated by reference. There are no Contract Documents other than those listed in this Article 9.
- 9.03 The Contract Documents may only be amended or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – COMPLIANCE WITH KENTUCKY LAW

- 10.01 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 11 – EQUAL OPPORTUNITY

- 11.01 Unless exempted under KRS 45.590, during the performance of this Agreement, Contractor agrees as follows:
- A. 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;

- B. 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;
- C. 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;
- D. 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
- E. Contractor will send a notice to each labor union or representative of workers with which he 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 12 - MISCELLANEOUS

12.01 Terms

- A. Terms used in this Agreement will have the meanings indicated in the General Conditions and the Supplementary Conditions.

12.02 Assignment of Contract

- A. 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.

12.03 Successors and Assigns

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

12.04 Severability

- A. 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.

12.05 Waiver

- A. The waiver by the Owner of any breach or violation of any term, covenant, or condition of this Agreement or of any Law or Regulation shall not be deemed to be a waiver of any other term, covenant, condition, or Law or Regulation or of any subsequent breach or violation of the same or of any other term, covenant, condition, or Law or Regulation. The subsequent payment of any monies or fee by the Owner which may become due hereunder shall not be deemed to be a waiver of any preceding breach or violation by Contractor of any term, covenant, condition of this Agreement or of any applicable Law or Regulation.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement on the day and year first written above.

This Agreement will be effective on _____, 20____ (which is the Effective Date of the Agreement).

Owner: _____ Contractor: _____

Signature: _____ Signature: _____

Name: _____ Name: _____

Title: _____ Title: _____

[CORPORATE SEAL]

[CORPORATE SEAL]

Attest _____

Attest _____

Title: _____

Title: _____

Address for giving notices

Address for giving notices

(If Owner is a corporation, partnership, or limited liability company, attach evidence of authority to sign) (If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Agreement.)

License No. _____
(where applicable)

Agent for service of process: _____

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

Designated Representative:

Designated Representative:

Signature: _____

Signature: _____

Name: _____

Name: _____

Title: _____

Title: _____

Address: _____

Address: _____

Phone No.: _____

Phone No.: _____

Fax No.: _____

Fax No.: _____

++END OF AGREEMENT++

NOTICE OF INTENT TO AWARD

To: Contractor:
Street:
City, State, Zip Code:

Date: _____, 20__

Description of Work:

Construction of the Taylor Mill Water Treatment Plant Electrical and Basin Improvements Project consisting of: Conduct structural rehabilitation on the Sedimentation Basins and Tunnel at Taylor Mill Treatment Plant; Install new conduits, cable trays, four new MCCs (Pumps no. 1 – 4), and 2 new VFDs (Pumps no. 5 – 6) at Filter Building; Re-roof entire Filter Building and replace skylights above the filters; Complete Architectural, Electrical, and HVAC work at Filter Building; Remove existing feeder, controls, and existing starters to pumps nos. 1–6. Install new feeders from new MCCs and new VFDs, and make all power and control connections; Disconnect and remove existing pump nos. 1, 3, 5, and 6 and motors and appurtenances. Install new pump nos. 1, 3, 5, and 6 and motors, install new shafts, and make all power and control connections; Install new control valves and required piping at pumps nos. 1, 2, and 3. Drain Sedimentation Basins, remove existing tube settler modules and install new tube settler modules and protective surface grating. General demolition and modifications; and Other miscellaneous work as indicated in the drawings or specifications.

The Owner represented by the undersigned has considered the Bid submitted by you for the above described work and any adopted alternatives in response to its Invitation to Bid and Instructions to Bidders dated _____

It appearing that it is to the best interest of said Owner to accept your Base Bid and any adopted alternatives in the amount of (\$ _____), you are hereby notified that your Base Bid has been accepted for the above referenced project. You are required by the Instructions to Bidders to execute the formal Agreement with the undersigned Owner and to furnish the required Contractor's Performance Bond 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 Intent to 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 Proposal 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 Proposal to another, or to re-advertise the work or otherwise dispose thereof as the Owner may see fit.

Dated this ____ day of _____, 20__.

Owner
Northern Kentucky Water District

By: _____
Richard Harrison
V.P. Engineering, Production & Distribution

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Intent to Award is hereby acknowledged this

_____ day of _____, 20__.

By: _____

NOTICE TO PROCEED

To: Contractor:

Street:

City, State, Zip Code:

Project Description: Construction of the Taylor Mill Water Treatment Plant Electrical and Basin Improvements Project consisting of: Conduct structural rehabilitation on the Sedimentation Basins and Tunnel at Taylor Mill Treatment Plant; Install new conduits, cable trays, four new MCCs (Pumps no. 1 – 4), and 2 new VFDs (Pumps no. 5 – 6) at Filter Building; Re-roof entire Filter Building and replace skylights above the filters; Complete Architectural, Electrical, and HVAC work at Filter Building; Remove existing feeder, controls, and existing starters to pumps nos. 1–6. Install new feeders from new MCCs and new VFDs, and make all power and control connections; Disconnect and remove existing pump nos. 1, 3, 5, and 6 and motors and appurtenances. Install new pump nos. 1, 3, 5, and 6 and motors, install new shafts, and make all power and control connections; Install new control valves and required piping at pumps nos. 1, 2, and 3. Drain Sedimentation Basins, remove existing tube settler modules and install new tube settler modules and protective surface grating. General demolition and modifications; and Other miscellaneous work as indicated in the drawings or specifications.

You are hereby notified to commence WORK in accordance with the agreement dated _____ on or before _____, 20__.

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. The date of substantial completion of the WORK is _____, 20__ and the date of final completion of all WORK is therefore _____, 20__.

OWNER

Northern Kentucky Water District

By:

Richard Harrison
V.P. Engineering, Production &
Distribution

ACCEPTANCE OF NOTICE
Receipt of the above NOTICE TO
PROCEED is hereby acknowledged
this the _____ day of

_____, 20__.

By: _____

Title

Section 00 61 13
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 of Principal Place of Business):

OWNER (Name and Address):

CONTRACT

Date:

Amount:

Description (Name and Location):

BOND

Bond Number:

Date (Not earlier than 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 Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

Company:

Signature: _____ (Seal)

Name and Title:

SURETY

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

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

Attest: _____

Signature and Title

CONTRACTOR AS PRINCIPAL

Company:

Signature: _____ (Seal)

Name and Title:

SURETY

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

Attest: _____

Signature and Title:

EJCDC No. C-610 (2002 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. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.
2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.
3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:
 - 3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
 - 3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and
 - 3.3. Owner has agreed to pay the Balance of the Contract Price to:
 1. Surety in accordance with the terms of the Contract;
 2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.
4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:
 - 4.1. Arrange for Contractor, with consent of 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 Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with 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 Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor 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 Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or
 2. Deny liability in whole or in part and notify Owner citing reasons therefor.
5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.
6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
 - 6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;
 - 6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of 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 Contractor.
7. Surety shall not be liable to Owner or others for obligations of 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 Owner or its heirs, executors, administrators, or successors.
8. Surety hereby waives notice of any change, including changes of time, to 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 Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, 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 Surety, Owner, or 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 requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory 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 Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.
 - 12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 12.3. Contractor Default: Failure of 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 Owner, which has neither been remedied nor waived, to pay 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
 Surety Agency or Broker
 Owner's Representative (engineer or other party)

Section 00 61 16
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*):

CONTRACT

Effective Date of Agreement:

Amount:

Description (*Name and Location*):

BOND

Bond Number:

Date (*Not earlier than Effective Date of Agreement*):

Amount:

Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

(Seal)
Contractor's Name and Corporate Seal

(Seal)
Surety's Name and Corporate Seal

By: _____
Signature

By: _____
Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to Owner, this obligation shall be null and void if Contractor:
 - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2 Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.
3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1 Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to 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 Contractor:
 1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to 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 or equipment 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 Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had 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 Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.
5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.
6. (Not Used.)
7. 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 Surety.
8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.
9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. 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. 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 Paragraph 4.1 or Paragraph 4.2.3, 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 Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or 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 requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory 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 of any person or entity appearing to be a potential beneficiary of this Bond, 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 Contractor, or with a first-tier subcontractor of 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 Contractor and 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 Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

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

FOR INFORMATION ONLY – (*Name, Address, and Telephone*)

Surety Agency or Broker:

Owner's Representative (*Engineer or other*):

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**GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT**

Adapted from EJCDC C-700, Standard General Conditions
of the Construction Contract (2007 Edition)

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GENERAL CONDITIONS

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’s 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* or *CONTRACTOR* – The individual or entity with whom Owner has entered into the Agreement.
16. *Cost of the Work* – See Paragraph 11.01.A 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* or *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 01 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 or 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 referenced in this Paragraph 1.02 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 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;
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 Representative*

- 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, 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 Engineer's 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. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site; that Engineer has used in preparing the Contract Documents; and
 - 2. Those drawings of physical conditions in or relating to existing surface or subsurface at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely on the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner 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 to Contractor written notice:: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work

under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

- G. To the fullest extent permitted by Laws and Regulations, 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.G shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. 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 Liability 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 insurance;
 - a. Such insurance shall remain in effect for at least two years after final payment, and
 - 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 (Not Used)

5.07 (Not Used)

5.08 (Not Used)

5.09 (Not Used)

5.10 *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.

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. Unless the Owner shall otherwise agree in writing, the superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey 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; and
 - 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; and
- 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 anything in the Contract Documents 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, 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 primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work 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 and 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 that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety programs 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 indicated use, 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 Drawing 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:

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

2. Is caused by any act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws or Regulations.
- 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 be limited in any way by the amount or types of insurance provided by Contractor under Article 5 of the General Conditions.
 - D. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the sole negligence or willful misconduct of Owner or Engineer or to the officers, directors, members, partners, employees, agents, and consultants and subcontractors of each and any of them.

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 shall 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, Contractor may cut or alter the work of others 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 *Legal Relationships*

- A. Paragraph 7.01.A is 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 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 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 *Furnish Data*

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

8.03 *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.

8.04 *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 or contiguous to the Site.

8.05 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.06 *Change Orders*

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.07 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.08 *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.

8.09 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.10 *Evidence of Financial Arrangements*

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

8.11 *Compliance With Safety Programs*

- A. While on 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.B.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties

and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Engineer.

9.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, or have control over Contractor's Work, nor shall Engineer have authority over or responsibility for the means, methods, techniques, sequences, or procedures of construction selected by Contractor, for safety precautions and programs incident to Contractor's Work in progress, nor for any failure of Contractor to comply with Laws and Regulations applicable to Contractor's furnishing and performing 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, if any,
 - 1. As to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21;
 - 2. As to Change Orders, see Articles 10, 11, and 12; and
 - 3. 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 Programs*

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

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.B.

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:
 - a) Ordered by Owner pursuant to Paragraph 10.01.A,
 - b) Required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or
 - c) 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, 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 Paragraph 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. 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.
- C. If Owner, Engineer, 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.
- D. 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 other contractors or utility owners, 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.D.
- E. Owner and Engineer and the officers, directors, members, partners, employees,

agents, consultants, and subcontractors of each of them 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.

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 Site safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. For inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
 - 2. That costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in said Paragraph 13.04.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 therefore 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, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and

- c. The conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - 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:
 - a) The releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and
 - b) 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 disregard of the authority of Engineer; or
 4. Contractor's repeated 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. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of Paragraph 10.05, Owner and Contractor may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 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.

++ END OF GENERAL CONDITIONS ++

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SECTION 00 73 01

SUPPLEMENTARY CONDITIONS

SCOPE

These Supplementary Conditions amend or supplement the General Conditions of the Construction Contract. All provisions of the General Conditions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to the singular and plural thereof.

The address system used in these Supplementary Conditions conforms to the address system used in the General Conditions, with the prefix "SC" added thereto.

SC-1.01.A.19. Add the following new sentences at the end of the Paragraph:

Where ever the terms "Engineer" or "Engineer's" appears in these Contract Documents it shall be understood that the terms apply to the position of the Construction Contract Administrator. Exceptions to this are where both "Engineer" and "Construction Contract Administrator" appear in the same sentence or where referring to the following activities: review of technical submittals such as shop drawings, preparation of the overall project operations manual that will incorporate equipment manuals from the Contractor, and configuration of controls software and operations screens. Engineer will assist Construction Contract Administrator in review of Change Orders, Field Orders, Work Change Directives, and requests for information. The terms "Construction Contract Administrator" or "Construction Contract Administrator's" have been inserted in the Contract Documents in some places, but the terms "Engineer" or "Engineer's" are frequently used in these Contract Documents.

The Engineer will retain full responsibility for its design. The Construction Contract Administrator is not authorized to change the design intent without Engineer's written approval.

SC-1.01.A.44. Delete Paragraph 1.01.A.44 in its entirety and insert the following in its place

44. *Substantial Completion* – The time at which the WORK of the entire project has progressed to the point where, in the opinion of Engineer, the WORK of the entire project is sufficiently complete, in

accordance with the Contract Documents, so that the WORK of the entire project 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. Substantial Completion is further defined as (i) that degree of completion of the entire Project’s operating facilities or systems sufficient to provide Owner the full time, uninterrupted, and continuous beneficial operation of the WORK of the entire project; and (ii) all required functional, performance and acceptance or startup testing has been successfully demonstrated for all components, devices, equipment, and instrumentation and control to the satisfaction of Construction Contract Administrator in accordance with the requirements of the Specifications. Final paving and installation of vegetated roof shall be completed but seeding and landscape planting are not required to be completed for Substantial Completion.

Partial utilization of any portion of the project by the Owner will not constitute Substantial Completion of that portion of the WORK that is being operated by the Owner until the entire WORK has been issued substantial completion.

SC-1.01.A.52. Add the new definitions immediately following Paragraph 1.01.A.51, that is to read as follows:

SC-1.01.A.52 *Construction Contract Administrator (CCA)*: The individual or entity with whom the Owner has entered into an agreement or selected for administration of construction activities. The term Construction Contract Administrator (CCA) is understood to be substituted for the word “Engineer” everywhere in these Contract Documents except where both terms appear in the same sentence or where the duties described are those set forth for the Engineer in paragraph SC-1.01.A.19.

SC-1.01. Add the following language at the end of Article 1:

G. Construction Contract Administrator 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, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable, suitable, satisfactory, sufficient, insufficient, rejected or condemned,” it shall be understood as if the expression were followed by the words, “by the Construction Contract Administer”, “to the Construction Contract Administrator”, and/or “by the Engineer” or “to

the Engineer” depending on whether the activity is of the type to be performed by the Engineer.

SC-1.02 Delete Paragraph 1.02.D.1.C in its entirety and insert the following in its place:

c. has been damaged prior to Engineer’s recommendation of final payment.

SC-2.02. Amend Paragraph 2.02. (by making the following revision):

In the first line delete the word “ten”, add the word “five”.

SC-2.03. *Commencement of Contract Times; Notice to Proceed* Delete Paragraph 2.03.A in its entirety and insert the following in its place:

A. The Contract Times will commence to run on the date in the Notice to Proceed.

SC-2.06. Amend Paragraph 2.06.A (by making the following revision):

In the first line after the word “Contractor”, add the word “Construction Contract Administrator”.

SC-3.03.A.3 Amend Paragraph 3.03.A.3 (by making the following revision):

In the first line after the word “Owner” add the words “Construction Contract Administrator,”.

SC-3.06.A. Amend Paragraph 3.06.A (by making the following revision):

In the first and second lines after the word “Owner” add the words “Construction Contract Administrator,”

SC-4.01. Add the following new paragraph immediately after Paragraph 4.01.B:

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

SC-4.02. Add a new Paragraph immediately after Paragraph 4.02.B that is to read as follows:

SC-4.02. C In preparation of Drawings and Specifications, Engineer or Related Entities relied upon the following drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the Site:

4.02.C.1 Water Treatment Plant, contact No. 3, dated September 1953 by Alfred LeFeber and Associates.

4.02.D.2 Taylor Mill Water Treatment Plant Improvements, dated June 1987 by Burgess & Niple, Limited.

4.02.C.3 Taylor Mill Water Treatment Plant Improvements, dated November 1987 by Burgess & Niple, Limited.

4.02.C.4 Taylor Mill Plant, Chemical Building, Clarifier, and Clearwell Improvements, dated October 1999 by CH2M Hill.

4.02.C.5 Taylor Mill Water Treatment Plant, Filter to Waste System, dated September 2003 by Black & Veatch.

SC-4.02.D Copies of drawings itemized in SC-4.02.C that are not included with Bidding Documents may be examined at Northern Kentucky Water District, 2835 Crescent Springs Road, Erlanger, KY 41018 during regular business hours. These reports and drawings are not part of the Contract Documents, but the “technical data” contained therein upon which Contactor may rely, except for specific locations of buried piping systems, electrical systems and topographic surveys. Contractor is not entitled to rely upon information and data utilized by Engineer and Related Entities in the preparation of Drawings and Specifications.

SC-4.03.C.3. Amend Paragraph 4.03.C.3 (by making the following revision):
In the fourth line after the word “Owner”, add the words “Construction Contract Administrator,”

SC-4.04.A.2.d. Amend Paragraph 4.04.A.2.d (by making the following revision):
Add the paragraph “1) 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.”

SC-4.04.A. Amend Article 4.04.A.(by making the following revisions):

After paragraph 4.04.A.2.d.add the following paragraphs,
3. 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 there to resulting from the

WORK, the cost of which will be considered as having been included in the Contract Price.

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.

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

6. Broken Underground Facilities.

a. Underground Facilities broken or damaged shall be repaired at once to avoid inconvenience to customers and utility owners.

b. Temporary arrangements, as approved by the Construction Contract Administrator, 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.

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. Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following in their place:

SC -4.06.A. The following reports are known to Owner as relating to Hazardous Environmental Conditions that have been identified at the Site.

1. The existing main substation transformer has been tested and contains PCBs. See faxed report sent from Power Plus Engineering, Inc. to the Owner dated June 1, 2009. A copy of the

report will be provided with the purchase of the Bid Set. This is not part of the Contract Documents, but the “technical data” contained therein upon which Contactor may rely, except for specific locations of buried piping systems, electrical systems and topographic surveys. Contractor is not entitled to rely upon information and data utilized by Engineer and Related Entities in the preparation of Drawings.

2. The existing coating systems in the tunnel and at key locations on the existing preliminary treatment structure have been tested for high levels of lead in the paint. Some of the paint has been identified as containing high levels of lead. See “Limited Lead Containing Paint Inspection, Taylor Mill Water Treatment Plant” report dated December 6, 2010 prepared by ATC Associates Incorporated. A copy of the report will be provided with the purchase of the Bid Set. This report is not part of the Contract Documents, but the “technical data” contained therein upon which Contactor may rely, except for specific locations of buried piping systems, electrical systems and topographic surveys. Contractor is not entitled to rely upon information and data utilized by Engineer and Related Entities in the preparation of Drawings and Specifications

SC-4.06.B. There is no technical data which can be relied upon.

SC-4.06.C. Amend Article 4.06.C (by making the following revision):

In the fourth line after the words “Environmental Condition” add the words, “that is created by, or”

SC-4.06.G. Amend Article 4.06.G (by making the following revisions):

In the second line after the word “Subcontractors”, add the words “Construction Contract Administrator,” and starting in line seven delete the words“(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 the Contractor or by anyone for whom the Contractor is responsible. Nothing in this Paragraph 4.06 G shall obligate the Owner to indemnify any individual or entity from and against the consequences of that individual’s or entities own negligence.”

and replace with the words

“was created by Owner or by anyone for whom the Owner is responsible, other than Contractor and all persons, subcontractors and entities for which the Contractor is responsible.”

SC-5.01.A. Modify the first part of the second sentence of Paragraph 5.01.A of the General Conditions to read:

“The payment bond shall remain in effect for one year and the performance bond shall remain in effect for one year after the date when final payment becomes due...”

SC-5.02. Add the following new paragraph immediately after Paragraph 5.02.A:

SC-5.02.B. Surety from which the bonds for this Project are purchased shall be listed by the US Treasury Department and the insurance companies from which the insurance for this Project is purchased from shall have an AM Best’s rating of no less than A in addition to other requirements specified herein.

SC-5.04A.7. Add the following new paragraph 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.”

SC-5.04.B.1. Change the second and third lines of Paragraph 5.04.B.1 by replacing the term, “Owner and” with the term, “Owner, Engineer, and Related Entities,”

SC-5.04. Add the following language after Paragraph 5.04.B.1:

Include the following Related Entities as additional insured:

5.04.B.1.a Northern Kentucky Water District, 2835 Crescent Springs Road, Erlanger, Kentucky 41018

5.04.B.1.b Arcadis, Inc., 4665 Cornell Road, Suite 350 Cincinnati, Ohio 45241

5.04.B.1.c Magna Engineers, 861 Corporate Drive, Suite 210, Lexington, Kentucky 40503

SC-5.04. Add a new paragraph immediately after Paragraph 5.04.B that is to read as follows:

“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 insurers 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, Construction Contract Administrator, Engineer, Related Entities, and their respective officers, directors, partners, employees, and agents.”

SC-5.04.C The limits of liability for the insurance required by Paragraph 5.04 shall provide coverage for not less than the following amounts, or greater where required by Laws and Regulations:

1. Workers’ compensation, and related coverage’s under Paragraphs 5.04.A.1. and 5.04.A.2.
 - a. Applicable Federal or State: Statutory
 - b. Maritime Not Required
 - c. Railroad Not Required
 - d. Employer's Liability \$1,000,000 Each Accident

2. For Contractor’s General Liability insurance under Paragraphs 5.04.A.3 through 5.04.A.6 and Paragraph 5.04.B which shall include Premises-Operations, Independent Contractor’s Protection, Products and Completed Operations, Broad Form Property Damage, Contractual Liability) and shall protect Contractor, Owner, Construction Contract Administrator, Related Entities, and Engineer, as additional insured, against claims arising from injuries, sickness, disease, or death of any person or damage to property arising out of performance of the WORK:
 - a. Bodily Injury:

\$1,000,000	Each Occurrence
\$2,000,000	Annual Aggregate

 - b. Property Damage:

\$1,000,000	Each Occurrence
\$2,000,000	Annual Aggregate

 - c. Property Damage liability insurance shall provide Explosion, Collapse and Underground coverage’s.

3. For Contractor’s Automobile Liability under Paragraph 5.04.A.6:
 - a. Bodily Injury:

\$1,000,000	Each Person
-------------	-------------

\$1,000,000 Each Accident

b. Property Damage:
\$1,000,000 Each Occurrence

c. Combined Single Limit of: \$1,000,000

4. Umbrella Liability insurance shall protect Contractor, Owner, Construction Contract Administrator, Related Entities, and Engineer as additional insured, against claims in excess of the limits provided under workers' compensation and employer's 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:

a. Bodily injury and \$4,000,000 combined single
Property damage limit for Each Occurrence

SC-5.05. Delete paragraph 5.05 in its entirety and insert the following in its place:

5.05 Owner's Liability Insurance

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

a. Bodily Injury:
\$1,000,000 Each Occurrence
\$1,000,000 Annual Aggregate

b. Property Damage:
\$1,000,000 Each Occurrence
\$1,000,000 Annual Aggregate

SC-5.06. Add Paragraph 5.06. in its entirety:

5.06 Property Insurance

A. Contractor shall purchase and maintain property insurance coverage upon the WORK at the Site in the amount of the full replacement cost thereof. This insurance shall:

1. Include the interest of Owner, Contractor, Subcontractors, Engineer, Related Entities, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, commissioners, partners, members, managers, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;

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

3. Cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the WORK, provided that such materials and equipment have been included in an Application for Payment accepted by Owner.

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

5. Allow for partial utilization of the WORK by Owner;

6. Include testing and startup; and

7. Be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer, with 30 days' written notice to each other additional insured to whom a certificate of insurance has been issued.

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

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

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

SC-5.07. Add Paragraph 5.06. in its entirety:

5.07. Waiver of Rights

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractor, Construction Contract Administrator, Related Entities, 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 insurer will have no rights of recovery against any of the insured or loss payees there under. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultant 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, Construction Contractor Administrator, 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 expend 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, Subcontractor, Construction Contract Administrator, and Engineer, and the officer, 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, Subcontractor, Construction Contract Administrator, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

SC-5.08. Add Paragraph 5.08. in its entirety:

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 Contractor and made payable to Contractor as fiduciary for the insured, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Contractor 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 cost thereof covered by an appropriate Change Order.
- B. Contractor 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 Contractor's exercise of this power. If such objection be made, Contractor as fiduciary shall make settlement with the insurers in accordance with such an agreement as the parties in interest may reach. If no such agreement amount the parties in interest is reached, Contractor as fiduciary shall adjust and settle the loss and the insurers and, if required in writing by any party in interest, Contractor as fiduciary shall give bond for the proper performance of such duties.

SC-5.09. Add Paragraph 5.09. in its entirety:

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 reasonable 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.

SC-5.010. Add Paragraph 5.010. in its entirety:

5.10. Partial Utilization, Acknowledgement 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. The property insurance shall contain no partial occupancy restriction for utilization of the Project by Owner for the purpose intended.

SC-6.02. Add the following language at the end of Paragraph 6.02.B:

- C. In accordance with Kentucky Revised Statute 337.540, no laborer, worker, or mechanic shall be permitted to Work more than 8 hours in 1 day or more than 40 hours in 1 week except in cases of emergency caused by fire, flood, or damage to life or property. This shall not prohibit any laborer, worker, or mechanic from working more than 8 hours in 1 day, but not more than 10 hours in 1 day, where the employee and employer enter into an agreement prior to the working of any 1 day in excess of 8 hours, or where provided for in a collective bargaining agreement. Owner shall determine when an emergency exists. Any time worked in excess of 8 hours per day or 40 hours per week shall be paid at least 1-1/2 times the basic hourly rate. No

Work or Deliveries shall be done between 6:00 p.m. and 8:00 a.m. without permission of Owner. However, emergency work may be done without prior permission

D. Any laborer, worker, or mechanic worked in excess of 8 hours in 1 day or 40 hours in 1 week, except in cases of emergency shall be paid at not less than 1 -1/2 times the basic hourly rate for all overtime worked. In a case where the agreement between the employee and employer provides for not more than 10 hours in 1 day, any hours worked in excess of 10 hours in 1 day or 40 hours in 1 week, except in cases of emergency, shall be paid at not less than 1-1/2 times the basic hourly rate for all overtime worked.

E. 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-6.02. Add the following new paragraph immediately after Paragraph 6.02.B:

6.02.C. Contractor shall reimburse Owner for Engineer's additional extraordinary costs for onsite personnel overtime work resulting from Contractor's overtime operations. Overtime work is work in excess of 40 hours per week Reimbursement shall be on the cost basis defined in Paragraph 14.02.D.4 of these Supplementary Conditions.

SC-6.05.A. 2.d Add the following new paragraph immediately after Paragraph 6.05.A.2.d.

“a. 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, changes in the controls software development and operator screens, etc., shall be at the expense of the Contractor proposing the substitute unless otherwise agreed to by the Owner.”

SC-6.05.E. Delete Paragraph 6.05.E and replace with the following:

"E. *Construction Contract Administrator's and Engineer's Cost Reimbursement:* Construction Contract Administrator will record Construction Contract Administrator's and Engineer's costs in evaluating a substitute proposed or submitted by the Contractor pursuant to Paragraphs 6.05A.2 and 6.05.B. Whether or not the Construction Contract Administrator approves a substitute so proposed or submitted by the Contractor, Contractor shall reimburse Owner for the reasonable charges of Construction Contract Administrator and Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the

reasonable charges of Construction Contract Administrator and 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.

Reimbursement rates for Engineer or Related Entities for evaluation of proposed substitutes shall be on the basis as established in Paragraph 14.02.D.4 of these Supplementary Conditions. Insert the term "Construction Contract Administrator" between the words "Owner and Engineer" or the words "Owner or Engineer". Insert the term "Construction Contract Administrator" between the words "Owner and Engineer" or the words "Owner or Engineer".

SC-6.07. Add the following new paragraphs immediately after Paragraph 6.07.B:

6.07.D. Contractor shall, at its sole expense, defend and pay all damages, fees, royalties, and costs awarded in any proceeding brought against Owner, its employees and Engineer, Construction Contract Administrator, and Related Entities, in which it is claimed that the use of any treatment process, material, equipment, or parts thereof furnished constitutes an infringement of any patent or other proprietary information right, provided Contractor is promptly notified of the commencement of any such proceedings. Contractor's indemnity applies only when infringement occurs from the normal use for which such treatment process, material, or equipment were designed. Owner may, at its option, be represented at any such proceeding. If use is held in any such proceeding to constitute an infringement and is enjoined, Contractor, at its expense, shall either procure for Owner the right to use such treatment process, material and equipment or manufacture and sell product generated from the use of the treatment process; or pay the costs for damages, fees, or royalties.

SC-6.08. Add the following new paragraphs immediately after Paragraph 6.08.A:

6.08.B. Owner will obtain and pay for the following construction permits and licenses if needed:

6.08.B.1. Road and Highway Encroachment Permits

6.08.B.2. Kentucky Division of Water Construction Application For Drinking Water Treatment.

6.08.B.3. Kentucky Division of Water 401/404 Permit

6.08B.4. NKAPC Plumbing Permit

6.08B.5. NKAPC Building Permits

6.08B.6. Sanitation District No.1 Land Disturbance Permit

6.08B.7. Stream Construction Permit

6.08B.8. KPDES Permit

6.08B.9. Fuel Tank Permit

6.08.C. A copy of each permit is available at Owner's office. Contractor shall examine the permits and conform to the requirements contained therein, including the purchase of additional bonds or insurance as specified therein, and such requirements are hereby made a part of these Contract Documents as fully and completely as though the same were set forth herein. Failure to examine the permit(s) will not relieve Contractor from compliance with the requirements stated therein. Within 15 days after the date of signing the Agreement, Contractor shall confer with an agent of the permitting agency so that insurance requirements and similar matters can be arranged prior to the time set for that portion of the WORK.

Insert the term "Construction Contract Administrator" between the words "Owner or Engineer".

SC-6.09. Add the following new paragraph immediately after Paragraph 6.09.C:

6.09.D. While not intended to be inclusive of all Laws or Regulations for which Contractor may be responsible under Paragraph 6.09, the following Laws or Regulations are included as mandated by statute or for the convenience of Contractor:

6.09.D.1. Prevailing Wages: All laborers, workmen, and mechanics performing WORK under the Contract shall be paid not less than the prevailing hourly rate of wages as determined by the Commissioner of Workplace Standards. Wage rates are provided at the end of this section.

6.09.D.2. Contractor agrees as follows:

6.09.D.2.a. Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, or national origin;

6.09.D.2.b. 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, or national origin; however, when layoffs occur, employees shall be laid off according to seniority with the youngest employee being laid off first. When employees are recalled, this shall be done in the reverse of the way the employees were laid off;

6.09.D.2.c. Contractor will state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, or national origin;

6.09.D.2.d. Contractor will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of nondiscrimination clauses; and

6.09.D.2.e. Contractor will send a notice to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding advising the labor union or workers' representative of the Contractor's commitments under the nondiscrimination clauses.

6.09.D.2.f Employment requirements shall be as specified herein and in the attachments at the end of Supplementary Conditions.

- SC-6.10. Add the following new paragraphs immediately after Paragraph 6.10.A:
- B. Portions of this project may be exempt from taxes. It is the Contractor's responsibility to determine any applicable exemptions.
- SC-6.11. Add the following language to the end of Paragraph 6.11.A.1:
- Contractor shall not enter upon nor use property not under Owner control until appropriate easements have been executed and a copy is on file at the Site.
- SC-6.11. Amend Paragraph 6.11.A.3 (by making the following revisions):
- In lines two and seven, insert the term "Construction Contract Administrator" between the words "Owner, Engineer".
- SC-6.12. Amend Paragraph 6.12 (by making the following revisions):

In the fifth line after the words “available to” add the term “Owner, Construction Contract Administrator, and”.

SC-6.13. Delete Paragraph 6.13.D. and replace with the following:

“D. Contractor shall inform Owner, Construction Contract Administrator, and Engineer of the specific requirements of Contractor’s safety program with which Owner’s, Construction Contract Administrator’s and Engineer’s employees and representatives must comply while at the site.”

SC-6.13. Amend Paragraph 6.13.E. (by making the following revision):

Insert the term “Construction Contract Administrator” between the words “Owner or Engineer”.

SC-6.13 Add the following new paragraphs immediately after Paragraph 6.13.E:

G. The Contractor shall be in compliance with all applicable safety Laws and Regulations including OSHA (P.L. 91-596) and the Contract Work Hours and Safety Standards Act (P.L. 91-54).

SC-6.17.D. Amend paragraphs 6.17.D and 6.17.E (by making the following revisions):

Where ever the word “Engineer” appears, insert the term “Construction Contract Administrator and” before “Engineer”.

SC-6.17. Add the following new paragraphs immediately after Paragraph 6.17.E.1:

6.17.E.2. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than the number of submittals specified in Paragraph 14.02.D.4 of these Supplementary Conditions. Construction Contract Administrator and Engineer will record time for reviewing subsequent submittals of Shop Drawings, samples or other items requiring approval and Contractor shall reimburse Owner for Construction Contract Administrator and Engineer’s charges for such time in accordance with Paragraph 14.02.D.4 of these Supplementary Conditions.

6.17.E.3. In the event that Contractor requests a substitution for a previously approved item, Contractor shall reimburse Owner for Construction Contractor and Engineer’s charges for such time, unless the need for such substitution is beyond the control of Contractor.

SC-6.19.C. Delete Paragraph 6.19.C in its entirety and replace with the following:

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 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 Construction Contract Administrator or Engineer;
2. Review of daily inspection reports by Construction Contract Administrator or Engineer;
3. Recommendation by Construction Contract Administrator for, or payment by Owner of any progress or final payment;
4. The issuance of a certificate of Substantial Completion by Construction Contract Administrator or any payment related thereto by Owner;
5. Use or occupancy of the Work or any part thereof by Owner;
6. Any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Construction Contract Administrator or Engineer;
7. Any inspection, test, or approval by others;
8. Any correction of defective WORK by Owner; or
9. Any expiration of a correction period

SC-6.20.A. Amend paragraph 6.20.A (by making the following revisions):

Where the word "Engineer" appears, add the phrase "Construction Contract Administrator, or Related Entities," and before the word "Engineer".

SC-6.20.B. Amend Paragraph 6.20.B (by making the following revisions):

In the first line add the phrase "Construction Contract Administrator Related Entities, or" before the word "Engineer".

SC-6.20.C. Amend Paragraph 6.20.C (by making the following revisions):

Where the word "Engineer" appears, add the phrase "Construction Contract Administrator, Related Entities, and" before the word "Engineer" and where the word "Engineer's" appears add the term "Construction

Contract Administrator's, Related Entities, and" before the word "Engineer's).

SC-7.04. Add the following new paragraph immediately after Paragraph 7.03:

SC-7.04. Claims between Contractors:

7.04.A Should Contractor cause damage to the WORK or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the WORK at the Site be made by any other contractor against Contractor, Owner, Construction Contract Administrator, Engineer, or the construction coordinator, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law.

7.04.B Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Construction Contract Administrator, Engineer, Related Entities, the Construction Coordinator (if applicable) and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all Claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Construction Contract Administrator, Engineer, Related Entities, or the Construction Coordinator (if applicable) to the extent said Claim is based on or arises out of Contractor's performance of the WORK. Should another contractor cause damage to the WORK or property of Contractor or should the performance of WORK by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Construction Contract Administrator, Engineer, or the Construction Coordinator (if applicable) or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Construction Contract Administrator, Engineer, or the Construction Coordinator (if applicable) on account of any such damage or Claim.

7.04.C If Contractor is delayed at any time in performing the WORK by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Construction Contract Administrator, or Engineer, for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Construction Contract

Administrator, or Engineer, for activities that are their respective responsibilities.

SC-8.01.A. Delete the Paragraph in its entirety and replace with the following:

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Construction Contract Administrator.

SC-9.01. Amend Paragraph 9.01.A. (by making the following revision):

Where the word “Engineer” appears, add the term “Construction Contract Administrator or” before the word “Engineer”.

SC-9.02. Insert the following Paragraph after Paragraph 9.02.B:

C. Construction Contract Administrator and Engineer will make visits to the site as described in Paragraph 9.02 but communications by Engineer with Contractor will be transmitted through Construction Contract Administrator

SC-9.03. Add the following new paragraphs immediately after Paragraph 9.03.A:

9.03.B Resident Project Representative (RPR) will be furnished by Construction Contract Administrator. The responsibilities, authority, and limitations of the RPR are limited to those of Engineer in accordance with Paragraph 9.09 and as set forth elsewhere in the Contract Documents and are further limited and described below.

9.03.C. Responsibilities and Authority:

9.03.C.1 Schedules: Review and monitor Progress Schedule, Schedule of Submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

9.03.C.2 Conferences and Meetings: Conduct or attend meetings with Contractor, such as preconstruction conferences, progress meetings, Work Conferences and other Project related meetings.

9.03.C.3 Liaison: (i) Serve as Construction Contract Administrator’s liaison with Contractor, working principally through Contractor’s superintendent and assist in understanding the intent of the Contract Documents; (ii) assist Construction Contract Administrator in serving as Owner’s liaison with Contractor when Contractor’s operations affect Owner’s onsite operations; (iii) assist in obtaining from Owner additional details or information when required for proper execution of the WORK.

9.03.C.4 Submittals: Receive Submittals that are furnished at the Site by Contractor, and notify Construction Contract Administrator and Engineer of availability for examination. Advise Construction Contract Administrator, Engineer, and Contractor of the commencement of any WORK or arrival of Products at Site, when recognized, requiring a Shop Drawing or Sample if the Submittal has not been approved by Construction Contract Administrator or Engineer.

9.03.C.5 Review of WORK, Rejection of defective WORK, Inspections and Tests: (i) Conduct onsite observations of the WORK in progress to assist Construction Contract Administrator in determining if the WORK is in general proceeding in accordance with the Contract Documents; (ii) inform Engineer and Contractor whenever RPR believes that any WORK is defective; (iii) advise Engineer whenever RPR believes that any WORK will not produce a completed Project that conforms generally to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or whenever RPR believes WORK should be uncovered for observation, or requires special testing, inspection, or approval; (iv) monitor that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor maintains adequate records thereof; (v) observe, record and report to Construction Contract Administrator appropriate details relative to the test procedures and startups; and (vi) accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to Construction Contract Administrator.

9.03.C.6 Interpretation of Contract Documents: Inform Construction Contract Administrator when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Construction Contract Administrator and approved by Engineer.

9.03.C.7 Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and provide recommendations to Engineer; transmit to Contractor the decisions issued by Engineer.

9.03.C.8 Records: (i) maintain at the Site files for correspondence, Conference records, Submittals including Shop Drawings and Samples, reproductions of original Contract Documents including all Addenda, signed Agreement, Work Change Directives, Change Orders, Field Orders, additional Drawings issued after the Effective Date of the Agreement, Construction Contract Administrator's written clarifications and interpretations, progress reports, and other Project related documents;

(ii) keep a diary or log book recording pertinent Site conditions, activities, decisions and events.

9.03.C.9 Reports: (i) Furnish Construction Contract Administrator periodic reports of progress of the WORK and of Contractor's compliance with the Progress Schedule and Schedule of Submittals; (ii) consult with Construction Contract Administrator in advance of scheduled major tests, inspections or start of important phases of the WORK; and (iii) assist in drafting proposed Change Orders, Work Change Directives, and Field Orders, obtain backup material from Contractor as appropriate.

9.03.C.10 Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Construction Contract Administrator, noting particularly the relationship of the payment requested to the Schedule of Values, WORK completed and materials and equipment delivered at the Site but not incorporated in the WORK.

9.03.C.11 Certificates, Operation and Maintenance Manuals, Record Documents, and Site Records: During the course of the WORK, monitor that these documents and other data required to be assembled, maintained, and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Construction Contract Administrator and Engineer as appropriate for review and forwarding to Owner prior to final payment for the WORK.

9.03.C.12 Substantial Completion: (i) Conduct an inspection in the company of Construction Contract Administrator, Engineer, Owner, and Contractor and prepare a list of items to be completed or corrected; (ii) submit to Construction Contract Administrator a list of observed items requiring completion or correction.

9.03.C.13 Completion: (i) conduct final inspection in the company of Construction Contract Administrator, Engineer, Owner and Contractor, and (ii) notify Contractor and Engineer in writing of all particulars in which this inspection reveals that the WORK is incomplete or defective; and (iii) observe that all items on final list have been completed, corrected, or accepted by Owner and make recommendations to Construction Contract Administrator concerning acceptance.

9.03.D. Limitations of Authority: Resident Project Representative will not:

9.03.D.1 Have authority to authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by Construction Contract Administrator and Engineer; or

9.03.D.2 Undertake any of the responsibilities of Contractor, Subcontractors, or Contractor's superintendent; or

9.03.D.3 Accept Submittals from anyone other than Contractor; or

9.03.D.4 Authorize Owner to occupy the Project in whole or in part; or

9.03.D.5 Participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by Engineer

SC-9.10.A. Amend Paragraph 9.10.A (by making the following revision):

Insert the term "Construction Contract Administrator's and" before the word "Engineer's".

SC-10.01. Add the following new paragraph immediately after Paragraph 10.01.A:

10.01.A.1. In accordance with Kentucky Revised Statute 45A.120, when accepting a Change Order, Contractor shall certify that, to the best of its knowledge and belief, the data submitted is accurate, complete, and current for performing the additional WORK or supplying the additional materials.

SC-10.01 Add the following new sentence immediately after Paragraph 10.01.B:

Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A

SC-12.01.C. Delete the semicolon at the end of GC 12.01.C.2.c, and add the following:

provided, however, that on any subcontracted WORK the total maximum fee to be paid by Owner to Contractor under this Paragraph shall be no greater than 27 percent of the costs incurred by the Subcontractor who actually performs the WORK;

SC-12.01.C Add the following new paragraph immediately after Paragraph 12.01.C:

D. Change orders to the construction contract shall comply with the Kentucky Department of Water Procurement Guidance for Construction and Equipment Contracts. Change orders exceeding \$100,000 shall include the cost, pricing and certifications required by the Kentucky Department of Water Procurement Guidance for Construction and Equipment Contracts.

SC-12.03. Add the following language to the end of Paragraph 12.03.E:

F. In no event shall Owner, Construction Contract Administrator, 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-13.02. Access to WORK. Add the following new paragraph immediately after paragraph 13.02.A:

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

SC-13.03. Amend paragraph 13.03.D (by making the following revision):

In the second line insert the term “Construction Contract Administrator’s” after the word “Owner’s” and in the last line insert the term “Construction Contract Administrator, and” after the word “Owner”.

SC-13.04.A. Amend Paragraphs 13.04.A (by making the following change):

In the second line insert the term “Construction Contract Administrator’s or” before the words “Engineer’s observation”.

SC-13.04.B. Amend Paragraphs 13.04.B (by making the following changes):

In the first and third line in insert the term “Construction Contract Administrator or” before the word “Engineer” wherever the word “Engineer” appears.

SC-13.07 Delete Paragraph 13.07.C in its entirety and insert the following in its place:

C. No warranty period for any individual piece of equipment or material will start prior to the commencement of the correction period even if it has been put into beneficial service prior to Substantial Completion.

SC-13.07. At the end of Paragraph 13.07.E insert the following:

“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 the 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.

G. 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 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. Any transfer of warranties to Owner should have an effective date after the end of the correction period."

SC-13.09.B. Amend Paragraphs 13.09.B (by making the following change):

In the second to last line insert the term "Construction Contract Administrator, Construction Contract Administrator's consultant's" before the words "and Engineer".

SC-14.02. Amend Paragraph 14.02.A.1 (by making the following revision):

Delete the word "Engineer" and replace it with "Construction Contract Administrator".

SC-14.02.A. Add the following language to the end of Paragraph 14.02.A.3:

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

5. Payments for stored materials and equipment shall be based only upon the actual cost to the 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 drawing schedules, procurement schedules, value of material on hand included in application, and other data specified in Contract Documents or reasonably required by Owner."

SC-14.02.B Amend Paragraph 14.02.B. (by making the following revision):

Delete the word "Engineer" and replace it with "Construction Contract Administrator".

SC-14.02. Delete Paragraph 14.02.C.1 in its entirety and insert the following in its place:

14.02.C.1. Twenty-five days after presentation of the Application for Payment to Owner with Construction Contract Administrator'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-14.02. Add the following new paragraph(s) immediately after Paragraph 14.02.D.3:

14.02.D.4. Items entitling Owner to retain set-offs from the amount recommended, including but not limited to:

14.02.D.4.a. Owner compensation to Construction Contract Administrator or Engineer at an estimated average rate of \$140 per each extra personnel hour for labor plus expenses, if applicable, because of the following Contractor caused events:

(1). Return visits to manufacturing facilities to witness factory testing or retesting;

(2). Submittal review in excess of three reviews by Construction Contract Administrator or Engineer for substantially the same Submittal, in accordance with Paragraph 6.17.E of these Supplementary Conditions;

(3). Evaluation of proposed substitutes and in making changes to Contract Documents occasioned thereby, in accordance with Paragraph 6.05. of these Supplementary Conditions;

(4). Overtime worked by Contractor necessitating Construction Contract Administrator, Engineer, and Related Entities, Resident Project Representative or Resident Project Representative's Site staff, if any, to work extraordinary overtime in accordance with Paragraph 6.02.C. of these Supplementary Conditions.

14.02.D.4.b. Liability for liquidated damages incurred by Contractor as set forth in the Agreement.

SC-14.04.A. Add the following new paragraphs immediately after Paragraph 14.04.A:

1. 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: seeding, placement of sod and landscape planting.

SC-14.05. Delete the 14.05 entirety and insert the following in its place:

“14.05 Partial Utilization

A. Prior to Substantial Completion of all the WORK, Owner may use or occupy any part of the WORK which is generally defined as the proposed pretreatment process and all appurtenances, 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. If and when Contractor agrees that such part of the WORK is ready for its intended use, Contractor, Owner and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the WORK, with the exception that the partial utilization of a part of the WORK will not constitute Substantial Completion for that part of the WORK. The Contractor shall continue to provide all bonds and insurance for the WORK that the Owner is operating until the date specified after Substantial Completion. The correction period as specified in section 13.07 shall not commence on any piece of equipment or Work until the date of Substantial Completion for the entire 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 request Engineer allow Owner to operate 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 operational, Engineer will notify Owner and Contractor in writing giving the reasons therefore. A correction list will be written by the Engineer and

shall be corrected by the Contractor. If Engineer considers that part of the WORK to be operational the Owner may operate that part of the WORK.

4. The Contractor shall continue to provide all insurance and bonds while part of the WORK is being operated by the Owner.”

SC-14.07. Add the following sentences to the end 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 the documents identified in this paragraph;”

SC-15.03.A. Delete the first sentence of Paragraph 15.03.A in its entirety and insert the following in its place:

Upon 7 days written notice to Contractor and Construction Contract Administrator, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract or any portion of the Contract.

SC-16.01. Delete Article 16 in its entirety and insert the following new Article in its place:

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

B. Any suit involving any dispute or other matter arising under this Contract may only be brought in the state as federal courts for the county or district in which the project is located. All parties hereby consent to the exercise of personal jurisdiction by any such court with respect to any such proceeding.”

SC-17.07. Add a new paragraph immediately after Paragraph 17.06 that is to read as follows:

17.07 Confidential Information

- A. All Drawings, Specifications, technical data, and other information furnished to Contractor either by Owner or Engineer or developed by Contractor or others in connection with the WORK are, and will remain, the property of Owner or Engineer, and shall not be copied or otherwise reproduced or used in any way except in connection with the WORK, or disclosed to third parties or used in any manner detrimental to the interests of Owner or Engineer.

B. The following information is not subject to the above confidentiality requirements:

1. Information in the public domain through no action of Contractor in breach of the Contract Documents; or
2. Information lawfully possessed by Contractor before receipt from Owner or Engineer; or
3. Information required to be disclosed by Laws or Regulations, or by a court or agency of competent jurisdiction. However, in the event Contractor shall be so required to disclose such information, Contractor shall, prior to disclosure, provide reasonable notice to Owner and Engineer, who shall have the right to interpose all objections Owner may have to the disclosure of such information.

++ END OF DOCUMENT ++

SUPPLEMENTAL GENERAL CONDITIONS
FOR
CLEAN WATER STATE REVOLVING FUND
DRINKING WATER STATE REVOLVING FUND
(Drinking Water and Wastewater)

**Project Name: Taylor Mill Water Treatment Plant Electrical
and Basin Improvements**

Project Number: DWL 13060

The attached instructions and regulations as listed below shall be incorporated into the Specifications and comprise Special Conditions.

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SRF SPECIAL PROVISIONS

- (a) **Line crossings of all roads and streets shall be done in accordance with the Kentucky Transportation Cabinet requirements as may be set forth in the Special Conditions.**
- (b) **Construction is to be carried out so as to prevent by-passing of flows during construction unless a schedule has been approved by the State or EPA, whichever is applicable. Siltation and soil erosion must be minimized during construction. All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The permit can be found at the following web address: <https://dep.gateway.ky.gov/eForms/default.aspx?FormID=7>.
If you have any questions regarding the completion of this form call the Surface Water Permits Branch at (502) 564-3410.**
- (c) **Restore disturbed areas to original or better condition.**
- (d) **Use of Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either DOW or EPA. Use of all such chemicals and disposal of residues shall be in conformance with instructions on the manufacturer's label.**
- (e) **The construction of the project, including the letting of contracts in connection therewith, shall conform to the applicable requirements of state, territorial, and local laws and ordinances to the extent that such requirements do not conflict with Federal laws and this subchapter.**
- (f) **The owner shall provide and maintain competent and adequate supervision and inspection.**
- (g) **The Kentucky Infrastructure Authority and Kentucky Division of Water shall have access to the site and the project work at all times.**
- (h) **In the event Archaeological materials (arrowheads, stone tools, stone axes, prehistoric and historic pottery, bottles, foundations, Civil War artifacts, and other types of artifacts) are uncovered during the construction of this project, work is to immediately cease at the location and the Kentucky Heritage Council shall be contacted. The telephone number is (502) 564-7005. Construction shall commence at this location until a written release is received from the Kentucky Heritage Council. Failure to report a find could result in legal action.**
- (i) **This procurement will be subject to DOW Procurement Guidance including the Davis-Bacon Act.**
- (j) **Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.**
- (k) **No wastewater bypassing will occur during construction unless a schedule has been approved by the Kentucky Division of Water.**
- (l) **Change orders to the construction contract (if required) must be negotiated pursuant to DOW/KIA Procurement Guidance for Construction and Equipment Contracts.**

**TITLE 40--PROTECTION OF ENVIRONMENT
CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY**

**PART 31--UNIFORM ADMINISTRATIVE REQUIREMENTS FOR GRANTS AND
COOPERATIVE AGREEMENTS TO STATE AND LOCAL GOVERNMENTS**

Subpart C--Post-Award Requirements

Sec. 31.36 Procurement.

(a) *States.* When procuring property and services under a grant, a State will follow the same policies and procedures it uses for procurements from its non-Federal funds. The State will ensure that every purchase order or other contract includes any clauses required by Federal statutes and executive orders and their implementing regulations. Other grantees and subgrantees will follow paragraphs (b) through (i) in this section.

(b) *Procurement standards.* (1) Grantees and subgrantees will use their own procurement procedures which reflect applicable State and local laws and regulations, provided that the procurements conform to applicable federal law, the standards identified in this section, and if applicable, § 31.38.

(2) Grantees and subgrantees will maintain a contract administration system which ensures that contractors perform in accordance with the terms, conditions, and specifications of their contracts or purchase orders.

(3) Grantees and subgrantees will maintain a written code of standards of conduct governing the performance of their employees engaged in the award and administration of contracts. No employee, officer or agent of the grantee or subgrantee shall participate in selection, or in the award or administration of a contract supported by Federal funds if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when:

(i) The employee, officer or agent,

(ii) Any member of his immediate family,

(iii) His or her partner, or

(iv) An organization which employs, or is about to employ, any of the above, has a financial or other interest in the firm selected for award. The grantee's or subgrantee's officers, employees or agents will neither solicit nor accept gratuities, favors or anything of monetary value from contractors, potential contractors, or parties to subagreements. Grantee and subgrantees may set minimum rules where the financial interest is not substantial or the gift is an unsolicited item of nominal intrinsic value. To the extent permitted by State or local law or regulations, such standards or conduct will provide for penalties, sanctions, or other disciplinary actions for violations of such standards by the grantee's and subgrantee's officers, employees, or agents, or by contractors or their agents. The awarding agency may in regulation provide additional prohibitions relative to real, apparent, or potential conflicts of interest.

(4) Grantee and subgrantee procedures will provide for a review of proposed procurements to avoid purchase of unnecessary or duplicative items. Consideration should be given to consolidating or breaking out procurements to obtain a more economical purchase. Where appropriate, an analysis will be made of lease versus purchase alternatives, and any other appropriate analysis to determine the most economical approach.

(5) To foster greater economy and efficiency, grantees and subgrantees are encouraged to enter into State and local intergovernmental agreements for procurement or use of common goods and services.

(6) Grantees and subgrantees are encouraged to use Federal excess and surplus property in lieu of purchasing new equipment and property whenever such use is feasible and reduces project costs.

(7) Grantees and subgrantees are encouraged to use value engineering clauses in contracts for construction projects of sufficient size to offer reasonable opportunities for cost reductions. Value engineering is a systematic and creative analysis of each contract item or task to ensure that its essential function is provided at the overall lower cost.

(8) Grantees and subgrantees will make awards only to responsible contractors possessing the ability to perform successfully under the terms and conditions of a proposed procurement. Consideration will be given to such matters as contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

(9) Grantees and subgrantees will maintain records sufficient to detail the significant history of a procurement. These records will include, but are not necessarily limited to the following: rationale for the method of procurement, selection of contract type, contractor selection or rejection, and the basis for the contract price.

(10) Grantees and subgrantees will use time and material type contracts only—

(i) After a determination that no other contract is suitable, and

(ii) If the contract includes a ceiling price that the contractor exceeds at its own risk.

(11) Grantees and subgrantees alone will be responsible, in accordance with good administrative practice and sound business judgment, for the settlement of all contractual and administrative issues arising out of procurements. These issues include, but are not limited to source evaluation, protests, disputes, and claims. These standards do not relieve the grantee or subgrantee of any contractual responsibilities under its contracts. Federal agencies will not substitute their judgment for that of the grantee or subgrantee unless the matter is primarily a Federal concern. Violations of law will be referred to the local, State, or Federal authority having proper jurisdiction.

(12) Grantees and subgrantees will have protest procedures to handle and resolve disputes relating to their procurements and shall in all instances disclose information regarding the protest to the awarding agency. A protestor must exhaust all administrative remedies with the grantee and subgrantee before pursuing a protest with the Federal agency. Reviews of protests by the Federal agency will be limited to:

(i) Violations of Federal law or regulations and the standards of this section (violations of State or local law will be under the jurisdiction of State or local authorities) and

(ii) Violations of the grantee's or subgrantee's protest procedures for failure to review a complaint or protest. Protests received by the Federal agency other than those specified above will be referred to the grantee or subgrantee.

(c) *Competition.* (1) All procurement transactions will be conducted in a manner providing full and open competition consistent with the standards of § 31.36. Some of the situations considered to be restrictive of competition include but are not limited to:

(i) Placing unreasonable requirements on firms in order for them to qualify to do business,

(ii) Requiring unnecessary experience and excessive bonding,

(iii) Noncompetitive pricing practices between firms or between affiliated companies,

(iv) Noncompetitive awards to consultants that are on retainer contracts,

(v) Organizational conflicts of interest,

(vi) Specifying only a “brand name” product instead of allowing “an equal” product to be offered and describing the performance of other relevant requirements of the procurement, and

(vii) Any arbitrary action in the procurement process.

(2) Grantees and subgrantees will conduct procurements in a manner that prohibits the use of statutorily or administratively imposed in-State or local geographical preferences in the evaluation of bids or proposals, except in those cases where applicable Federal statutes expressly

mandate or encourage geographic preference. Nothing in this section preempts State licensing laws. When contracting for architectural and engineering (A/E) services, geographic location may be a selection criteria provided its application leaves an appropriate number of qualified firms, given the nature and size of the project, to compete for the contract.

(3) Grantees will have written selection procedures for procurement transactions. These procedures will ensure that all solicitations:

(i) Incorporate a clear and accurate description of the technical requirements for the material, product, or service to be procured. Such description shall not, in competitive procurements, contain features which unduly restrict competition. The description may include a statement of the qualitative nature of the material, product or service to be procured, and when necessary, shall set forth those minimum essential characteristics and standards to which it must conform if it is to satisfy its intended use. Detailed product specifications should be avoided if at all possible. When it is impractical or uneconomical to make a clear and accurate description of the technical requirements, a “brand name or equal” description may be used as a means to define the performance or other salient requirements of a procurement. The specific features of the named brand which must be met by offerors shall be clearly stated; and

(ii) Identify all requirements which the offerors must fulfill and all other factors to be used in evaluating bids or proposals.

(4) Grantees and subgrantees will ensure that all prequalified lists of persons, firms, or products which are used in acquiring goods and services are current and include enough qualified sources to ensure maximum open and free competition. Also, grantees and subgrantees will not preclude potential bidders from qualifying during the solicitation period.

(5) Construction grants awarded under Title II of the Clean Water Act are subject to the following “Buy American” requirements in paragraphs (c)(5) (i)-(iii) of this section. Section 215 of the Clean Water Act requires that contractors give preference to the use of domestic material in the construction of EPA-funded treatment works.

(i) Contractors must use domestic construction materials in preference to nondomestic material if it is priced no more than 6 percent higher than the bid or offered price of the nondomestic material, including all costs of delivery to the construction site and any applicable duty, whether or not assessed. The grantee will normally base the computations on prices and costs in effect on the date of opening bids or proposals.

(ii) The award official may waive the Buy American provision based on factors the award official considers relevant, including:

(A) Such use is not in the public interest;

(B) The cost is unreasonable;

(C) The Agency's available resources are not sufficient to implement the provision, subject to the Deputy Administrator's concurrence;

(D) The articles, materials or supplies of the class or kind to be used or the articles, materials or supplies from which they are manufactured are not mined, produced or manufactured in the United States in sufficient and reasonably available commercial quantities or satisfactory quality for the particular project; or

(E) Application of this provision is contrary to multilateral government procurement agreements, subject to the Deputy Administrator's concurrence.

(iii) All bidding documents, subagreements, and, if appropriate, requests for proposals must contain the following “Buy American” provision: In accordance with section 215 of the Clean Water Act (33 U.S.C. 1251 *et seq.*) and implementing EPA regulations, the contractor agrees that preference will be given to domestic construction materials by the contractor, subcontractors, materialmen and suppliers in the performance of this subagreement.

(d) *Methods of procurement to be followed*—(1) *Procurement by small purchase procedures.* Small purchase procedures are those relatively simple and informal procurement methods for

securing services, supplies, or other property that do not cost more than the simplified acquisition threshold fixed at 41 U.S.C. 403(11) (currently set at \$100,000). If small purchase procedures are used, price or rate quotations shall be obtained from an adequate number of qualified sources.

(2) Procurement by *sealed bids* (formal advertising). Bids are publicly solicited and a firm-fixed-price contract (lump sum or unit price) is awarded to the responsible bidder whose bid, conforming with all the material terms and conditions of the invitation for bids, is the lowest in price. The sealed bid method is the preferred method for procuring construction, if the conditions in 31.36(d)(2)(i) apply.

(i) In order for sealed bidding to be feasible, the following conditions should be present:

(A) A complete, adequate, and realistic specification or purchase description is available;

(B) Two or more responsible bidders are willing and able to compete effectively and for the business; and

(C) The procurement lends itself to a firm fixed price contract and the selection of the successful bidder can be made principally on the basis of price.

(ii) If sealed bids are used, the following requirements apply:

(A) The invitation for bids will be publicly advertised and bids shall be solicited from an adequate number of known suppliers, providing them sufficient time prior to the date set for opening the bids;

(B) The invitation for bids, which will include any specifications and pertinent attachments, shall define the items or services in order for the bidder to properly respond;

(C) All bids will be publicly opened at the time and place prescribed in the invitation for bids;

(D) A firm fixed-price contract award will be made in writing to the lowest responsive and responsible bidder. Where specified in bidding documents, factors such as discounts, transportation cost, and life cycle costs shall be considered in determining which bid is lowest. Payment discounts will only be used to determine the low bid when prior experience indicates that such discounts are usually taken advantage of; and

(E) Any or all bids may be rejected if there is a sound documented reason.

(3) Procurement by *competitive proposals*. The technique of competitive proposals is normally conducted with more than one source submitting an offer, and either a fixed-price or cost-reimbursement type contract is awarded. It is generally used when conditions are not appropriate for the use of sealed bids. If this method is used, the following requirements apply:

(i) Requests for proposals will be publicized and identify all evaluation factors and their relative importance. Any response to publicized requests for proposals shall be honored to the maximum extent practical;

(ii) Proposals will be solicited from an adequate number of qualified sources;

(iii) Grantees and subgrantees will have a method for conducting technical evaluations of the proposals received and for selecting awardees;

(iv) Awards will be made to the responsible firm whose proposal is most advantageous to the program, with price and other factors considered; and

(v) Grantees and subgrantees may use competitive proposal procedures for qualifications-based procurement of architectural/engineering (A/E) professional services whereby competitors' qualifications are evaluated and the most qualified competitor is selected, subject to negotiation of fair and reasonable compensation. The method, where price is not used as a selection factor, can only be used in procurement of A/E professional services. It cannot be used to purchase other types of services though A/E firms are a potential source to perform the proposed effort.

(4) Procurement by *noncompetitive proposals* is procurement through solicitation of a proposal from only one source, or after solicitation of a number of sources, competition is determined inadequate.

(i) Procurement by noncompetitive proposals may be used only when the award of a contract is infeasible under small purchase procedures, sealed bids or competitive proposals and one of the following circumstances applies:

(A) The item is available only from a single source;

(B) The public exigency or emergency for the requirement will not permit a delay resulting from competitive solicitation;

(C) The awarding agency authorizes noncompetitive proposals; or

(D) After solicitation of a number of sources, competition is determined inadequate.

(ii) Cost analysis, i.e., verifying the proposed cost data, the projections of the data, and the evaluation of the specific elements of costs and profits, is required.

(iii) Grantees and subgrantees may be required to submit the proposed procurement to the awarding agency for pre-award review in accordance with paragraph (g) of this section.

(e) [Reserved]

(f) *Contract cost and price.* (1) Grantees and subgrantees must perform a cost or price analysis in connection with every procurement action including contract modifications. The method and degree of analysis is dependent on the facts surrounding the particular procurement situation, but as a starting point, grantees must make independent estimates before receiving bids or proposals. A cost analysis must be performed when the offeror is required to submit the elements of his estimated cost, e.g., under professional, consulting, and architectural engineering services contracts. A cost analysis will be necessary when adequate price competition is lacking, and for sole source procurements, including contract modifications or change orders, unless price reasonableness can be established on the basis of a catalog or market price of a commercial product sold in substantial quantities to the general public or based on prices set by law or regulation. A price analysis will be used in all other instances to determine the reasonableness of the proposed contract price.

(2) Grantees and subgrantees will negotiate profit as a separate element of the price for each contract in which there is no price competition and in all cases where cost analysis is performed. To establish a fair and reasonable profit, consideration will be given to the complexity of the work to be performed, the risk borne by the contractor, the contractor's investment, the amount of subcontracting, the quality of its record of past performance, and industry profit rates in the surrounding geographical area for similar work.

(3) Costs or prices based on estimated costs for contracts under grants will be allowable only to the extent that costs incurred or cost estimates included in negotiated prices are consistent with Federal cost principles (see § 31.22). Grantees may reference their own cost principles that comply with the applicable Federal cost principles.

(4) The cost plus a percentage of cost and percentage of construction cost methods of contracting shall not be used.

(g) *Awarding agency review.* (1) Grantees and subgrantees must make available, upon request of the awarding agency, technical specifications on proposed procurements where the awarding agency believes such review is needed to ensure that the item and/or service specified is the one being proposed for purchase. This review generally will take place prior to the time the specification is incorporated into a solicitation document. However, if the grantee or subgrantee desires to have the review accomplished after a solicitation has been developed, the awarding agency may still review the specifications, with such review usually limited to the technical aspects of the proposed purchase.

(2) Grantees and subgrantees must on request make available for awarding agency pre-award review procurement documents, such as requests for proposals or invitations for bids, independent cost estimates, etc. when:

(i) A grantee's or subgrantee's procurement procedures or operation fails to comply with the procurement standards in this section; or

- (ii) The procurement is expected to exceed the simplified acquisition threshold and is to be awarded without competition or only one bid or offer is received in response to a solicitation; or
 - (iii) The procurement, which is expected to exceed the simplified acquisition threshold, specifies a “brand name” product; or
 - (iv) The proposed award is more than the simplified acquisition threshold and is to be awarded to other than the apparent low bidder under a sealed bid procurement; or
 - (v) A proposed contract modification changes the scope of a contract or increases the contract amount by more than the simplified acquisition threshold.
- (3) A grantee or subgrantee will be exempt from the pre-award review in paragraph (g)(2) of this section if the awarding agency determines that its procurement systems comply with the standards of this section.

(i) A grantee or subgrantee may request that its procurement system be reviewed by the awarding agency to determine whether its system meets these standards in order for its system to be certified. Generally, these reviews shall occur where there is a continuous high-dollar funding, and third-party contracts are awarded on a regular basis.

(ii) A grantee or subgrantee may self-certify its procurement system. Such self-certification shall not limit the awarding agency's right to survey the system. Under a self-certification procedure, awarding agencies may wish to rely on written assurances from the grantee or subgrantee that it is complying with these standards. A grantee or subgrantee will cite specific procedures, regulations, standards, etc., as being in compliance with these requirements and have its system available for review.

(h) *Bonding requirements.* For construction or facility improvement contracts or subcontracts exceeding the simplified acquisition threshold, the awarding agency may accept the bonding policy and requirements of the grantee or subgrantee provided the awarding agency has made a determination that the awarding agency's interest is adequately protected. If such a determination has not been made, the minimum requirements shall be as follows:

(1) *A bid guarantee from each bidder equivalent to five percent of the bid price.* The “bid guarantee” shall consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of his bid, execute such contractual documents as may be required within the time specified.

(2) *A performance bond on the part of the contractor for 100 percent of the contract price.* A “performance bond” is one executed in connection with a contract to secure fulfillment of all the contractor's obligations under such contract.

(3) *A payment bond on the part of the contractor for 100 percent of the contract price.* A “payment bond” is one executed in connection with a contract to assure payment as required by law of all persons supplying labor and material in the execution of the work provided for in the contract.

(i) *Contract provisions.* A grantee's and subgrantee's contracts must contain provisions in paragraph (i) of this section. Federal agencies are permitted to require changes, remedies, changed conditions, access and records retention, suspension of work, and other clauses approved by the Office of Federal Procurement Policy.

(1) Administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as may be appropriate.

(Contracts more than the simplified acquisition threshold)

(2) Termination for cause and for convenience by the grantee or subgrantee including the manner by which it will be effected and the basis for settlement. (All contracts in excess of \$10,000)

(3) Compliance with Executive Order 11246 of September 24, 1965, entitled “Equal Employment Opportunity,” as amended by Executive Order 11375 of October 13, 1967, and as supplemented in Department of Labor regulations (41 CFR chapter 60). (All construction contracts awarded in excess of \$10,000 by grantees and their contractors or subgrantees)

- (4) Compliance with the Copeland "Anti-Kickback" Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR part 3). (All contracts and subgrants for construction or repair)
 - (5) Compliance with the Davis-Bacon Act (40 U.S.C. 276a to 276a-7) as supplemented by Department of Labor regulations (29 CFR part 5). (Construction contracts in excess of \$2000 awarded by grantees and subgrantees when required by Federal grant program legislation)
 - (6) Compliance with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330) as supplemented by Department of Labor regulations (29 CFR part 5). (Construction contracts awarded by grantees and subgrantees in excess of \$2000, and in excess of \$2500 for other contracts which involve the employment of mechanics or laborers)
 - (7) Notice of awarding agency requirements and regulations pertaining to reporting.
 - (8) Notice of awarding agency requirements and regulations pertaining to patent rights with respect to any discovery or invention which arises or is developed in the course of or under such contract.
 - (9) Awarding agency requirements and regulations pertaining to copyrights and rights in data.
 - (10) Access by the grantee, the subgrantee, the Federal grantor agency, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers, and records of the contractor which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, and transcriptions.
 - (11) Retention of all required records for three years after grantees or subgrantees make final payments and all other pending matters are closed.
 - (12) Compliance with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 1857(h)), section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR part 15). (Contracts, subcontracts, and subgrants of amounts in excess of \$100,000)
 - (13) Mandatory standards and policies relating to energy efficiency which are contained in the State energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Pub. L. 94-163, 89 Stat. 871).
- (j) *Payment to consultants.* (1) EPA will limit its participation in the salary rate (excluding overhead) paid to individual consultants retained by grantees or by a grantee's contractors or subcontractors to the maximum daily rate for a GS-18. (Grantees may, however, pay consultants more than this amount). This limitation applies to consultation services of designated individuals with specialized skills who are paid at a daily or hourly rate. This rate does not include transportation and subsistence costs for travel performed; grantees will pay these in accordance with their normal travel reimbursement practices. (Pub. L. 99-591).
- (2) Subagreements with firms for services which are awarded using the procurement requirements in this part are not affected by this limitation.
- (k) *Use of the same architect or engineer during construction.* (1) If the grantee is satisfied with the qualifications and performance of the architect or engineer who provided any or all of the facilities planning or design services for a waste-water treatment works project and wishes to retain that firm or individual during construction of the project, it may do so without further public notice and evaluation of qualifications, provided:
- (i) The grantee received a facilities planning (Step 1) or design grant (Step 2), and selected the architect or engineer in accordance with EPA's procurement regulations in effect when EPA awarded the grant; or
 - (ii) The award official approves noncompetitive procurement under § 31.36(d)(4) for reasons other than simply using the same individual or firm that provided facilities planning or design services for the project; or
 - (iii) The grantee attests that:

- (A) The initial request for proposals clearly stated the possibility that the firm or individual selected could be awarded a subagreement for services during construction; and
 - (B) The firm or individual was selected for facilities planning or design services in accordance with procedures specified in this section.
 - (C) No employee, officer or agent of the grantee, any member of their immediate families, or their partners have financial or other interest in the firm selected for award; and
 - (D) None of the grantee's officers, employees or agents solicited or accepted gratuities, favors or anything of monetary value from contractors or other parties to subagreements.
- (2) However, if the grantee uses the procedures in paragraph (k)(1) of this section to retain an architect or engineer, any Step 3 subagreements between the architect or engineer and the grantee must meet all of the other procurement provisions in § 31.36.

[53 FR 8068 and 8087, Mar. 11, 1988, and amended at 53 FR 8075, Mar. 11, 1988; 60 FR 19639, 19644, Apr. 19, 1995; 66 FR 3794, Jan. 16, 2001; 73 FR 15913, Mar. 26, 2008]

KRS Chapter 45A
Kentucky Model Procurement Code

45A.075 Methods of awarding state contracts.

Except as otherwise authorized by law, all state contracts shall be awarded by:

- (1) Competitive sealed bidding, pursuant to KRS 45A.080; or
- (2) Competitive negotiation, pursuant to KRS 45A.085 and 45A.090 or 45A.180; or
- (3) Noncompetitive negotiation, pursuant to KRS 45A.095; or
- (4) Small purchase procedures, pursuant to KRS 45A.100.

Effective: June 24, 2003

History: Amended 2003 Ky. Acts ch. 98, sec. 4, effective June 24, 2003. -- Created 1978 Ky. Acts ch. 110, sec. 16, effective January 1, 1979.

45A.080 Competitive sealed bidding.

(1) Contracts exceeding the amount provided by KRS 45A.100 shall be awarded by competitive sealed bidding, which may include the use of a reverse auction, unless it is determined in writing that this method is not practicable. Factors to be considered in determining whether competitive sealed bidding is not practicable shall include:

- (a) Whether specifications can be prepared that permit award on the basis of best value; and
- (b) The available sources, the time and place of performance, and other relevant circumstances as are appropriate for the use of competitive sealed bidding.

(2) The invitation for bids shall state that awards shall be made on the basis of best value. In any contract which is awarded under an invitation to bid which requires delivery by a specified date and imposes a penalty for late delivery, if the delivery is late, the contractor shall be given the opportunity to present evidence that the cause of the delay was beyond his control. If it is the opinion of the purchasing officer that there is sufficient justification for delayed delivery, the purchasing officer may adjust or waive any penalty that is provided for in the contract.

(3) Adequate public notice of the invitation for bids and any reverse auction shall be given a sufficient time prior to the date set forth for the opening of bids or beginning of the reverse auction. The notice may include posting on the Internet or publication in a newspaper or newspapers of general circulation in the state as determined by the secretary of the Finance and Administration Cabinet not less than seven (7) days before the date set for the opening of the bids and any reverse auction. The provisions of this subsection shall also apply to price contracts and purchase contracts of state institutions of higher education.

(4) Bids shall be opened publicly or entered through a reverse auction at the time and place designated in the invitation for bids. At the time the bids are opened, or the reverse auction has ended, the purchasing agency shall announce the agency's engineer's estimate, if applicable, and make it a part of the agency records pertaining to the letting of any contract for which bids were received. Each written or reverse auction bid, together with the name of the bidder and the agency's engineer's estimate, shall be recorded and be open to public inspection. Electronic bid opening and posting of the required information for public viewing shall satisfy the requirements of this subsection.

(5) The contract shall be awarded by written notice to the responsive and responsible bidder whose bid offers the best value.

(6) Correction or withdrawal of written or reverse auction bids shall be allowed only to the extent permitted by regulations issued by the secretary.

Effective: July 15, 2010

History: Amended 2010 Ky. Acts ch. 63, sec. 3, effective July 15, 2010. -- Amended 2000 Ky. Acts ch. 509, sec. 1, effective July 14, 2000. -- Amended 1998 Ky. Acts ch. 120, sec. 10, effective July 15, 1998. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 27, effective May 30, 1997. -- Amended 1996 Ky. Acts ch. 60, sec. 2, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 278, sec. 1, effective July 15, 1994. -- Amended 1982 Ky. Acts ch. 282, sec. 1, effective July 15, 1982. -- Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 1, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 17, effective January 1, 1979.

45A.085 Competitive negotiation.

(1) When, under administrative regulations promulgated by the secretary or under KRS 45A.180, the purchasing officer determines in writing that the use of competitive sealed bidding is not practicable, and except as provided in KRS 45A.095 and 45A.100, a contract may be awarded by competitive negotiation, which may include the use of a reverse auction.

(2) Adequate public notice of the request for proposals and any reverse auction shall be given in the same manner and circumstances as provided in KRS 45A.080(3).

(3) Contracts other than contracts for projects utilizing an alternative project delivery method under KRS 45A.180 may be competitively negotiated when it is determined in writing by the purchasing officer that the bids received by competitive sealed bidding either are unreasonable as to all or part of the requirements, or were not independently reached in open competition, and for which each competitive bidder has been notified of the intention to negotiate and is given reasonable opportunity to negotiate.

(4) Contracts for projects utilizing an alternative project delivery method shall be processed in accordance with KRS 45A.180.

(5) The request for proposals shall indicate the relative importance of price and other evaluation factors, and any reverse auction procedures.

(6) Award shall be made to the responsible and responsive offeror whose proposal is determined in writing to be the most advantageous to the Commonwealth, taking into consideration price and the evaluation factors set forth in the request for proposals and the reciprocal preference for resident bidders required under KRS 45A.494.

(7) Written or oral discussions shall be conducted with all responsible offerors who submit proposals determined in writing to be reasonably susceptible of being selected for award. Discussions shall not disclose any information derived from proposals submitted by competing offerors. Discussions need not be conducted:

(a) With respect to prices, where the prices are fixed by law, reverse auction, or administrative regulation, except that consideration shall be given to competitive terms and conditions;

(b) Where time of delivery or performance will not permit discussions; or

(c) Where it can be clearly demonstrated and documented from the existence of adequate competition or prior experience with the particular supply, service, or construction item, that acceptance of an initial offer without discussion would result in fair and reasonable best value procurement, and the request for proposals notifies all offerors of the possibility that award may be made on the basis of the initial offers.

Effective: July 15, 2010

History: Amended 2010 Ky. Acts ch. 63, sec. 4, effective July 15, 2010; and ch. 162, sec. 8, effective July 15, 2010. -- Amended 2003 Ky. Acts ch. 98, sec. 5, effective June 24, 2003. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 28, effective May 30, 1997. -- Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 2, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 18, effective January 1, 1979.

45A.090 Negotiation after competitive sealed bidding when all bids exceed available funds.

(1) In the event that all bids submitted pursuant to competitive sealed bidding under KRS 45A.080 result in bid prices in excess of the funds available for the purchase, and the chief purchasing officer determines in writing:

(a) That there are no additional funds available from any source so as to permit an award to the responsive and responsible bidder whose bid offers the best value; and
(b) The best interest of the state will not permit the delay attendant to a resolicitation under revised specifications, or for revised quantities, under competitive sealed bidding as provided in KRS 45A.080, then a negotiated award may be made as set forth in subsections (2) or (3) of this section.

(2) Where there is more than one (1) bidder, competitive negotiations pursuant to KRS 45A.085(3) shall be conducted with the three (3) (two (2) if there are only two (2)) bidders determined in writing to be the most responsive and responsible bidders, based on criteria contained in the bid invitation and the reciprocal preference for resident bidders under KRS 45A.494. Such competitive negotiations shall be conducted under the following restrictions:

(a) If discussions pertaining to the revision of the specifications or quantities are held with any potential offeror, all other potential offerors shall be afforded an opportunity to take part in such discussions; and

(b) A request for proposals, based upon revised specifications or quantities, shall be issued as promptly as possible, shall provide for an expeditious response to the revised requirements, and shall be awarded upon the basis of best value.

(3) Where, after competitive sealed bidding, it is determined in writing that there is only one (1) responsive and responsible bidder, a noncompetitive negotiated award may be made with such bidder in accordance with KRS 45A.095.

Effective: July 15, 2010

History: Amended 2010 Ky. Acts ch. 162, sec. 9, effective July 15, 2010. -- Amended 2003 Ky. Acts ch. 98, sec. 6, effective June 24, 2003. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 29, effective May 30, 1997. -- Created 1978 Ky. Acts ch. 110, sec. 19, effective January 1, 1979.

45A.095 Noncompetitive negotiation.

(1) A contract may be made by noncompetitive negotiation only for sole source purchases, or when competition is not feasible, as determined by the purchasing officer in writing prior to award, under administrative regulations promulgated by the secretary of the Finance and Administration Cabinet or the governing boards of universities operating under KRS Chapter 164A, or when emergency conditions exist. Sole source is a situation in which there is only one (1) known capable supplier of a commodity or service, occasioned by the unique nature of the requirement, the supplier, or market conditions. Insofar as it is practical, no less than three (3) suppliers shall be solicited to submit written or oral quotations whenever it is determined that competitive sealed bidding is not feasible. Award shall be made to the supplier offering the best value. The names of the suppliers submitting quotations and the date and amount of each quotation shall be placed in the procurement file and maintained as a public record. Competitive bids may not be required:

(a) For contractual services where no competition exists, such as telephone service, electrical energy, and other public utility services;

(b) Where rates are fixed by law or ordinance;

(c) For library books;

(d) For commercial items that are purchased for resale;

(e) For interests in real property;

(f) For visiting speakers, professors, expert witnesses, and performing artists;

(g) For personal service contracts executed pursuant to KRS 45A.690 to 45A.725; and

(h) For agricultural products in accordance with KRS 45A.645.

(2) The chief procurement officer, the head of a using agency, or a person authorized in writing as the designee of either officer may make or authorize others to make emergency procurements when an emergency condition exists.

(3) An emergency condition is a situation which creates a threat or impending threat to public health, welfare, or safety such as may arise by reason of fires, floods, tornadoes, other natural or man-caused disasters, epidemics, riots, enemy attack, sabotage, explosion, power failure, energy shortages, transportation emergencies, equipment failures, state or federal legislative mandates, or similar events. The existence of the emergency condition creates an immediate and serious need for services, construction, or items of tangible personal property that cannot be met through normal procurement methods and the lack of which would seriously threaten the functioning of government, the preservation or protection of property, or the health or safety of any person.

(4) The Finance and Administration Cabinet may negotiate directly for the purchase of contractual services, supplies, materials, or equipment in bona fide emergencies regardless of estimated costs. The existence of the emergency shall be fully explained, in writing, by the head of the agency for which the purchase is to be made. The explanation shall be approved by the secretary of the Finance and Administration Cabinet and shall include the name of the vendor receiving the contract along with any other price quotations and a written determination for selection of the vendor receiving the contract. This information shall be filed with the record of all such purchases and made available to the public. Where practical, standard specifications shall be followed in making emergency purchases. In any event, every effort should be made to effect a competitively established price for purchases made by the state.

Effective: July 15, 2002

History: Amended 2002 Ky. Acts ch. 344, sec. 9, effective July 15, 2002. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 30, effective May 30, 1997. -- Amended 1990 Ky. Acts ch. 496, sec. 4, effective July 13, 1990. -- Created 1978 Ky. Acts ch. 110, sec. 20, effective January 1, 1979

45A.100 Small purchases by state governmental bodies.

(1) Procurements may be made in accordance with small purchase administrative regulations promulgated by the secretary of the Finance and Administration Cabinet, pursuant to KRS Chapter 13A, as follows:

(a) Up to ten thousand dollars (\$10,000) per project for construction and one thousand dollars (\$1,000) for purchases by any state governmental body, except for those state administrative bodies specified in paragraph (b) of this subsection; and

(b) Up to forty thousand dollars (\$40,000) per project for construction or purchases by the Finance and Administration Cabinet, state institutions of higher education, and the legislative branch of government.

(2) Procurement requirements shall not be artificially divided so as to constitute a small purchase under this section. Reverse auctions may be used for small purchase procurements. At least every two (2) years, the secretary shall review the prevailing costs of labor and materials and may make recommendations to the next regular session of the General Assembly for the revision of the then current maximum small purchase amount as justified by intervening changes in the cost of labor and materials.

(3) The secretary of the Finance and Administration Cabinet may grant to any state agency with a justifiable need a delegation of small purchasing authority which exceeds the agency's small purchase limit provided in subsection (1) of this section. Delegations of small purchasing authority shall be granted or revoked by the secretary of the Finance and Administration Cabinet, in accordance with administrative regulations promulgated by the cabinet pursuant to KRS Chapter 13A. These administrative regulations shall establish, at a minimum, the criteria for granting and revoking delegations of small purchasing authority, including the requesting agency's past compliance with purchasing regulations, the level of training of the agency's purchasing staff, and the extent to which the agency utilizes the Kentucky Automated Purchasing System. The administrative regulations may permit the secretary of the Finance and

Administration Cabinet to delegate small purchase procurements up to the maximum amount specified in subsection (1)(b) of this section.

Effective: July 15, 2010

History: Amended 2010 Ky. Acts ch. 63, sec. 5, effective July 15, 2010. -- Amended 2002 Ky. Acts ch. 320, sec. 2, effective July 15, 2002. -- Amended 2000 Ky. Acts ch. 225, sec. 1, effective July 14, 2000. -- Amended 1996 Ky. Acts ch. 60, sec. 1, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 323, sec. 1, effective July 15, 1994. -- Amended 1990 Ky. Acts ch. 496, sec. 5, effective July 13, 1990. -- Amended 1986 Ky. Acts ch. 384, sec. 1, effective July 15, 1986. -- Amended 1984 Ky. Acts ch. 384, sec. 1, effective July 13, 1984. -- Amended 1982 Ky. Acts ch. 282, sec. 2, effective July 15, 1982. -- Amended 1980 Ky. Acts ch. 242, sec. 1, effective July 15, 1980; and ch. 250, sec. 19, effective April 9, 1980. -- Created 1978 Ky. Acts ch. 110, sec. 21, effective January 1, 1979.

**NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE
EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)**

The following excerpts are from 45 FR 65984 (October 3, 1980):

The minority and female goals apply to Federal and federally assisted construction contractors and subcontractors which have covered contracts. The goals are expressed as a percentage of the total hours worked by such a covered or subcontractor's entire onsite construction workforce, which is working on any construction site within a relevant area. The goal applies to each construction craft and trade in the contractor's entire workforce in the relevant area including those employees working on private non-federally involved projects.

Until further notice, the following goals for minority utilization in each construction craft and trade shall be included in all Federal or federally assisted construction contracts and subcontracts in excess of \$10,000 to be performed in the respective geographic area. The goals are applicable to each nonexempt contractor's total onsite construction workforce, regardless of whether or not part of that workforce is performing work on a Federal, federally assisted or non-federally related project, contract or subcontract.

Construction contractors which are participating in an approved Hometown Plan (see 41 CFR 60-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply as follows:

- Goals for female participation in each trade.....6.9%
- Goals for minority participation in each trade.....Insert goals for each year
(see Attachment Number 6)

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area.

The following excerpts are from 45 FR 65977 (October 3, 1980):

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the covered area is (insert description of the geographical areas where the contract is to be performed giving the state, country, and city, if any).

**STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION
CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)**

EEO Specifications

Following is the standard language, which must be incorporated into all solicitations for offers and bids on all Federal and Federally assisted construction contracts or subcontracts in excess of \$10,000 to be performed in designated geographical areas:

1. As used in these specifications:

- (a) Covered Area means the geographical area described in the solicitation from which this contract resulted.
- (b) Director means Director, Office of Federal Contract Compliance Program, United States Department of Labor, or any person to whom the Director delegates authority;
- (c) Employer identification number means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
- (d) Minority includes:
 - (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take a good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7-a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative actions steps at least as extensively as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligation.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources complied under 7-b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, lay-off, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foreman, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative actions obligations (7 a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant may be asserted as fulfilling any one or more of its obligations under 7 a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example: even though the Contractor has achieved its goal for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables for affirmative action standards to discriminate against any person because of race, color, religion, sex or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

EEO Goals for Economic Areas in Region 4

Source: Appendix B-80 in 45 FR 65984 (October 3, 1980)

Kentucky:

053 Knoxville, TN
 SMSA Counties:
 3840 Knoxville, TN 6.6
 TN Anderson; TN Blount; TN Knox; TN Union.
 Non-SMSA Counties 4.5
 KY Bell; KY Harlan; KY Knox; KY Laurel; KY McCreary; KY Wayne; KY Whitley; TN
 Campbell; TN Claiborne; TN Cocke; TN Cumberland; TN Fentress; TN Grainger, TN Hamblen;
 TN Jefferson; TN Loudon; TN Morgan; TN Roane; TN Scott;
 TN Sevier.

054 Nashville, TN:
 SMSA Counties:
 1660 Clarksville - Hopkinsville, TN - KY 18.2
 KY Christian; TN Montgomery.
 5360 Nashville - Davidson, TN 15.8
 TN Cheatham, TN Davidson; TN Dickson; TN Robertson; TN Rutherford; TN Sumner; TN
 Williamson; TN Wilson.
 Non-SMSA Counties 12.0
 KY Allen; KY Barren; KY Butler; KY Clinton; KY Cumberland; KY Edmonson; KY Logan; KY
 Metcalfe; KY Monroe; KY Simpson; KY Todd; KY Trigg; KY Warren; TN Bedford; TN Cannon;
 TN Clay; TN Coffee; TN DeKalb; TN Franklin; TN Giles; TN Hickman; TN Houston; TN
 Humphreys; TN Jackson; TN Lawrence; TN Lewis; TN Macon; TN Marshall; TN Maury; TN
 Moore; TN Overton; TN Perry; TN Pickett; TN Putnam; TN Smith; TN Stewart; TN Trousdale;
 TN Van Buren; TN Warren; TN Wayne; TN White.

056 Paducah, KY:
 Non-SMSA Counties 5.2
 IL Hardin; IL Massac; IL Pope; KY Ballard; KY Caldwell; KY Calloway. KY Carlisle; KY
 Crittenden; KY Fulton; KY Graves; KY Hickman; KY Livingston; KY Lyon. KY McCracken; KY
 Marshall.

057 Louisville, KY:
 SMSA Counties:
 4520 Louisville, KY-IN 11.2
 IN Clark; IN Floyd; KY Bullitt; KY Jefferson; KY Oldham.
 Non-SMSA Counties 9.6
 IN Crawford; IN Harrison; IN Jefferson; IN Orange; IN Scott; IN Washington; KY Breckinridge;
 KY Grayson; KY Hardin; KY Hart; KY Henry; KY Larue; KY Marion;
 KY Meade; KY Nelson; KY Shelby; KY Spencer; KY Trimble; KY Washington.

058 Lexington, KY
 SMSA Counties
 4280 Lexington-Fayette, KY 10.8
 KY Bourbon; KY Clark; KY Fayette; KY Jessamine; KY Scott; KY Woodford.
 Non-SMSA Counties 7.0
 KY Adair KY Anderson; KY Bath; KY Boyle; KY Breathitt; KY Casey; KY Clay; KY Estill; KY
 Franklin; KY Garrard; KY Green; KY Harrison; KY Jackson; KY Knott; KY Lee; KY Leslie; KY
 Letcher; KY Lincoln; KY Madison; KY Magoffin; KY Menifee; KY Mercer; KY Montgomery;
 KY Morgan. KY Nicholas; KY Owsley; KY Perry; KY Powell; KY Pulaski; KY Rockcastle; KY
 Russell; KY Taylor; KY Wolfe.

059 Huntington, WV:
 SMSA Counties:
 3400 Huntington – Ashland, WV-KY-OH 2.9
 KY Boyd; KY Greenup; OH Lawrence; WV Cabell; WV Wayne.
 Non-SMSA Counties 2.5
 KY Carter; KY Elliott; KY Floyd; KY Johnson; KY Lawrence; KY Martin; KY Pike; KY Rowan;
 OH Gallia; WV Lincoln; WV Logan; WV Mason; WV Mingo.

067 Cincinnati, OH:
 SMSA Counties:
 1640 Cincinnati, OH-KY-IN 11.0
 IN Dearborn; KY Boone; KY Campbell; KY Kenton; OH Clermont;
 OH Hamilton; OH Warren.
 3200 Hamilton-Middletown, OH 5.0

OH Butler.	
Non-SMSA Counties	9.2
IN Franklin; IN Ohio; IN Ripley; IN Switzerland; KY Bracken; KY Carroll; KY Fleming; KY Gallatin; KY Grant; KY Lewis; KY Mason; KY Owen; KY Pendleton; KY Robertson; OH Adams; OH Brown; OH Clinton; OH Highland.	
080 Evansville, IN:	
SMSA Counties	
2440 Evansville, IN-KY	4.8
IN Gibson; IN Posey; IN Vanderburgh; IN Warrick; KY Henderson.	
5990 Owensboro, KY	4.7
KY Daviess.	
Non-SMSA Counties	3.5
IL Edwards; IL Gallatin; IL Hamilton; IL Lawrence; IL Saline; IL Wabash; IL White; IN Dubois; IN Knox; IN Perry; IN Pike; IN Spencer; KY Hancock; KY Hopkins; KY McLean; KY Muhlenberg; KY Ohio; KY Union; KY Webster.	

**CHECK LIST OF EEO DOCUMENTATION FOR BIDDERS
ON GRANT/LOAN CONSTRUCTION
(Required by Executive Order 11246 as amended)**

The low, responsive responsible bidder must forward the following items, in duplicate, to the owner no later than ten (10) days after bid opening. The owner shall have one (1) copy available for inspection by the Office of Federal Contracts Compliance within 14 days after the bid opening. The web site for the OFCC is http://www.dol.gov/esa/ofcc_org.htm.

1. Project Number. Project Location. Type of Construction.
2. Proof of registration with the Joint Reporting Commission. (See Attachment Number 8.)
3. Copy of Affirmative Action Plan of contractor. Indicate company official responsible for EEO.
4. List of current construction contracts, with dollar amount. List contracting Federal Agency, if applicable.
5. Statistics concerning company percent workforce, permanent and temporary, by sex, race, trade, handicapped, and age. 40 CFR Part 7.
6. List of employment sources for project in question. If union sources are utilized, indicate percentage of minority membership within the union crafts.
7. Anticipated employment needs for this project, by sex, race and trade, with estimate of minority participation in specific trades.
8. List of subcontractors (name, address and telephone) with dollar amount and duration of subcontract. Subcontractor contracts over \$10,000 must submit items 1- 8. The following information must be provided for all supplier contracts regardless of contract size: name of company, contact person, address, telephone number, dollar value of the contract, and a list of the materials to be supplied to the prime contractor.
9. List of any subcontract work yet to be committed with estimate of dollar amount and duration of contract.
10. Contract Price. Duration of prime contract.
11. DBE Documents - See special instructions regarding use of Minority, and Women Owned, and Small Businesses.

Employer Information Report EEO-1

Under the direction of the US Equal Employment Opportunity Commission, the Joint Reporting Committee is responsible for the full-length, multi-phase processing of employment statistics collected on the Employer Information Report EEO-1. This report, also termed Standard Form 100, details the sex and race/ethnic composition of an employer's work force by job category.

The Employer Information EEO-1 survey is conducted annually under the authority of Public Law 88-352, Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972. All employers with 15 or more employees are covered by Public Law 88-352 and are required to keep employment records as specified by Commission regulations. Based on the number of employees and federal contract activities, certain large employers are required to file an EEO-1 Report on an annual basis.

The EEO-1 Report must be filed by:

(A) All private employers who are: (1) subject to Title VII of the Civil Rights Act of 1964 (as amended by the Equal Employment Opportunity Act of 1972) with 100 or more employees EXCLUDING State and local governments, primary and secondary school systems, institutions of higher education, Indian tribes and tax-exempt private memberships clubs other than labor organizations; OR (2) subject to Title VII who have fewer than 100 employees if the company is owned or affiliated with another company, or there is centralized ownership, control or management (such as central control of personnel policies and labor relations) so that the group legally constitutes a single enterprise and the entire enterprise employs a total of 100 or more employees.

(B) All federal contractors (private employers), who: (1) are not exempt as provided for by 41 CFR 60-1.5, (2) have 50 or more employees, and (a) are prime contractors or first-tier subcontractors, and have a contract, subcontract, or purchase order amounting to \$50,000 or more; or (b) serve as depository of Government funds in any amount, or (c) is a financial institution which is an issuing an paying agent for U.S. Savings Bonds and Notes.

Only those establishments located in the District of Columbia and the 50 states are required to submit the EEO-1 Report. No Reports should be filed for establishments in Puerto Rico, the Virgin Islands or other American Protectorates.

When filing for the EEO-1 Report for the first time, go to the web site at:

<http://www.mimdms.com/jrc.html> and select "Filing for the first time" from the box labeled INFORMATION. File out the electronic questionnaire to enter your company into Joint Reporting Committee (JRC) system. Once you have completed the registration process, you will be contacted on how to proceed with the EEO-1 Report. If you have previously registered with the JRC, follow their instructions to update your information.

Labor Standards Provisions for Federally Assisted Construction

Labor standards provisions applicable to contracts covering federally financed and assisted construction (29 CFR 5.5, Contract Provisions and Related Matters) that apply to EPA Special Appropriations Projects grants are:

(a)(4)(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(a)(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

(a)(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5 (a) (1) through (10) and such other clauses as the U.S. Environmental Protection Agency may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(a)(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(b) Contractor Work Hours and Safety Standards Act. The Administrator, EPA shall cause or require the contracting officer to insert the following clauses set forth in paragraph (b)(1),(2),(3), and (4) of this section in full in any contract subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by *Section 5.5(a) of this title. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any work week in which he or she is employed on such work to in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b) (1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for unliquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The U.S. Environmental Protection Agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally- assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such liabilities of such contractor or

subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b) (2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in section 5.1, the Administrator of EPA shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly worked, deductions made, and actual wages paid. Further, the Administrator of EPA shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the U.S. Environmental Protection Agency and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job. (Approved by the Office of Management and Budget under OMB control numbers 1215-0140 and 1215-0017.)

CERTIFICATIONS

Debarred Firms

All prime Construction Contractors shall certify that Subcontractors have not and will not be awarded to any firm that is currently on the EPA Master List of Debarred, Suspended and Voluntarily Excluded Persons in accordance with the provisions of 40 CFR 32.500(c). Debarment action is taken against a firm for noncompliance with Federal Law.

All bidders shall complete the attached certification (Attachment Number 10) and submit to the owner with the bid proposal.

Anti-lobbying Certification

All prime Construction Contractors must certify (Attachment Number 11) that no appropriated funds were or will be expended for the purpose of lobbying the Executive or Legislative Branches of the Federal Government or Federal Agency concerning this contract (contract in excess of \$100,000). If the Contractor has made or agreed to make payment to influence any member of Congress in regard to award of this contract, a Disclosure Form must be completed and submitted to the owner with the bid proposal.

All prime Contractors must require all Subcontractors to submit the certification, which must also be submitted to the owner.

**CERTIFICATION REGARDING DEBARMENT,
SUSPENSION AND OTHER RESPONSIBILITY MATTERS**

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to \$10,000 or imprisonment for up to 5 years, or both.

Typed Name & Title of Authorized Representative

Signature of Authorized Representative

Date

_____ I am unable to certify to the above statements. My explanation is attached.

CERTIFICATION REGARDING LOBBYING
Certification for Contracts, Grants,
Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Typed Name & Title of Authorized Representative

Signature of Authorized Representative

Date

_____ I am unable to certify to the above statements. My explanation is attached.

EPA DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

EPA's Disadvantaged Business Enterprise Program rule applies to contract procurement actions funded in part by EPA assistance agreements awarded after May 27, 2008. The rule is found at Federal regulation Title 40, Part 33. Specific responsibilities are highlighted below.

Grant recipient responsibilities:

- Conduct an Availability Analysis and negotiate fair share objectives with EPA (§33.411), or adopt the fair share objectives of the oversight state agency revolving loan fund for comparable infrastructure. (§33.405(b)(3)).
- Include the Appendix A term and condition in each contract with a primary contractor (§3.106). The term and condition is included in the EPA Region 4 contract specifications insert *FEDERAL REQUIREMENTS AND CONTRACT PROVISIONS FOR SPECIAL APPROPRIATION ACT PROJECTS US ENVIRONMENTAL PROTECTION AGENCY, Region III, June 2008*.
- Employ the six Good Faith Efforts during prime contractor procurement (§33.301).
- Require prime contractor to comply with the following prime contractor requirements of Title 40 Part 33:
 - To employ the six Good Faith Efforts steps in paragraphs (a) through (e) of §33.301 if the prime contractor awards subcontracts (§33.301(f)).
 - To provide EPA form 6100-2 – *DBE Subcontractor Participation Form* to all DBE subcontractors (§33.302(e)).
 - To submit EPA forms 6100-3 – *DBE Program Subcontractor Performance Form* and 6100-4 – *DBE Program Subcontractor Utilization Form* with bid package or proposal. (§33.302 (f) and (g)).
 - To pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient (§33.302(a)).
 - To notify recipient in writing by its prime contractor prior to any termination of a DBE subcontractor for convenience by the prime contractor (§33.302(b)).
 - To employ the six good faith efforts described in §33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason. (§33.302(c)).
 - To employ the six good faith efforts described in §33.301 even if the prime contractor has achieved its fair share objectives under subpart D of Part 33. (§33.302(d)).

- Semiannually complete and submit to Charles Hayes, EPA Region 4 DBE Coordinator EPA form 5700-52A summarizing DBE participation achieved during the previous six months (§33.502).
- Maintain records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its prime contractors', good faith efforts (§33.501(a)).

Prime Contractor Responsibilities:

- Employ the six Good Faith Efforts steps in paragraphs (a) through (e) of §33.301 if the prime contractor awards subcontracts (§33.301(f)).
- Provide EPA form number 6100-2 – *DBE Program Subcontractor Participation Form* and form number 6100-3 – *DBE Program Subcontractor Performance Form* to each DBE subcontractor prior to opening of the contractor's bid or proposal (§33.302(e) and (f)).
- Complete EPA form number 6100-4 – *DBE Program Subcontractor Utilization Form* (§33.302(g)).
- Submit to recipient with its bid package or proposal the completed EPA form number 6100-4, plus an EPA form number 6100-3 for each DBE subcontractor used in the contractor's bid or proposal (§33.302(f) and (g)).
- Pay subcontractors for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient (§33.302(a)).
- Notify the recipient in writing prior to prime contractor termination of a DBE subcontractor for convenience (§33.302(b)).
- Employ the six good faith efforts described in §33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason. (§33.302(c)).
- Employ the six good faith efforts described in §33.301 even if the prime contractor has achieved its fair share objectives under subpart D of Part 33. (§33.302(d)).
- Semiannually inform recipient of DBE participation achieved (§33.502).
- Maintain records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its prime contractors', good faith efforts (§33.501(a)).

Subcontractor Responsibilities:

- May submit EPA form 6100-2 – *DBE Subcontractor Participation Form* to Charles Hayes, EPA Region 4 DBE Coordinator (§33.302(e)).
- Must complete EPA form 6100-3 – *DBE Program Subcontractor Performance Form*, and submit it to the prime contractor soliciting services from the subcontractor prior to the opening of bids for the prime contract.

SPAP Requirements:

Form	Requirement	Provided By:	Completed By:	Submitted To:
EPA Form 6100-2	Grant Recipients required to have prime contractors provide form to Subcontractors	Prime Contractors	DBE Subcontractors	EPA Region 4 DBE Coordinator Charles Hayes
EPA Form 6100-3	Grant Recipients required to have prime contractors provide form to Subcontractors	Prime Contractors	DBE Subcontractors	Grant Recipients as part of a bid or proposal package
EPA Form 6100-4	Grant Recipients required to have prime contractors complete the form	Grant Recipients	Prime Contractors	Grant Recipients as part of a bid or proposal package

SRF Requirements:

Form	Requirement	Provided By:	Completed By:	Submitted To:
EPA Form 6100-2	Recipients required to have prime contractors provide form to Subcontractors	Prime Contractors	DBE Subcontractors	DOW Project Administrator
EPA Form 6100-3	Recipients required to have prime contractors provide form to Subcontractors	Prime Contractors	DBE Subcontractors	Dow Project Administrator w/ATA Package
EPA Form 6100-4	Recipients required to have prime contractors complete the form	Recipients	Prime Contractors	DOW Project Administrator w/ATA Package
Pay Request DBE Form	Recipients required to have prime contractors complete the form	Recipients	Prime Contractors	DOW Project Administrator w/EACH PAYMENT

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION POLICY

PROJECT NAME: _____

BID DATE: _____

1. Name, address and telephone number of contact person on all DBE matters:

Prime Contractor's Name: _____

Contact Person: _____

Address: _____

Phone: _____

Cell Phone: _____

Email: _____

Total Contract Amount: _____

2. Total dollar amount/percent of contract of MBE participation: _____

3. Total dollar amount/percent of contract of WBE participation: _____

4. Are certifications* for each MBE/WBE/DBE subcontractor enclosed; if no, please explain: Yes No _____

5. Are MBE/WBE/DBE subcontracts or letters of intent signed by both parties enclosed; if no, please explain: Yes No _____

6. List of MBE Subcontractors:

Name: _____

Contact Person: _____

Address: _____

Phone: _____

Cell Phone: _____

Email: _____

Type of Contract: _____

Work to be Done: _____

Amount: _____

7. List of WBE Subcontractors:

Name: _____

Contact Person: _____

Address: _____

Phone: _____

Cell Phone: _____

Email: _____

Type of Contract: _____

Work to be Done: _____

Amount: _____

Attach Additional Sheets, If Necessary

*Self-certification: Self certification of MBE/WBE/DBE firms will NOT be accepted as a valid form of certification of MBE/WBE/DBE status.

8. Information and documentation concerning efforts taken to comply with EPA's "six good faith efforts"

- (i). Ensure DBE construction firms or material suppliers are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources. A good source for a list of DBEs is the Kentucky Transportation's website: <http://transportation.ky.gov/Civil-Rights-and-Small-Business-Development/Pages/Certified-DBE-Directory.aspx>.
- The prime contractor certifies that a bidders list (see example sheet below) of qualified vendors, including DBEs, was developed for current and future solicitations and that the list will be maintained. *Submit a copy of the list as documentation.*
- (ii). Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process; including, whenever possible, posting solicitation for bids or proposals for a sufficient amount of time as to receive a competitive bid or proposal pool.
- The prime contractor certifies that every opportunity was provided to a number of DBEs to encourage their participation in the competitive process and that an adequate amount of time was provided for response.
- a. List each DBE construction firm or material supplier to which a solicitation was attempted. *Submit copies of letters, emails, faxes, telecommunication logs, certified mail receipts, returned envelopes, certified mail return receipts, etc. as documentation.*
- Company name and phone number: _____
Area of work expertise: _____
Date of any follow-ups and person spoke to: _____
- b. Advertisements, if applicable: List each publication in which an announcement or notification was placed. *Submit a tear sheet of each announcement from each publication as documentation.*
- Name of publication: _____
Date(s) of advertisement: _____
Specific subcontract areas announced: _____
- c. Other, if applicable: List each notification method in which an announcement or outreach was used; list serve, public meeting, etc. *Submit applicable information to document effort.*
- Method of notification: _____
Date(s) of notification: _____
- (iii). Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs; including dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
- The prime contractor certifies that the project was broken into its basic elements (i.e., dirt hauling, landscaping, painting, pipe installation, material supplies, etc.) and that a determination was made whether it's economically feasible to bid the elements separately and that the analysis of this effort was documented with a short memo to the project file.

- (iv). Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women’s business enterprises.
- The prime contractor certifies that they established delivery schedules which would allow DBEs to participate in the projects.
- (v). Use the services and assistance of the Small Business Administration (SBA) and the Minority Business Development Agency (MBDA) of the U.S. Department of Commerce. The easiest way to utilize the services of SBA and MBDA is to visit their websites: www.sba.gov and www.mbda.gov and use the electronic tools available there or you may send the nearest SBA and MBDA office a certified letter that generally describes the solicitation, the dates it will be open, the types of vendors you are seeking and applicable SIC or NAIC codes if known. You may also use the services and assistance of the Kentucky Procurement Assistance Program (KPAP). The easiest way to utilize the services of KPAP is to send an email: ced.kpap@ky.gov and provide information on forthcoming opportunities available to DBEs.
- The prime contractor certifies that the assistance of the SBA, MBDA, and/or KPAP was utilized. *Submit pages printed off the SBA and MBDA websites which evidence efforts to register a solicitation on those sites or submit copies of the letter sent and certified mail receipt as documentation; submit copies of emails with KPAP as documentation.*
- (vi). If a subcontractor awards any subcontracts, require the subcontractor to take the steps in numbers (i) through (v) above.
- The prime contractor certifies that subcontractors used for this project will be required to follow the steps of the “six good faith efforts” as listed above.

9. Signature and date:

To the best of my knowledge and belief, all “six good faith efforts” have been met and the information contained in this document is true and correct; the document has been duly authorized by the legal representative.

Signature

Print name and title

Date

BONDS AND INSURANCE

The minimum requirements shall be as follows:

Bonding requirements for contracts of \$100,000 or less are contained in 40 CFR 31.36(h).

Bond requirements for contracts in excess of \$100,000 are:

- Bid guarantee equivalent to five percent of the bid price. The bid guarantee shall consist of a firm commitment such as a certified check or bid bond submitted with the bid;
- Performance bond equal to 100 percent of the contract price, and
- Payment bond equal to 100 percent of the contract price. Bonds must be obtained from companies holding Certificates of Authority as acceptable sureties, issued by the U.S. Treasury.

Insurance requirements are contained in the General Conditions of the contract. In addition to the other required insurance, the owner or the contractor, as appropriate, must acquire any flood insurance made available by the Federal Emergency Management Agency as required by 44 CFR Parts 59-79, if construction will take place in a flood hazard area identified by the Federal Emergency Management Agency. The owner's requirements on Flood Insurance are contained in the Special Conditions Section of the Contracts Documents.

NOTICE OF INTENT

All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The permit can be found at the following web address:
<https://dep.gateway.ky.gov/eForms/default.aspx?FormID=7>.

If you have any questions regarding the completion of this form call the Surface Water Permits Branch, at (502) 564-3410.

Davis-Bacon Wage Rate Requirements

CWSRF: The recipient agrees to include in all agreements to provide assistance for the construction of treatment works carried out in whole or in part with such assistance made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.), or with such assistance made available under section 205(m) of that Act (33 U.S.C. 1285(m)), or both, a term and condition requiring compliance with the requirements of section 513 of that Act (33 U.S.C. 1372) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions. All contracts and subcontracts for the construction of treatment works carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of \$2,000 the contract clauses as set forth below titled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)". This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

DWSRF: The recipient agrees to include in all agreements to provide assistance for any construction project carried out in whole or in part with such assistance made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12), a term and condition requiring compliance with the requirements of section 1450(e) of the Safe Drinking Water Act (42 U.S.C.300j-9(e)) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions All contracts and subcontracts for any construction project carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of \$2,000 the contract clauses as set forth below entitled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)". This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)

Preamble

With respect to the Clean Water and Safe Drinking Water State Revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State. Typically, the subrecipients are municipal or other local governmental entities that manage the funds. For these types of recipients, the provisions set forth under Roman Numeral I, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section 3(ii)(A), below and for compliance as described in Section I-5.

Occasionally, the subrecipient may be a private for profit or not for profit entity. For these types of recipients, the provisions set forth in Roman Numeral II, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section II-3(ii)(A), below and for compliance as described in Section II-5.

I. Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) For Subrecipients That Are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. The recipient or subrecipient may also obtain additional guidance from DOL's website at <http://www.dol.gov/whd/>

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2013 Continuing Resolution, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's website, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all

interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that

the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will

no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29

CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of \$100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may

be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification.

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during

the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractor's use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/contacts/whd/america2.htm>.

II. Requirements Under The Consolidated and further Continuing Appropriations Act, 2013 (P.L. 113-6) For Subrecipients That Are Not Governmental Agencies

The following terms and conditions specify how recipients will assist EPA in meeting its DB responsibilities when DB applies to EPA awards of financial assistance under the FY2013 Continuing Resolution with respect to subrecipients that are not governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at <http://www.dol.gov/whd/>.

Under these terms and conditions, the subrecipient must submit its proposed DB wage determinations to the State recipient for approval prior to including the wage determination in any solicitation, contract task orders, work assignments, or similar instruments to existing contractors.

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, Davis-Bacon prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients must obtain proposed wage determinations for specific localities at www.wdol.gov. After the Subrecipient obtains its proposed wage determination, it must submit the wage determination to (insert contact information for State recipient DB point of contact for wage determination) for approval prior to inserting the wage determination into a solicitation, contract or issuing task orders, work assignments or similar instruments to existing contractors

(ordering instruments unless subsequently directed otherwise by the State recipient Award Official).

(b) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov on a weekly basis to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(c) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including

painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2013 Continuing Resolution, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request, and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s) shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by

the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered

program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of \$100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient shall upon the request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (a)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification.

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB . In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/whd/america2.htm> or its successor site.

SECTION 00 83 13

PREVAILING WAGE RATES

R-1. GENERAL. The successful bidder will be required to conform to all provisions of the federal Davis-Bacon and Related Acts (The Act) which requires that all laborers and mechanics employed by contractors and subcontractors performing on federal contracts (and contractors and subcontractors performing on federally assisted contracts under the related ACTS) in excess of \$2,000 pay their laborers and mechanics not less than the prevailing wage rates and fringe benefits, as determined by the Department of Labor, for corresponding classes of laborers and mechanics employed on similar projects in the area.

This Contract shall be based upon payment by the Contractor and his Subcontractors of wage rates not less than the prevailing hourly wage rate for each craft or type of workman engaged on the Work as determined by the Department of Labor of the Commonwealth of Kentucky.

The Contractor shall comply with the prevailing wage law of Kentucky, Kentucky Revised Statutes 337.510 to 337.550, including latest amendments thereto.

The Contractor and each Subcontractor shall keep accurate records indicating the hours worked each day by each employee in each classification of work and the amount paid each employee for his work in each classification. Such records shall be open to the inspection and transcript of the Commissioner of Labor or his duly authorized representatives at any reasonable time. These payroll records shall not be destroyed or removed from the state for one year following completion of the improvement.

The Contractor and each Subcontractor shall post and keep posted in a conspicuous place or places at the construction site a copy or copies of prevailing rates of wages and working hours as prescribed in these Contract Documents.

If, during the life of this Contract, the prevailing hourly rate of wages is changed by the Department of Labor, such change shall not be the basis of any claim by the Contractor against the Owner, nor will deductions be made by the Owner against sums due the Contractor by reason of any such change.

The prevailing wage law does not prohibit payment of more than the prevailing rate of wages.

Pursuant to Kentucky Revised Statute 337.540, no laborer, workman, mechanic, helper, assistant, or apprentice shall be permitted to work more than 8 hours in one calendar day, nor more than 40 hours in one week, except in cases of emergency caused by fire, flood, or damage to life or property. Whenever work in excess of 8 hours per day or 40 hours per week is required, payment for overtime shall be at not less than one and one-half times the prevailing rate of wages.

R-2. PREVAILING WAGES. The following wage rate schedule is the prevailing wage rate determination made by the Department of Labor of the Commonwealth of Kentucky on the designated date, and shall be a part of the Contract.

The Contractor shall note that where a contract is not awarded within 90 days from the date of establishment of the prevailing wages, there shall be a redetermination of the prevailing rate of wage before the contract is awarded.

Davis Bacon wages can be obtained from the Wage Determination OnLine website. Use this link to Find the Davis Bacon wages: <http://www.wdol.gov/dba.aspx#0>. Use the pull down menus to enter "Kentucky", "Kenton", and "Heavy Construction" and click "Search" to find the Davis Bacon Wages.

PREVAILING WAGE RATES DESCRIBED ABOVE SHALL BE PROVIDED BY
ADDENDA.

SECTION 01 11 13

SUMMARY OF WORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Table of Articles for this Section is:

<u>Article</u>	<u>Title</u>
1.1	Section Includes
1.2	Location and Description of Work
1.3	Other Construction Contracts
1.4	Work By Others
1.5	Work By OWNER
1.6	OWNER-furnished Equipment and Materials
1.7	Assigned Procurement Contracts
1.8	Sequence and Progress of Work
1.9	CONTRACTOR's Use of Site
1.10	Easements and Rights-of-Way
1.11	Notices to Owners and Authorities of Properties Adjacent to the Work
1.12	Salvage of Equipment and Materials
1.13	Partial Utilization by OWNER

1.2 LOCATION AND DESCRIPTION OF WORK

- A. The Work is located on the site of the Taylor Mill Water Treatment Plant, 608 Grand Avenue, Taylor Mill, Kentucky, 41015.
- B. The Work to be performed under this Contract consists of providing all equipment, materials, supplies, tools, and supervision necessary to construct the **TAYLOR MILL WATER TREATMENT PLANT ELECTRICAL AND BASIN IMPROVEMENTS**, as shown on the Drawings, specified herein, and required for a fully operational and complete facility. See Section 01 14 19, Use of Site, for project work restrictions. The scope of work includes, but is not limited to, the following major items:
1. Conduct structural rehabilitation on the Sedimentation Basins and Tunnel at Taylor Mill Treatment Plant.
 2. Install new conduits, cable trays, four new MCCs (Pumps no. 1 – 4), and 2 new VFDs (Pumps no. 5 – 6) at Filter Building
 3. Re-roof entire Filter Building and replace skylights above the filters.
 4. Complete Architectural, Electrical, and HVAC work at Filter Building.

5. Remove existing feeder, controls, and existing starters to pumps nos. 1–6. Install new feeders from new MCCs and new VFDs, and make all power and control connections.
6. Disconnect and remove existing pump nos. 1, 3, 5, and 6 and motors and appurtenances. Install new pump nos. 1, 3, 5, and 6 and motors, install new shafts, and make all power and control connections;
7. Install new control valves and required piping at pumps nos. 1, 2, and 3.
8. Drain Sedimentation Basins, remove existing tube settler modules and install new tube settler modules and protective surface grating.
9. General demolition and modifications; and
10. Other miscellaneous work as indicated in the drawings or specifications.

C. Contracting Method: Work shall be constructed under one prime contract.

1.3 OTHER CONSTRUCTION CONTRACTS (NOT USED)

1.4 WORK BY OTHERS

- A. The ENGINEER will be programming the SCADA system. The CONTRACTOR shall provide time in their schedule for the ENGINEER to program the SCADA system as specified in section 01 14 19, Use of Site.

1.5 WORK BY OWNER

- A. OWNER will perform the following in connection with the Work:
 1. Operate all existing valves, gates, pumps, equipment, and appurtenances that will affect OWNER's operation, unless otherwise specified or indicated.

1.6 OWNER-FURNISHED EQUIPMENT AND MATERIALS (NOT USED)

1.7 ASSIGNED PROCUREMENT CONTRACTS (NOT USED)

1.8 SEQUENCE AND PROGRESS OF WORK

- A. The Work shall be constructed in accordance with the requirements as outlined in Section 01 14 16, Coordination with Owner's Operations, and Section 01 12 00, Suggested Sequence of Construction. All specific planning for tie-ins to existing facilities and other matters pertaining to coordination the sequence of construction and maintaining operation of the facilities shall be submitted to the OWNER and ENGINEER for approval.

1.9 CONTRACTOR'S USE OF SITE

- A. CONTRACTOR's use of the Site shall be confined to the areas shown.
- B. CONTRACTOR shall:

1. Assume full responsibility for protection and safekeeping of products stored on or off the Site.
 2. Move stored products that interfere with the operations of OWNER, other contractors or others performing work for OWNER.
 3. Obtain and pay for all additional storage for work areas required for its operations.
 4. Not interfere with operation of OWNER.
 5. Provide all tools, ladders, equipment, etc., for CONTRACTOR's work and the work of all its subcontractors.
- C. Limits on CONTRACTOR's use of the Site are:
1. CONTRACTOR and all personnel shall be restricted to the construction areas shown on the Drawings and designated by the OWNER.
 2. CONTRACTOR shall ensure that all utilities are in good working condition for use by the OWNER's personnel at all times unless written permission is received from the OWNER for temporary outages.
 3. CONTRACTOR shall be responsible for any damage resulting from construction activities.
 4. CONTRACTOR shall not block any access to private property.
 5. CONTRACTOR shall submit written requests and be granted approval a minimum of 48 hours in advance of temporary utility outage.

1.10 EASEMENTS AND RIGHTS-OF-WAY

- A. Easements and rights-of-way will be provided by OWNER in accordance with the General Conditions. Confine construction operations within OWNER's property, public rights-of-way, easements obtained by OWNER, and the limits shown. Use care in placing construction tools, equipment, excavated materials, and materials and equipment to be incorporated into the Work to avoid damaging property and interfering with traffic. Do not enter private property outside the construction limits without permission from the owner of the property.

1.11 NOTICES TO OWNERS AND AUTHORITIES OF PROPERTIES ADJACENT TO THE WORK

- A. Notify owners of adjacent property and utilities when prosecution of the Work may affect their property, facilities, or use of property.
- B. When it is necessary to temporarily obstruct access to property, or when utility service connection will be interrupted, provide notices one week in advance to enable affected persons to provide for their needs. Conform notices to Laws and Regulations and, whether delivered orally or in writing, include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

- C. Notify utility owners and other concerned entities at least 72 hours prior to cutting or closing streets or other traffic areas or excavating near Underground Facilities or exposed utilities.

1.12 SALVAGE OF EQUIPMENT AND MATERIALS

- A. Comply with the requirements of Section 02 41 00, Demolition.
- B. CONTRACTOR shall disassemble and transport all salvaged material that is to remain the property of the OWNER, to an OWNER-designated location, within 20 miles of the Taylor Mill Water Treatment Plant. This equipment includes the following:
 - 1. Electrical Items
- C. Existing equipment and materials removed and not shown or specified to be reused in the Work will become CONTRACTOR's property
- D. Existing equipment and materials removed by CONTRACTOR shall not be reused in the Work, except where so specified or indicated.
- E. Carefully remove in manner to prevent damage all equipment and materials specified or indicated to be salvaged and reused or to remain property of OWNER. Store and protect salvaged items specified or indicated to be used in the Work. Replace in kind or with new items equipment, materials, and components damaged in removal, storage, or handling through carelessness or improper procedures.
- F. CONTRACTOR may furnish and install new items, with ENGINEER's approval, instead of those specified or indicated to be salvaged and reused, in which case such removed items will become CONTRACTOR's property.

1.13 PARTIAL UTILIZATION BY OWNER

- A. Complete Work as specified. OWNER shall operate existing pumps while the Work is taking place. The OWNER will operate the basins and pumps 1, 3, 5, and 6 once they have been rehabilitated / replaced but the CONTRACTOR will continue to provide all insurance and bonds. The correction period as outlined in GC-13.07 will not begin until substantial completion has been given for the entire project.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 12 00

SUGGESTED SEQUENCE OF CONSTRUCTION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR will be required to execute the work in such a manner as will least interfere with the operation of the facility. When filters, clearwells, tanks, process units and conduits are to be taken out of service for construction, dewatering of pipelines shall be done to the extent possible with the existing plant facilities by plant personnel only. Where plant facilities are not sufficient for complete dewatering, the CONTRACTOR shall furnish adequate facilities for and shall completely dewater the pipes or conduits at no additional costs to the OWNER. The CONTRACTOR is advised that existing valves may not be water tight and may leak. The CONTRACTOR shall furnish and operate those additional facilities necessary to handle leakage due to faulty gates or valves. The CONTRACTOR is to include costs of this work in a lump sum bid.
- B. It is the CONTRACTOR'S responsibility to hose down and clean all tanks, basins or structures and remove and dispose of any debris, sludge, solids, etc within the tank or structure in accordance with all applicable regulations.
- C. Temporary power generation/supply is the responsibility of the CONTRACTOR as specified in Section 01 51 13, Temporary Electricity and Lighting.
- D. Provide temporary reducing couplings, supports, and appurtenances as required for phased construction. Install temporary blind flanges as required to keep water from entering new piping during phased construction.
- E. The CONTRACTOR shall field verify the locations and elevations of the existing piping prior to any piping submittals, as required to perform the Work.
- F. All temporary electrical and piping materials, supports and routings shall be submitted for approval prior to installation.
- G. Interruptions in facility operations shall be coordinated in accordance with Section 01 14 16, Coordination with Owner's Operation, and other contract documents.
- H. The CONTRACTOR shall provide necessary temporary structural support.

- I. The CONTRACTOR shall maintain in operation the monitoring and control capabilities that are currently available in the Control Room on the second floor of the Filter Building. Access shall be provided at all times.
- J. The CONTRACTOR shall coordinate the construction WORK such that plant systems which are currently in operation remain in operation at all times throughout the construction period unless otherwise approved by the Construction Contract Administrator.

PART 2 SUGGESTED SEQUENCE OF WORK

2.1 DESCRIPTION

- A. The following suggested sequence of construction can be used as a guide to scheduling the WORK required to meet the project milestones, constraints and work restrictions. Many of these items should be done in parallel to meet the required project milestones, constraints and work restrictions. This is only a suggested sequence of WORK; the CONTRACTOR shall be responsible for the actual sequence of WORK, and all means and methods.

2.2 SUGGESTED SEQUENCE

- A. Once NKWD Board approves apparent low bidder but before Notice to Proceed (NTP), CONTRACTOR is permitted to start submitting shop drawings for time critical items (MCCs, VFDs, tube settlers, pump, motors, etc.). OWNER and CONTRACTOR will follow section 01 33 00 procedures. CONTRACTOR shall sign and submit completed Form No. 35, NKWD Early Submittal of Time Sensitive Shop Drawings Letter (Section 01 33 13, Reference Forms) to the OWNER.
- B. Upon receipt of NTP initiate purchase of items, which have approved shop drawing submittals.
- C. On September 1, 2014 (or sooner if NKWD can shut down sooner) drain and clean the basins.
- D. Complete the demolition and repair of the tunnel and flocculator area(s) by October 31, 2014. Portions of the existing tube settlers may need to be removed and reinstalled in order to access some areas for rehabilitation.
- E. Complete the rehabilitation of at least 1 of the basins and return it to service by October 31, 2014. Portions of the existing tube settlers may need to be removed and reinstalled in order to access some areas for rehabilitation.
- F. Have at least 1 basin operational on October 31, 2104.

- G. Complete the rehabilitation of the other basin by December 19, 2014. Portions of the existing tube settlers may need to be removed and reinstalled in order to access some areas for rehabilitation.
- H. Shutdown entire plant and demolish existing tube settlers and install new tube settlers between March 1, 2015 and April 30, 2015.
- I. Install new conduits and cable tray from new filter building MCC/VFD on third floor, as far as possible to existing high service pumps, and to transformer backfeed locations on mezzanine and in outside substation area.
- J. Furnish and install new conduit from new MCC/VFD location on third floor, to the existing main transformer secondary bus.
- K. Remove portions of the storefronts and install new conduit and control wiring from new filter building MCC/VFD to existing PLC cabinet, and new high service pump remote control station.
- L. Furnish and install new motor control center and variable frequency drives.
- M. Tap existing main transformer secondary bus, connect new MCC/VFD, and energize. Existing bus duct shall remain at this time. (This step requires an outage).
- N. Re-roof entire filter building and replace skylights above the filters.
- O. Complete third floor architectural, electrical and HVAC work.
- P. Steps Q/R through V below shall not be performed concurrently.
- Q. Disconnect and replace existing high service pump no. 3, pump, motor, Magna Drive, control valve and appurtenances. Remove existing feeder and controls from existing starter to high service pump no. 3. Furnish and install feeder from new MCC, and make all power and control connections. Perform startup of high service pump no. 3 on new service. Perform the work described in this paragraph concurrently with the work described in paragraph 2.2.R below.
- R. Disconnect and replace existing control valve and appurtenances at pump no. 2. Replace suction valve. Remove existing feeder and controls from existing starter to high service pump no. 2 and install new feeder from new MCC, and make all power and control connections. Perform startup of high service pump no. 2 on new service. Perform the work described in this paragraph concurrently with the work described in paragraph 2.2.Q above.
- S. Disconnect and replace existing high service pump no. 6, pump, motor, suction piping and appurtenances. Install new “can” for pump. Remove existing feeder

and controls from existing starter to high service pump no. 6. Furnish and install feeder from new VFD, and make all power and control connections. Perform startup of high service pump no. 6 on new service.

- T. Disconnect and replace existing high service pump no. 1, pump, motor, control valve and appurtenances. Replace suction valve. Remove existing feeder and controls from existing starter to high service pump no. 1. Furnish and install feeder from new MCC, and make all power and control connections. Perform startup of high service pump no. 1 on new service.
- U. Remove existing feeder and controls from existing starter to high service pump no. 4 and install new feeder from new MCC, and make all power and control connections. Perform startup of high service pump no. 4 on new service.
- V. Disconnect and replace existing high service pump no. 5, pump, motor and appurtenances. Remove existing feeder and controls from existing starter to high service pump no. 5. Furnish and install feeder from new VFD, and make all power and control connections. Perform startup of high service pump no. 5 on new service.
- W. Remove existing starter in mezzanine adjacent to 150 KVA transformer, and prepare bussing for new connection. Install feeder from new MCC/VFD and make connection to existing transformer. Energize transformer from new service.
- X. Remove existing feeder to existing 2400V switch in mezzanine, serving 150 KVA basement transformer. Install new feeder from MCC/VFD and make connection. Energize transformer from new service. (Must be installed and connected between October 16th and April 30st, plant out of service).
- Y. Disconnect and remove existing switch feeding to existing 300 KVA transformer located outside. Install new feeder from MCC and make connection. Energize transformer from new service. (Must be installed and connected between October 16th and April 30st, plant out of service).
- Z. Disconnect and remove existing secondary bus duct from primary service transformer, existing 2400V switchgear, existing 2400V starters, and associated unused wiring and conduit.
- AA. Finish HVAC, Architectural, and electrical work in filter building.
- BB. Bring plant back on line and test

PART 3 EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 14 16

COORDINATION WITH OWNER'S OPERATIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Scope:
1. This Section includes requirements for coordinating with OWNER's operations during the Work, and includes requirements for tie-ins and shutdowns necessary to complete the Work without impact on OWNER's operations except as allowed in this Section.
 2. CONTRACTOR shall provide labor, materials, tools, equipment and incidentals shown, specified and required to coordinate with OWNER's operations during the Work.
 3. CONTRACTOR shall complete the Work without interfering in an unapproved manner with the OWNER's operation of its facility.
- B. Coordination:
1. Review installation procedures under other Specification sections and coordinate Work that must be performed with or before the Work specified in this Section.
- C. Related Sections:
1. Section 01 11 13, Summary of Work.
 2. Section 01 12 00, Suggested Sequence of Construction
 3. Section 01 73 24, Installation.
 4. Section 01 73 29, Cutting and Patching.
- D. Except for the shutdowns specified herein, the Work shall be performed such that the OWNER's plant or facility remains in continuous satisfactory operation during the Project. Work shall be scheduled and conducted by CONTRACTOR such that it does not impede the OWNER's production or processes, create potential hazards to operating equipment and personnel, reduce the quality of the treated water.
- E. Work not specifically covered herein and in the referenced Specification sections may, in general, be completed at any time during normal work hours, subject to operating requirements described herein.
- F. CONTRACTOR has the option of providing additional temporary facilities that can eliminate or mitigate a constraint without additional cost to OWNER, provided such additional temporary facilities: do not present hazards to the public, personnel, structures, and equipment; that such additional temporary facilities do not adversely affect OWNER's ability to comply with Laws and Regulations, permits, and operating requirements; that such temporary facilities do not

generate or foster the generation of odors and other nuisances; and that requirements of the Contract Documents are fulfilled.

- G. Coordinate shutdowns with OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR. When possible, combine multiple tie-ins into a single shutdown to minimize impacts on OWNER's operations and processes.
- H. Do not shut off or disconnect existing operating systems, unless accepted by CONSTRUCTION CONTRACT ADMINISTRATOR in writing. Operation of existing equipment will be by OWNER unless otherwise specified or indicated. Where necessary for the Work, CONTRACTOR shall seal or bulkhead OWNER-operated gates and valves to prevent leakage that may affect the Work, OWNER's operations, or both. Provide temporary watertight plugs, bulkheads, and line stops as required. After completing the Work, remove seals, plugs, bulkhead, and line stops to satisfaction of CONSTRUCTION CONTRACT ADMINISTRATOR.
- I. Bypassing:
 - 1. Diversion of flows around treatment processes is not allowed.
- J. SCADA programming for the proposed equipment shall be done by the ENGINEER. CONTRACTOR shall provide enough time in their construction schedule for the programming to be completed prior to the date of Substantial Completion.

1.2 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Substitute Sequence Submittal: When deviation from specified sequence is proposed, provide submittal explaining in detail the proposed sequence change and its effects, including evidence that OWNER's operations will not be adversely affected by proposed change. List benefits of proposed sequence change, including benefits to Progress Schedule. Submit in accordance with Section 01 25 00, Substitution Procedures.
- B. Informational Submittals: Submit the following:
 - 1. Shutdown Planning Submittal:
 - a. For each shutdown, submit an inventory of labor and materials required to perform the shutdown and tie-in tasks, an estimate of time required to accomplish the complete shutdown including time for OWNER to take down and start up existing equipment, systems, or conduits, and written description of steps required to complete the Work associated with the shutdown.
 - b. Furnish submittal to CONSTRUCTION CONTRACT ADMINISTRATOR at least thirty days prior to proposed shutdown start date. Do not start shutdown until obtaining CONSTRUCTION CONTRACT ADMINISTRATOR's acceptance of shutdown planning submittal.

2. Shutdown Notification: After acceptance of shutdown planning submittal and prior to starting the shutdown, provide written notification to OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR of date and time each shutdown is to start. Provide notification at least 2 weeks in advance of each shutdown.

1.3 GENERAL CONSTRAINTS

- A. Specified in the Contract Documents are the sequence and shutdown durations, where applicable, for OWNER'S equipment, systems, and conduits that are to be taken out of service temporarily for the Work. New equipment, materials, and systems may be used by OWNER after the specified field quality controls and testing are successfully completed and the materials or equipment are Substantially Complete.
- B. The following constraints apply to coordination with OWNER's operations:
 1. Operational Access: OWNER'S personnel shall have access to equipment and areas that remain in operation.
 2. Temporary Partitions and Enclosures: CONTRACTOR shall provide temporary partitions and enclosures necessary to maintain dust-free, heated, and ventilated spaces in areas that are adjacent to the Work and that must be kept operational.
 3. Schedule and perform equipment and system start-ups for Monday through Thursday. Equipment and systems shall not be placed into operation on Friday, Saturday, and Sunday without prior approval of OWNER.
 4. Dead End Valves or Pipe: Provide blind flanges, watertight bulkheads, or valve at temporary and permanent terminuses of pipes and conduits. Blind flanges and bulkheads shall be suitable for the service and braced and blocked, as required, or otherwise restrained as directed by CONSTRUCTION CONTRACT ADMINISTRATOR. Temporary valves shall be suitable for their associated service. Where valve is provided at permanent terminus of pipe or conduit, also provide on downstream side of valve a blind flange with drain/flushing connection.
 5. OWNER will assist CONTRACTOR in dewatering process tanks, basins, conduits, and other work areas to be dewatered for shutdowns. Maintain clean and dry work area by pumping and properly disposing of fluid that accumulates in work areas. Where plant facilities are not sufficient for complete dewatering, the CONTRACTOR shall provide all facilities to adequately dewater tanks, basins, conduits and other work areas.
 6. Draining and Cleaning of Conduits, Tanks, and Basins:
 - a. Unless otherwise specified, CONTRACTOR shall dewater process tanks, basins, conduits, and pipelines at beginning of each shutdown. Flush, wash down, and clean tanks, basins, pipelines, conduits, and other work areas.
 - b. CONTRACTOR shall remove liquids and solids and dispose of them at appropriate location at the Site as directed by CONSTRUCTION CONTRACT ADMINISTRATOR. Unless otherwise specified or

indicated, contents of pipes, tanks, basins, and conduits undergoing modifications shall be transferred to existing process tanks or conduits at the Site with capacity sufficient to accept such discharges, using hoses, piping, pumps, or other means provided by CONTRACTOR. Discharge of fluids across floors is not allowed.

- c. If drainage point is not available on the piping or conduit to be drained, provide a wet tap using tapping saddle and valve or other method approved by CONSTRUCTION CONTRACT ADMINISTRATOR. Uncontrolled spillage of pipe's or conduit's contents is not allowed.
- d. Spillage shall be brought to CONSTRUCTION CONTRACT ADMINISTRATOR'S attention immediately, both verbally and in writing, and reported in accordance with Laws and Regulations. CONTRACTOR shall wash down spillage to floor drains or sumps and flush the system to prevent clogging and odors. If spillage is not suitable for discharge to the drainage system, such as chemical spills, as determined by CONSTRUCTION CONTRACT ADMINISTRATOR, CONTRACTOR shall remove spillage by other method, such as vactor truck, acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR.

1.4 SEQUENCE OF WORK

- A. Perform the Work as required to meet all restrictions, constraints, and project milestones as suggested in Section 01 12 00, Suggested Sequence of Construction. Certain phases or stages of the Work may require working 24-hour days or work during hours outside of regular working hours. Work may be accelerated from a later stage to an earlier stage if OWNER's operations are not adversely affected by proposed sequence change, with CONSTRUCTION CONTRACT ADMINISTRATOR acceptance.

1.5 TIE-INS

- A. Table 01 14 16-A in this Section lists connections by CONTRACTOR to existing facilities. Table 01 14 16-A may not include all tie-ins required for the Work; CONTRACTOR shall perform tie-ins required to complete the Work. For tie-ins not included in Table 01 14 16-A, obtain requirements for tie-ins from CONSTRUCTION CONTRACT ADMINISTRATOR.

1.6 SHUTDOWNS

- A. General:
 1. Terminology: A "shutdown" is when a portion of the normal operation of OWNER's facility, whether equipment, systems, piping, or conduit, has to be temporarily suspended or taken out of service to perform the Work.
 2. Work that may interrupt normal operations shall be accomplished at times convenient to OWNER.

3. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, equipment, spare parts and materials, both temporary and permanent, necessary to successfully complete the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to the associated shutdown. Demonstrate to CONSTRUCTION CONTRACT ADMINISTRATOR'S satisfaction that CONTRACTOR has complied with these requirements before commencing the shutdown.
 4. If CONTRACTOR's operations cause an unscheduled interruption of OWNER's operations, immediately re-establish satisfactory operation for OWNER.
 5. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of OWNER's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by CONTRACTOR if, in CONSTRUCTION CONTRACT ADMINISTRATOR's opinion, CONTRACTOR did not conform to the requirements of the Contract Documents, or was negligent in the Work, or did not exercise proper precautions in conducting the Work.
 6. Shutdowns shall be in accordance with Table 01 14 16-B of this Section. Work requiring service interruptions for tie-ins shall be performed during scheduled shutdowns.
 7. Temporary, short-term shutdowns of smaller piping, conduits, equipment, and systems may not be included in Table 01 14 16-B. Coordinate requirements for such shutdowns with CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER.
- B. Shutdowns of Electrical Systems: Comply with Laws and Regulations, including the National Electric Code. CONTRACTOR shall lock out and tag circuit breakers and switches operated by OWNER and shall verify that affected cables and wires are de-energized to ground potential before shutdown Work is started. Upon completion of shutdown Work, remove the locks and tags and notify CONSTRUCTION CONTRACT ADMINISTRATOR that facilities are available for use.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL

- A. In addition to requirements of this Section, conform to requirements of Section 01 73 29, Cutting and Patching, and Section 01 73 24, Installation.

3.2 SCHEDULES

- A. The schedules listed below, following the “End of Section” designation, are part of this Specification section:
1. Table 01 14 16-A, Schedule of Tie-ins.
 2. Table 01 14 16-B, Schedule of Shutdowns.

++ END OF SECTION ++

**TABLE 01 14 16-A
SCHEDULE OF TIE-INS**

Tie-In No.	New Line Size and Service	Existing (Connecting) Line Size & Service	Tie-In Building/Location	Remarks
1	New Starter for Existing High Service Pump #1	---	New MCC on third floor of filter building	---
2	New Starter for Existing High Service Pump #2	---	New MCC on third floor of filter building	---
3	New Starter for Existing High Service Pump #3	---	New MCC on third floor of filter building	---
4	New Starter for Existing High Service Pump #4	---	New MCC on third floor of filter building	---
5	New Starter for Existing High Service Pump #5	---	New VFD on third floor of filter building	---
6	New Starter for Existing High Service Pump #6	---	New VFD on third floor of filter building	---
7	Modifications for Pump No.1, motor, control valve, and suction valve	---	Front Pump Room	---
8	Modifications for new control valve and suction valve for Pump No. 2	---	Front Pump Room	---
9	Modifications for Pump No.3, motor, and control valve	---	Front Pump Room	---
10	Modifications for Pump No.5, and motor	---	Back Pump Room	---
11	Modifications for Pump No.6, and motor	---	Back Pump Room	---

**TABLE 01 14 16-B
SCHEDULE OF SHUTDOWNS**

Shut-down No.	Reason For Plant Shutdown - Process Equipment and Service Lines Out-of-Service During Shutdown	Process Equipment To Remain In Operation During Shutdown	Tie-In Nos.	Maximum Duration of Shutdown	Constraints
A	Drain and clean basins, and conduct structural rehabilitation on the basins and tunnel	Remaining Plant In Service	--	As Required	CONTRACTOR Shall complete between September 1, 2014 and December 19, 2014
B	New Pump, Motor, Control Valve, and Suction Valve. Tie-in Proposed High Service Pump #1 Starter – High Service Pump #1 Out of Service	Remaining Plant In Service	2	15 Day	- High Service Pumps 2, 4, 5 & 6 Shall Remain Operational
C	New Control Valve and Suction Valve. Tie-in Proposed High Service Pump #2 Starter – High Service Pump #2 Out of Service. New Pump, Motor, and Control Valve. Tie-in Proposed High Service Pump #3 Starter – High Service Pump #3 Out of Service	Remaining Plant In Service	4, 1	15 Day	- High Service Pumps 1, 4, 5 & 6 Shall Remain Operational
D	Tie-in Proposed High Service Pump #4 Starter – High Service Pump #4 Out of Service	Remaining Plant In Service	5	<1 Day	- High Service Pumps 1, 2, 3, 5 & 6 Shall Remain Operational
E	New Pump and Motor. Tie-in Proposed High Service Pump #5 Starter – High Service Pump #5 Out of Service	Remaining Plant In Service	6	15 Day	- High Service Pumps 1, 2, 3, 4 & 6 Shall Remain Operational
F	New Pump and Motor. Tie-in Proposed High Service Pump #6 Starter – High Service Pump #6 Out of Service	Remaining Plant In Service	3	30 Day	- High Service Pumps 1, 2, 3, 4 & 5 Shall Remain Operational
G	Install New Tube Settler Modules and Protective Surface Grating at Basins	Remaining Plant In Service	--	As Required	CONTRACTOR Shall complete between March 1, 2015 and April 30, 2015

SECTION 01 14 19

USE OF SITE

PART 1 – GENERAL

1.1 USE OF PREMISES

- A. Limit use of premises at the Site to work areas shown or indicated on the Drawings and as specified in this Section. Do not disturb portions of the Site beyond areas of the Work.
1. Limits:
 - a. Confine construction operations to property owned by the OWNER.
 - b. Confine storage of materials and equipment, and locations of temporary facilities to property owned by the OWNER. Coordinate lay down area with OWNER
 - c. No equipments shall be on the slope north of the existing filter building and existing preliminary treatment facility.
 2. Driveways and Entrances: At all times, keep driveways and entrances serving premises clear and available to OWNER, OWNER's employees, daily deliveries, and emergency vehicles. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for on-site storage of materials and equipment.
- B. Use of Existing Building: Maintain existing building in weather-tight condition throughout construction. Protect building and its occupants during construction.
1. Use of Existing Utilities, Sanitary Facilities, and First-aid Facilities: Refer Sections 01 51 13, 01 51 36, 01 51 16 and 01 52 16.
 2. Use of Existing Elevators: CONTRACTOR may use OWNER's freight elevator for moving materials and equipment during construction. Elevator shall be available to OWNER at all times unless otherwise arranged with OWNER and ENGINEER. Do not load elevator beyond posted capacity. Use of other elevators is not allowed.
- C. Promptly repair damage to premises caused by construction operations. Upon completion of the Work, restore premises to specified condition; if condition is not specified, restore to pre-construction condition.
- D. The Taylor Mill Water Treatment Plant shall not be taken out of service between May 1st and August 31st of any year.

- E. Existing high service pumps 1, 2, and 6 shall remain in service while the Taylor Mill Water Treatment Plant is out of service.
- F. With the exception of Pumps No. 2 and 3, which may be taken out of service at the same time, all other high service pumps shall be taken out of service one at a time.
- G. Access to the east overhead door of the existing sludge building shall be maintained throughout the project. If the CONTRACTOR blocks the west overhead door of the existing sludge building the CONTRACTOR shall provide manpower and equipment to assist the OWNER as needed to remove and rearrange the existing east and west sludge dumpsters up to 11 times per week.
- H. From May 1st to October 15th of any year access to the chemical building shall not be blocked for more than 14 consecutive days. CONTRACTOR shall notify the OWNER at least 14 days in advance of the chemical building being blocked for 14 consecutive days during this time period.
- I. From October 16th to April 30th of any year access to the chemical building shall not be blocked for more than 30 consecutive days. CONTRACTOR shall notify the OWNER at least 14 days in advance of the chemical building being blocked for 30 consecutive days during this time period.
- J. Following the individual complete and satisfactory commissioning and start-up of pumps 1, 2 & 3, 4, 5 and 6 which must be returned to service before starting on the next pump, the CONTRACTOR shall allow a minimum of 7 days after each pump is operational for the ENGINEER to program the SCADA system for each individual pump.
- K. Howard Street shall not be closed to traffic. Contractor shall coordinate with the OWNER and St. Anthony's School to allow access for drop-off and pick up at the school.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 21 00

ALLOWANCES

PART 1 – GENERAL

1.1 SCOPE

- A. This Section includes administrative and procedural requirements governing the following types of allowances:
 - 1. Cash allowances.
 - 2. Contingency allowances.
- B. Authorization of Allowances:
 - 1. Work that will be paid under an allowance will be authorized in OWNER's written instruction to CONTRACTOR.
 - 2. Do not perform Work under an allowance without written authorization of OWNER.

1.2 CASH ALLOWANCES

- A. Cash allowances are stipulated amounts for anticipated purchase of materials or equipment. In addition to this Section, refer to General Conditions, as may be modified by the Supplementary Conditions; and individual Specification Sections for CONTRACTOR's costs to be covered by allowances, and CONTRACTOR's costs, including overhead and profit, to be included elsewhere in the Contract Price.
- B. At earliest practical date after the Contract Times commence running, notify Construction Contract Administrator of date when final selection and purchase of each material or equipment described by an allowance must be completed to avoid delaying the Work.
- C. Consult with CONSTRUCTION CONTRACT ADMINISTRATOR in selecting Suppliers and obtain proposals for price and time from selected suppliers. Submit proposals to CONSTRUCTION CONTRACT ADMINISTRATOR along with recommendations relevant to furnishing and installing products covered in the allowance.
- D. Purchase materials or equipment from Suppliers selected by CONSTRUCTION CONTRACT ADMINISTRATOR.
- E. Submit invoices or delivery slips to show actual cost and quantity of materials or equipment furnished and used in fulfilling each allowance.

- F. Prepare unused materials or equipment for storage by OWNER, when not economically practical to return for credit. Deliver to storage space at the Site designated by OWNER.
- G. For each allowance, submit to CONSTRUCTION CONTRACT ADMINISTRATOR a Change Order proposal to adjust Contract Price for difference between specified allowance amount and actual cost. Prepare Change Order proposal in accordance with the General Conditions and Supplementary Conditions except that payment within limit of a cash allowance shall exclude cost of bond and insurance premiums.

1.3 CONTINGENCY ALLOWANCE

- A. Contingency allowances are stipulated amounts available as reserve for sole use by OWNER to cover unanticipated costs.
- B. When authorization of Work under contingency allowance is contemplated by OWNER for a defined scope, submit Change Order proposal to CONSTRUCTION CONTRACT ADMINISTRATOR. Prepare Change Order proposal in accordance with the General Conditions as may be modified by the Supplementary Conditions, except that payments within limit of contingency allowance shall exclude cost of bond and insurance premiums.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SCHEDULE OF ALLOWANCES

- A. Contingency Allowance:
 - 1. Contingency Allowance No. 1 – OWNER’s Contingency Allowance
 - a. The amount of \$40,000 is to be included in the Base Bid.
 - b. Allowance will be used for unidentified changes in the work.

++ END OF SECTION ++

SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Items listed in this Section, beginning with Article 1.4, refer to and are the same pay items listed in the Bid Form. They constitute all pay items for completing the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, plant services, CONTRACTOR'S or CONSTRUCTION CONTRACT ADMINISTRATOR'S field offices, layout surveys, Project signs, sanitary requirements, testing, safety devices, submittals and record drawings, water supplies, power and fuel, traffic maintenance, removal of waste, security, coordination with OWNER'S operations, bonds, insurance, or all other requirements of the General Conditions, Supplementary Conditions, General Requirements, and other requirements of the Contract Documents. Compensation for all services, items, and products shall be included in prices stipulated for lump sum and unit price pay items listed in this Section and included in the Contract.
- B. Each lump sum and unit bid price shall be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each separately identified item.

1.2 ENGINEER'S ESTIMATE OF QUANTITIES

- A. ENGINEER'S estimated quantities for unit price items, as listed in the Bid Form, are approximate only and are included solely for purpose of comparing Bids. OWNER does not expressly or by implication agree that nature of materials encountered below ground surface or actual quantities of material encountered or required shall correspond with quantities on the Bid Form, and reserves the right to increase or decrease quantities or to eliminate quantities as OWNER may deem necessary. CONTRACTOR shall not be entitled to adjustment in a unit bid price as result of change in an estimated quantity and agrees to accept the unit prices bid as complete and total compensation for additions or deductions caused by changes or alterations in the Work directed by OWNER.

1.3 RELATED PROVISIONS

- A. Payments to CONTRACTOR: Refer to General Conditions, Supplementary Conditions, and Agreement.
- B. Changes in Contract Price: Refer to General Conditions and Supplementary Conditions.

- C. Schedule of Values: Refer to General Conditions, Supplementary Conditions, and Section 01 29 73, Schedule of Values.

1.4 CONTRACT NO. 1 – GENERAL CONSTRUCTION

A. Item 1 – General Construction

1. Measurement and Payment: Lump sum payment for Item 1 will be full compensation for completing the Work, as shown and specified under Divisions 1 through 48, including allowances specified in section 01 21 00, Allowances, but not Work specifically included under other items or other contracts.

B. Item 2 – Wall Expansion Joint Repair

1. Description: Item 2 includes all wall expansion joint repair required for completing the Work as shown and specified.
2. Measurement: The quantity of wall expansion joint repair will be measured for payment on the basis of linear feet of leaking crack.
3. Payment: The unit price payment per linear foot of wall expansion joint repair will be full compensation for all wall expansion joint repair actually performed as shown and specified and not specifically included under other items and under other contracts. The unit price shall apply to actual quantities up to one hundred fifty percent (150%) or to actual quantities less than fifty percent (50%) of the estimated quantity.

C. Item 3 – Crack Repair:

1. Description: Item 3 includes all crack repair required for completing the Work as shown and specified.
2. Measurement: The quantity of crack repair will be measured for payment on the basis of linear feet of crack.
3. Payment: The unit price payment per linear foot of crack repair will be full compensation for all crack repairs actually performed as shown and specified and not specifically included under other items and under other contracts. The unit price shall apply to actual quantities up to one hundred fifty percent (150%) or to actual quantities less than fifty percent (50%) of the estimated quantity.

D. Item 4 – Surface Spall Repair:

1. Description: Item 4 includes all surface spall repair required for completing the Work as shown and specified.
2. Measurement: The quantity of surface spall repair will be measured for payment on the basis of square feet of surface spall.
3. Payment: The unit price payment per square feet of surface spall repair will be full compensation for all surface spall repair actually performed as shown and specified and not specifically included under other items and under other contracts. The unit price shall apply to actual quantities up to one hundred fifty

percent (150%) or to actual quantities less than fifty percent (50%) of the estimated quantity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 23 00

ALTERNATIVES

PART 1 – GENERAL

1.1 SCOPE

- A. This Section identifies each alternative and describes the basic changes that shall be incorporated into the Work when that alternative is made part of the Work.
- B. Coordination:
 - 1. CONTRACTOR shall coordinate related Work as required to complete the Work under each alternative included in the Contract. Include as part of each alternative miscellaneous devices, accessories, and similar items incidental to or required for a complete installation whether or not shown or indicated as part of the alternative.
 - 2. Notification: Immediately following award of the Contract, notify in writing each entity involved of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

1.2 DESCRIPTION

- A. Alternative No. 1: Deduct New Medium Voltage Variable Frequency Drives For Pumps No. 5 and No. 6.
 - 1. Description: Provide solid state reduced voltage starters for Pumps No. 5 and No. 6 in lieu of the variable frequency drives specified.
 - 2. The scope of Work includes, but is not limited to, the following:
 - a. In lieu of the variable frequency drives shown for Pumps No. 5 and No. 6, furnish and install solid state reduced voltage starters, as specified for Pumps 1-4. The reduced voltage starters shall be furnished in separate enclosures, not in the MCC, and with enclosures sized to accommodate future variable frequency drives.
 - b. Delete the remote potentiometers shown at the pumps, as well as the cabling from the third floor electrical room.
 - c. Delete the speed control and speed reference signal cabling from the third floor electrical room to the existing SCADA panel.
- B. Alternative No. 2: Deduct New Vertical Turbine Pump No. 3 Work.
 - 1. Description: Deduct the Work to remove and replace Vertical Turbine Pump No. 3 and associated valves, piping, fittings, and appurtenances modifications detailed in the Contract Documents.
 - 2. The scope of Work to deduct includes, but is not limited to, the following:

- a. Vertical Turbine Pump and Motor Equipment as specified in Section 43 21 40 and Section 26 29 01 and as shown in the Contract Documents.
 - b. Pump Control Valve and Air Release Valve as specified in Section 40 05 53.
 - c. Associated piping, fittings, specialties, and appurtenances as specified in Division 40.
3. Electrical Work for New Vertical Turbine Pump No. 3 and associated Pump Control Valve, as shown in the Contract Documents, shall be completed if OWNER selects Alternative No.2, except for final connections to pump motors, valves, and appurtenances
- C. Alternative No. 3: Deduct New Modified Bituminous Protected Membrane Roof, Unit Skylights, and Lighting Work at Filter Building.
1. Description: Deduct the Work to remove and replace Modified Bituminous Protected Membrane Roof, Unit Skylights, and Lighting at Filter Building detailed in the Contract Documents.
 2. The scope of Work to deduct includes, but is not limited to, the following:
 - a. Modified Bituminous Protected Membrane Roof as specified in Section 07 55 52 and as shown in the Contract Documents.
 - b. Unit Skylights as specified in Section 08 62 00 and as shown in the Contract Documents.
 - c. Demolition of lighting on the third floor, except in the area of the proposed electrical room, as indicated. If necessary, re-wire existing lighting to accommodate the removal of fixtures in the area of the proposed electrical room.
 - d. New third floor lighting and associated electrical work as specified in Section 26 50 00 and as shown in the Contract Documents, except in the area of the proposed electrical room
 3. Provide roof penetrations in the existing roof for routing of hydronic piping and conduit to ACCU-1, as detailed on the Drawings.
 4. Provide roof support curbs for ACCU-1 complete with roofing and flashing as required to install the support into the existing roofing system.
 5. Alternative No. 3 shall not be accepted by the OWNER if Alternative No. 1 is not excepted.
- D. Alternative No. 4: Deduct Cleaning, Preparation and Painting of Rake Arms, Center Cages, Center Columns and Feedwells .
1. Description: Deduct the Work to clean, prepare and paint the rake arms, center cages, center columns and feedwells in each of the sedimentation basins detailed in the Contract Documents:
 2. The scope of the Work to deduct includes, but is not limited to, the following:
 - a. Associated cleaning, preparation and painting of the rake arms, center cages, center columns and feedwells as shown on the Drawings and as specified in Section 09 91 00.

3. The repair of the steel rake arms, as detailed in the Drawings, shall continue to be completed if OWNER selects Alternative No. 4.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Administrative and procedural requirements for selecting products for the Project.
2. Procedural requirements for product substitutions.
3. Procedural requirements for substitute construction methods or procedures, when construction methods or procedures are specified.

1.2 PRODUCT SUBSTITUTIONS

A. Submit number of copies of request for substitution as specified for submittal of shop drawings. Submit separate request for each substitution. In addition to requirements in the General Conditions, include in request the following:

1. Product identification, including Supplier's name and address.
2. Manufacturer's literature with product description, performance and test data, and reference standards with which product complies.
3. Samples, if appropriate.
4. Name and address of similar projects on which product was used, and date of installation.

1.3 SUBSTITUTE CONSTRUCTION METHODS OR PROCEDURES

A. Submit number of copies of request for substitution as specified for submittal of shop drawings. Submit separate request for each substitution. In addition to requirements in the General Conditions, include in request the following:

1. Detailed description of proposed method or procedure.
2. Itemized comparison of the proposed substitution with the specified method or procedure.
3. Drawings illustrating method or procedure.
4. Other data required by ENGINEER to establish that proposed substitution is equivalent to specified method or procedure.

1.4 CONTRACTOR'S REPRESENTATION AND ACCEPTANCE

A. In making request for substitution, CONTRACTOR represents that:

1. CONTRACTOR has investigated proposed substitution and determined that it is equivalent to item, product, method, or procedure specified, as applicable.

2. CONTRACTOR will provide the same or better guarantees or warranties for proposed substitution as for the specified product, manufacturer, method, or procedure, as applicable.
 3. CONTRACTOR waives all Claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.
- B. A proposed substitution will not be accepted if:
1. Acceptance will require changes in design concept or a substantial revision of the Contract Documents.
 2. Acceptance will delay completion of the Work or the work of other contractors.
 3. Substitution request is indicated or implied on a Shop Drawing, request for interpretation or clarification, and is not accompanied by CONTRACTOR's formal request for substitution.
- C. If ENGINEER determines that proposed substitute is not acceptable, CONTRACTOR shall provide the specified product, manufacturer, method, or procedure, as applicable.
- D. Approval of a substitution request will not relieve CONTRACTOR from requirement for submitting Shop Drawings as set forth in the Contract Documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 29 73

SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Submit to CONSTRUCTION CONTRACT ADMINISTRATOR for acceptance a Schedule of Values in the format required in Section 01 32 22, Project Documentation, that allocates cost to each item of the Work. Schedule of Value list of line items shall correspond to each aspect of the Work, establishing in detail the portion of the Contract Price allocated to each major component of the Work.
- B. Upon request of CONSTRUCTION CONTRACT ADMINISTRATOR, support values with data that substantiate their correctness.
- C. Submit preliminary Schedule of Values to CONSTRUCTION CONTRACT ADMINISTRATOR for initial review. CONTRACTOR shall incorporate CONSTRUCTION CONTRACT ADMINISTRATOR's comments into the Schedule of Values and resubmit to CONSTRUCTION CONTRACT ADMINISTRATOR. CONSTRUCTION CONTRACT ADMINISTRATOR may require corrections and re-submittals until Schedule of Values is acceptable.
- D. Schedule of Values and the Progress Schedule updates specified in Section 01 32 22, Project Documentation, shall be basis for preparing each Application for Payment. Schedule of Values may be used as a basis for negotiating price of changes, if any, in the Work.
- E. Include in Schedule of Values unit price payment items with their associated quantity. Provide in the Schedule of Values detailed breakdown of unit prices when required by CONSTRUCTION CONTRACT ADMINISTRATOR.
- F. Requirements for preliminary Schedule of Values and Schedule of Values are:
 1. Schedule of Values shall show division of Work between CONTRACTOR and Subcontractors. Line items for Work to be done by Subcontractor shall include the word, "(SUBCONTRACTED)".
 2. Schedule of Values shall include breakdown of costs for materials and equipment, installation, and other costs used in preparing the Bid by CONTRACTOR and each Subcontractor. List purchase and delivery costs for materials and equipment for which CONTRACTOR may apply for payment as stored materials.
 3. Include separate amounts for each Specification Section in the Contract Documents by structure, building, and work area.

4. Identify each line item with number corresponding to the associated Specification Section number. List sub-items of major products or systems, as appropriate or when requested by CONSTRUCTION CONTRACT ADMINISTRATOR.
5. Sum of individual values shown on the Schedule of Values shall equal the total of associated payment item. Sum of payment item totals in the Schedule of Values shall equal the Contract Price.
6. Include in each line item a directly proportional amount of CONTRACTOR's overhead and profit. Do not include overhead and profit as separate item(s).
7. Include separate line item for each allowance, and for each unit price item
8. Line items for Site maintenance such as dust control, snow removal, compliance with storm water pollution prevention plans and permits, spill prevention control and countermeasures plans, and for construction photographic documentation; temporary utilities and temporary facilities, field offices, temporary controls, field engineering, and similar Work shall be included in the Schedule of Values and proportioned in Applications for Payment throughout duration of the Work.
9. Include separate line items for mobilization and demobilization. Document for CONSTRUCTION CONTRACT ADMINISTRATOR the activities included in mobilization and demobilization line items.
 - a. Mobilization will be limited to four percent of the Contract Price, and will be paid in four payments, each of twenty five percent of total amount for mobilization over the first four payment applications. Mobilization shall include bonds, insurance and job mobilization.
 - b. Demobilization shall be at least one percent of the Contract Price and shall be included with the Application for Payment following Substantial Completion, or other schedule accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
10. Costs for submittals, operations and maintenance manuals, field testing, and training of operations and maintenance personnel shall be as follows, unless otherwise accepted by CONSTRUCTION CONTRACT ADMINISTRATOR:
 - a. Up to eight percent of cost (including overhead and profit) of each equipment item, exclusive of transportation and installation costs associated with that item, may be allocated to preparation of submittals and may be included in the Application for Payment following CONSTRUCTION CONTRACT ADMINISTRATOR's approval of Shop Drawings (and acceptance of other submittals, as applicable) required for fabricating or purchasing for that item for the Work.
 - b. Up to three percent of total cost of each item (including overhead and profit), including materials and equipment, and installation, may be apportioned to testing and included in the Application for Payment following CONSTRUCTION CONTRACT ADMINISTRATOR's acceptance of the associated written Site testing report(s).
 - c. Up to a total of four percent of equipment cost (including overhead and profit), exclusive of transportation and installation costs, may be

apportioned to operations and maintenance manuals and training of operations and maintenance personnel, which may be included in the Application for Payment following completion of training for that item.

11. Schedule of Values shall include an itemized list of Work by work area, as applicable, for Work included in Section 01 14 16, Coordination with Owner's Operations.
 12. Submit Schedule of Values on 8.5-inch by 11-inch white paper, using the continuation sheets of the Application for Payment form specified in Section 01 33 13, Reference Forms.
- G. If the requirements of this section conflict the requirements of Section 01 32 22, Project Documentation, section 01 32 22 shall take precedence and CONTRACTOR shall coordinate with the CONSTRUCTION CONTRACT ADMINISTRATOR and the OWNER so that the project management software system may be utilized for document tracking and control.

1.2 SUBMITTALS

- A. Informational Submittals: Submit the following:
1. Submit to CONSTRUCTION CONTRACT ADMINISTRATOR five copies of Schedule of Values.
 2. Content of Schedule of Values submittals shall conform to Article 1.1 of this Section.
 3. Time Frames for Submittals:
 - a. Submit preliminary Schedule of Values within time frame specified in the General Conditions.
 - b. Submittal of the Schedule of Values shall be in accordance with the General Conditions. CONSTRUCTION CONTRACT ADMINISTRATOR will not accept Applications for Payment without an acceptable Schedule of Values.
 - c. When required by CONSTRUCTION CONTRACT ADMINISTRATOR, promptly submit updated Schedule of Values to include cost breakdowns for changes in the Contract Price.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 29 76

PROGRESS PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 PROGRESS PAYMENTS

A. General.

1. CONTRACTOR's requests for payment shall be in accordance with the Agreement, General Conditions and Supplementary Conditions, and the Specifications.
2. Applications for Payment shall be in the form of Form "Application for Payment" as found in Section 01 33 13, Reference Forms.
3. If the requirements of this section conflict the requirements of Section 01 32 22, Project Documentation, section 01 32 22 shall take precedence and CONTRACTOR shall coordinate with the CONSTRUCTION CONTRACT ADMINISTRATOR and the OWNER so the project management software system may be utilized for document tracking and control.

B. Procedure:

1. Review with Resident Project Representative (RPR) quantities and Work proposed for each progress payment. Application for Payment shall include only Work and quantities recommended by the RPR.
2. Submit to CONSTRUCTION CONTRACT ADMINISTRATOR originals of each complete Application for Payment and other documents to accompany the Application.
3. CONSTRUCTION CONTRACT ADMINISTRATOR will act on request for payment in accordance with the General Conditions and Supplementary Conditions.

C. Each request for progress payment shall include:

1. Completed Application for Payment form, including summary/signature page, progress estimate sheets, and stored materials summary. Progress estimate sheets shall have same level of detail as the Schedule of Values.
2. For materials and equipment not incorporated in the Work but suitably stored, submit documentation in accordance with the General Conditions and Supplementary Conditions. Legibly indicate on invoice or bill of sale the specific materials or equipment included in the Application and corresponding payment item number for each.
3. Updated Project Progress Schedule.

4. For Applications that include payment for Work under an allowance, submit documentation acceptable to OWNER of the authorization of allowance Work.
5. For Applications (other than request for final payment) that include reduction or payment of retainage in an amount greater than that required in the Contract Documents, submit on form acceptable to OWNER consent of surety to partial release or reduction of retainage.

D. Requirements for request for final payment are in the General Conditions, as may be modified by the Supplementary Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 31 13

PROJECT COORDINATION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall coordinate the Work, including testing agencies, Subcontractors, Suppliers, and others with whom coordination is necessary, in accordance with the General Conditions, Supplementary Conditions, and this Section, to complete the Work within the Contract Times.
- B. In accordance with the General Conditions, CONTRACTOR shall cooperate with and coordinate the Work with other contractors, utility service companies, OWNER's employees working at the Site, and other entities working at the Site, in accordance with Section 01 11 13, Summary of Work.
- C. CONTRACTOR will not be responsible or liable for damage unless it is through negligence of CONTRACTOR, or his Subcontractors, Supplier, or other entity employed by CONTRACTOR.
- D. Attend and participate in all project coordination and progress meetings, and report on the progress of all Work and compliance with the Progress Schedule.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 31 19

PRE-CONSTRUCTION CONFERENCE

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Scope:
1. A pre-construction conference will be held for the Project.
 2. CONTRACTOR shall attend the conference prepared to discuss all items on the agenda.
 3. CONSTRUCTION CONTRACT ADMINISTRATOR will distribute an agenda, preside at conference, and prepare and distribute minutes to all conference participants and others as requested.
 4. If the requirements of this section conflict the requirements of Section 01 32 22, Project Documentation, section 01 32 22 shall take precedence and CONTRACTOR shall coordinate with the CONSTRUCTION CONTRACT ADMINISTRATOR and the OWNER so the project management software system may be utilized for document tracking and control.
- B. Purpose of conference is to designate responsible personnel, establish working relationships, discuss preliminary schedules submitted by CONTRACTOR, and review administrative and procedural requirements for the Project. Matters requiring coordination will be discussed and procedures for handling such matters will be established.
- C. Date, Time and Location: Conference will be held after execution of the Contract and before Work starts at the Site. CONSTRUCTION CONTRACT ADMINISTRATOR will establish the date, time, and location of conference and notify the interested and involved parties.
- D. One week prior to the conference, submit the following preliminary schedules in accordance with the General Conditions:
1. Progress Schedule.
 2. Schedule of Submittals.
 3. Schedule of Values.
- E. CONTRACTOR shall provide information required and contribute appropriate items for discussion. CONTRACTOR shall bring to the conference the following, with sufficient number of copies for each attendee:
1. Preliminary Progress Schedule, as submitted to CONSTRUCTION CONTRACT ADMINISTRATOR.

2. Preliminary Schedule of Submittals, as submitted to CONSTRUCTION CONTRACT ADMINISTRATOR.
3. Preliminary Schedule of Values, as submitted to CONSTRUCTION CONTRACT ADMINISTRATOR.
4. List of emergency contact information, in accordance with Article 1.4 of this Section.

1.2 REQUIRED ATTENDANCE

- A. Representative of each entity attending the conference shall be authorized to act on that entity's behalf.
- B. Contractor Attendance: Conference shall be attended by CONTRACTOR's project manager, Site superintendent, project managers for major Subcontractors, and major equipment Suppliers as CONTRACTOR deems appropriate.
- C. Other attendees will be representatives of:
 1. OWNER.
 2. ENGINEER.
 3. Authorities having jurisdiction over the Work, if available.
 4. Utility owners, as applicable.
 5. Others as requested by OWNER, CONTRACTOR, CONSTRUCTION CONTRACT ADMINISTRATOR or ENGINEER.
 6. CONSTRUCTION CONTRACT ADMINISTRATOR

1.3 AGENDA

- A. Preliminary Agenda: Be prepared to discuss in detail the topics listed below. Revisions to this agenda, if any, will be furnished to CONTRACTOR prior to conference.
 1. Procedural and Administrative:
 - a. Personnel and Teams:
 - 1) Designation of roles and personnel.
 - 2) Limitations of authority of personnel, including personnel who will sign Contract modifications and make binding decisions.
 - 3) Lists of proposed Subcontractors and manufacturers (where applicable).
 - 4) Authorities having jurisdiction.
 - b. Procedures for communications and correspondence.
 - c. Copies of the Contract Documents and availability.
 - d. Subcontractors.
 - e. The Work and Scheduling:
 - 1) Scope of the Work.
 - 2) Contract Times, including Milestones (if any).
 - 3) Phasing and sequencing.
 - 4) Preliminary Progress Schedule.

- 5) Critical path activities.
- f. Safety:
 - 1) Responsibility for safety.
 - 2) Designation of Contractor's safety representative.
 - 3) Emergency procedures and accident reporting.
 - 4) Emergency contact information.
 - 5) Confined space entry procedures.
 - 6) Hazardous materials communication program.
 - 7) Impact of Project on public safety.
- g. Permits.
- h. Review of insurance requirements and insurance claims.
- i. Coordination:
 - 1) Project coordination, and coordination among contractors.
 - 2) Coordination with Owner's operations.
 - 3) Progress meetings.
- j. Products and Submittals:
 - 1) Preliminary Schedule of Submittals.
 - 2) Shop Drawings, Samples, and other submittals.
 - 3) Product options, "or equals", and substitutions..
 - 4) Construction photographic documentation.
- k. Contract Modification Procedures
 - 1) Requests for interpretation
 - 2) Clarification notices
 - 3) Field Orders
 - 4) Proposal requests
 - 5) Change Order proposals
 - 6) Work Change Directives.
 - 7) Change Orders.
 - 8) Procedure for filing Claims.
- l. Payment:
 - 1) Owner's Project financing and funding, as applicable.
 - 2) Owner's tax-exempt status.
 - 3) Preliminary Schedule of Values, and procedures for measuring for payment.
 - 4) Retainage.
 - 5) Progress payment procedures.
 - 6) Prevailing wage rates and payrolls.
- m. Testing and inspections, including notification requirements.
- n. Disposal of demolition materials.
- o. Record documents.
- p. Preliminary Discussion of Contract Closeout:
 - 1) Procedures for Substantial Completion.
 - 2) Contract closeout requirements.
 - 3) Correction period.
 - 4) Duration of bonds and insurance.

2. Site Mobilization (if not covered in a separate meeting):
 - a. Working hours and overtime.
 - b. Field offices, trailers, and staging areas.
 - c. Temporary facilities.
 - d. Temporary utilities and limitations on utility consumption (where applicable).
 - e. Utility company coordination (if not done as a separate meeting).
 - f. Access to Site, access roads, and parking for construction vehicles.
 - g. Maintenance and protection of traffic.
 - h. Use of premises.
 - i. Protection of existing property.
 - j. Security.
 - k. Temporary controls, such as sediment and erosion control, noise control, dust control, storm water control, and other such measures.
 - l. Site barriers and temporary fencing.
 - m. Storage of materials and equipment.
 - n. Reference points and benchmarks; surveys and layouts.
 - o. Site maintenance during the Project.
 - p. Cleaning and removal of trash and debris.
 - q. Restoration.
3. General discussion and questions.
4. Next meeting.
5. Site visit, if required.

1.4 EMERGENCY CONTACT INFORMATION

- A. CONTRACTOR shall provide list of emergency contact information for 24-hour use throughout the Project. Emergency contact information shall be updated and kept current throughout the Project. If personnel or contact information change, provide updated emergency contact information list at the next progress meeting.
- B. CONTRACTOR's list of emergency contact information shall include:
 1. CONTRACTOR's project manager's office, field office, cellular, and home telephone numbers.
 2. CONTRACTOR's Site superintendent's office, field office, cellular, and home telephone numbers.
 3. CONTRACTOR's foreman's field office, cellular (if available), and home telephone numbers.
 4. Major Subcontractors' and Suppliers' office, cellular, and home telephone numbers of project manager and foreman (when applicable).
- C. Additional Emergency Contact Information:
 1. OWNER's office and cellular telephone numbers.
 2. OWNER's central 24-hour emergency telephone number.
 3. CONSTRUCTION CONTRACT ADMINISTRATOR's project manager's

- office, cellular, and home telephone numbers.
4. CONSTRUCTION CONTRACT ADMINISTRATOR's project engineer's office, cellular, and home telephone numbers.
 5. Resident Project Representative's office, field office, cellular, and home telephone numbers.
 6. Utility companies' 24-hour contact telephone number(s), including gas, water, sewer, oil, telephone, cable television/telecommunications, and other companies or concerns having utilities in the vicinity of the Work.
 7. Highway and street owners' 24-hour telephone number(s).
 8. Emergency telephone numbers, including: "Emergency: Dial 911", and seven-digit telephone numbers for the hospital, ambulance, police, and fire department nearest to the Site. Provide names of each of these institutions.
 9. Other involved entities as applicable.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 31 23

PROGRESS MEETINGS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. Progress meetings will be held throughout the Project. CONTRACTOR shall attend each progress meeting prepared to discuss in detail all items on the agenda.
2. CONSTRUCTION CONTRACT ADMINISTRATOR will preside at progress meetings and will prepare and distribute minutes of progress meetings to all meeting participants and others as requested.
3. If the requirements of this section conflict the requirements of Section 01 32 22, Project Documentation, section 01 32 22 shall take precedence and CONTRACTOR shall coordinate with the CONSTRUCTION CONTRACT ADMINISTRATOR and the OWNER so the project management software system may be utilized for document tracking and control.

B. Date and Time:

1. Regular Meetings: Every month on a day and time agreeable to OWNER, ENGINEER, CONSTRUCTION CONTRACT ADMINISTRATOR, and CONTRACTOR.
2. Other Meetings: As required.

C. Place:

1. Location mutually agreed upon by OWNER, CONTRACTOR, CONSTRUCTION CONTRACT ADMINISTRATOR, and ENGINEER.

D. Handouts: CONTRACTOR shall bring to each progress meeting a minimum of ten copies of each of the following:

1. List of Work accomplished since the previous progress meeting.
2. Up-to-date Progress Schedule.
3. Up-to-date Schedule of Submittals.
4. Detailed “look-ahead” schedule of Work planned through the next progress meeting, with specific starting and ending dates for each activity, including shutdowns, deliveries of important materials and equipment, Milestones (if any), and important activities affecting the OWNER, Project, and Site.
5. When applicable, list of upcoming, planned time off (with dates) for personnel with significant roles on the Project, and the designated contact person in their absence.

1.2 REQUIRED ATTENDANCE

- A. Representatives present for each entity shall be authorized to act on that entity's behalf.
- B. Required Attendees:
 - 1. CONTRACTOR:
 - a. Project manager.
 - b. Site superintendent.
 - c. Safety representative.
 - d. When needed for the discussion of a particular agenda item, representatives of Subcontractors and Suppliers shall attend meetings.
 - 2. ENGINEER:
 - a. Project manager or designated representative.
 - b. Resident Project Representative (if any).
 - c. Others as required by ENGINEER.
 - 3. OWNER's representative(s), as required.
 - 4. Testing and inspection agencies, as required.
 - 5. Others, as appropriate.
 - 6. CONSTRUCTION CONTRACT ADMINISTRATOR

1.3 AGENDA

- A. Preliminary Agenda: Be prepared to discuss in detail the topics listed below. Revised agenda, if any, will be furnished to CONTRACTOR prior to first progress meeting. Progress meeting agenda may be modified by CONSTRUCTION CONTRACT ADMINISTRATOR during the Project as required.
 - 1. Review, comment, and amendment (if required) of minutes of previous progress meeting.
 - 2. Review of progress since the previous progress meeting.
 - 3. Planned progress through next progress meeting.
 - 4. Review of Progress Schedule
 - a. Contract Times, including Milestones (if any)
 - b. Critical path.
 - c. Schedules for fabrication and delivery of materials and equipment.
 - d. Corrective measures, if required.
 - 5. Submittals:
 - a. Review of status of critical submittals.
 - b. Review revisions to Schedule of Submittals.
 - 6. Contract Modifications
 - a. Requests for interpretation
 - b. Clarification notices
 - c. Field Orders
 - d. Proposal requests
 - e. Change Order proposals

- f. Work Change Directives.
- g. Change Orders.
- h. Claims.
- 7. Applications for progress payments.
- 8. Problems, conflicts, and observations.
- 9. Quality standards, testing, and inspections.
- 10. Coordination between parties.
- 11. Site management issues, including access, security, maintenance and protection of traffic, maintenance, cleaning, and other Site issues.
- 12. Safety.
- 13. Permits.
- 14. Construction photographic documentation.
- 15. Record documents status.
- 16. Punch list status, as applicable.
- 17. Other business.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 32 22

PROJECT DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The CONSTRUCTION CONTRACT ADMINISTRATOR will coordinate the project documentation using a project management software system. The primary function of the system is to facilitate timely processing and approval of all contract documentation. This system will utilize Primavera Contract Management for document tracking and control. The system will:
1. Facilitate communication among the OWNER, CONSTRUCTION CONTRACT ADMINISTRATOR, ENGINEER, and CONTRACTOR;
 2. Facilitate turnaround time with regard to responses and approvals;
 3. Provide a central location for all project information;
 4. Provide a standard system for project reporting and administration with accountability.
- B. The system will be used to create and track the following documents:
1. Contact List: name, address, regular and emergency phone numbers, etc.
 2. Shop drawing submittal log.
 3. Transmittals.
 4. Requests for Information (RFIs).
 5. Change Documents including but not limited to:
 - a. Requests for Proposals (RFPs)
 - b. Change Order Requests (CORs)
 - c. Change Orders (COs)
 6. Daily Reports.
 7. Field Orders and Clarification Memos.
 8. Notices of Non-Compliance.
 9. Construction Issue Memos.
 10. Punchlists.
 11. Meeting Minutes and Agendas.
 12. Correspondence.
 13. Progress Payments.
 14. Work plans including shut-downs and tie-ins .
 15. Start-up plans.
 16. Training and vendor requirements.
- C. Related Sections:
1. Section 01 32 22, Project Documentation shall take precedence over any conflicts with, but not limited to, the following sections:
 - a. Section 01 29 73, Schedule of Values
 - b. Section 01 29 76, Progress Payment Procedures
 - c. Section 01 31 19, Pre-Construction Conference

- d. Section 01 31 23, Progress Meetings
- e. Section 01 32 33, Photographic Documentation
- f. Section 01 33 00, Submittal Procedures
- g. Section 01 33 13, Reference Forms

CONTRACTOR shall coordinate conflicts between these sections with the CONSTRUCTION CONTRACT ADMINISTRATOR and the OWNER so that the project management software system may be utilized for document tracking and control.

1.2 TRANSMITTALS AND CORRESPONDENCE

- A. All project correspondence shall be generated utilizing the document control system and logged in the system.
- B. The CONTRACTOR shall generate transmittals for sending submittals, Requests for Information, work plans, shut-down plans, start-up plans, reports, training requirements, and other data to the CONSTRUCTION CONTRACT ADMINISTRATOR using the document control system.
- C. The CONTRACTOR shall electronically transmit documents to the CONSTRUCTION CONTRACT ADMINISTRATOR by placing documents in the CONSTRUCTION CONTRACT ADMINISTRATOR's In-Box in the document control system.
- D. All Change Documents will be generated within the document control system and will be monitored and managed by the CONSTRUCTION CONTRACT ADMINISTRATOR.

1.3 SUBMITTALS

- A. The CONSTRUCTION CONTRACT ADMINISTRATOR will manage the submittal review process through review and distribution of reviewed documents. The document control system will be utilized by the CONSTRUCTION CONTRACT ADMINISTRATOR to log and track submittals.
- B. The CONTRACTOR shall create a submittal log and send it electronically to the CONSTRUCTION CONTRACT ADMINISTRATOR for review within 30 days of the Notice to Proceed. The CONSTRUCTION CONTRACT ADMINISTRATOR will post the approved log on the document control system. The CONTRACTOR shall inform the CONSTRUCTION CONTRACT ADMINISTRATOR of any updates or modifications required to the log entries.
- C. To the maximum extent possible, the CONTRACTOR shall transmit Action Submittals and Informational submittals to the CONSTRUCTION CONTRACT ADMINISTRATOR electronically in color pdf format. The OWNER reserves the right to require submittals in electronic format. Exceptions are samples and color charts.

- D. The CONTRACTOR shall be responsible for printing copies of the approved shop drawings for itself, the OWNER, CONSTRUCTION CONTRACT ADMINISTRATOR, and the ENGINEER.

1.4 DAILY INSPECTION REPORTS

- A. The CONTRACTOR shall prepare daily inspection reports in the Contract Management program and enter them in the document control system.
- B. The CONTRACTOR shall complete each daily report by 11:00 a.m. of the subsequent day for each day that CONTRACTOR performs Work.
- C. Required information shall include the CONTRACTOR's name, date the work was performed, description of work performed, equipment utilized, field force, visitors, key materials and equipment delivered, and list the scheduled activities utilizing the P6 schedule activity codes.

1.5 CONSTRUCTION ISSUE MEMOS

- A. The CONSTRUCTION CONTRACT ADMINISTRATOR will manage and monitor the Construction Issue Memo log.
- B. Memos will identify the responsible "ball in court" party, date of issue, and track it through completion.

1.6 PUNCHLISTS

- A. The CONSTRUCTION CONTRACT ADMINISTRATOR shall prepare the punchlist and manage tracking punchlist items within the document control system.

1.7 MEETING AGENDA AND MINUTES

- A. The CONSTRUCTION CONTRACT ADMINISTRATOR will prepare the meeting agenda and be responsible for preparing and placing meeting minutes on the document control system within 7 days of the meeting.
- B. The CONTRACTOR shall notify the CONSTRUCTION CONTRACT ADMINISTRATOR of any changes to meeting minutes within 60 days of the meeting.

1.8 PROGRESS PAYMENTS

- A. The CONTRACTOR shall review the format of the progress payment requests with the CONSTRUCTION CONTRACT ADMINISTRATOR prior to submitting the first request.
- B. The CONTRACTOR shall prepare progress payment requests electronically by inputting the activity code and approved schedule of values into the P6 program.

1.9 PROGRESS SCHEDULE

- A. The CONTRACTOR shall prepare progress schedules using the P6 program.
- B. The format shall be Critical Path Network (CPN) unless otherwise approved by the CONSTRUCTION CONTRACT ADMINISTRATOR. The schedule shall follow the method as generally outlined in Associated General Contractors of America (AGC) 580, "Construction Project Planning and Scheduling Guidelines." If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.
- C. In the title block, show name of Project, OWNER, date submitted, revision or update number, and the name of the scheduler. Updated schedules shall indicate data date.
- D. Identify horizontally across top of schedule the time frame by year, month, and day.
- E. Identify each activity with a unique number and a brief description of the Work associated with that activity.
- F. Indicate the critical path.
- G. Provide a legend to describe standard and special symbols used.
- H. Cost-Loading:
 - 1. Note the estimated cost to perform each Work activity, with the exception of Submittals or Submittal reviews, in the network in a tabular listing.
 - 2. The sum of all activity costs shall equal the Contract Price. An unbalanced or front-end-loaded schedule will not be acceptable.
 - 3. The accepted cost-loaded Progress Schedule shall constitute the Schedule of Values.
- I. The CONTRACTOR shall submit a Preliminary Progress Schedule within 14 days of the Notice to Proceed. In addition to the basic requirements outlined in the General Conditions, show a detailed schedule beginning with Notice to Proceed for minimum duration of 120 days, and a summary of balance of the Project through Final Completion. Show activities including but not limited to the following:
 - 1. Notice to Proceed.
 - 2. Permits.
 - 3. Submittals, with review time.
 - 4. Early procurement activities for long lead equipment and materials.
 - 5. Initial Site work.
 - 6. Earthwork.
 - 7. Specified Work sequences and construction constraints including shutdowns and tie-ins.
 - 8. Contract Completion Dates.

9. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
 10. System startup summary.
 11. Project close-out summary.
 12. Demobilization summary.
- J. The CONTRACTOR shall submit a Detailed Progress Schedule within 30 days of the Notice to Proceed. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by CONTRACTOR.
- K. When accepted by CONSTRUCTION CONTRACT ADMINISTRATOR, the Detailed Progress Schedule will replace the Preliminary Progress Schedule and become the baseline CPN Progress Schedule.
- L. The CPN Progress Schedule will be updated by the CONTRACTOR monthly, at a minimum, to reflect actual progress and occurrences to date, including any weather delays. Identify Work on a calendar basis using days as a unit of measure. Show complete interdependence and sequence of construction and Project-related activities reasonably required to complete the Work. Identify the Work of separate stages and other logically grouped activities, and clearly identify critical path of activities. Include as applicable, at a minimum:
1. Obtaining permits, submittals for early product procurement, and long lead time items.
 2. Mobilization and other preliminary activities.
 3. Initial Site work.
 4. Specified Work sequences, constraints, and Contract Times including shut-downs and tie-ins
 5. Major equipment design, fabrication, factory testing, and delivery dates.
 6. Sitework.
 7. Concrete Work.
 8. Structural Steel Work.
 9. Architectural features Work.
 10. Conveying systems Work.
 11. Equipment Work.
 12. Mechanical Work.
 13. Electrical Work.
 14. Instrumentation and control Work.
 15. Other important Work for each major facility.
 16. Equipment and system startup and test activities.
 17. Project closeout and cleanup.
 18. Demobilization.
- M. No activity duration, exclusive of those for Submittals review and product fabrication/delivery, shall be less than 1 day nor more than 14 days, unless otherwise approved by the CONSTRUCTION CONTRACT ADMINISTRATOR. Activity duration for Submittal review shall not be less than review time specified

unless clearly identified and prior written acceptance has been obtained from the CONSTRUCTION CONTRACT ADMINISTRATOR.

- N. Updated Progress Schedules shall reflect:
1. Progress of Work to within 5 working days prior to submission.
 2. Approved changes in Work scope and activities modified since submission.
 3. Delays in Submittals or resubmittals, deliveries, or Work.
 4. Adjusted or modified sequences of Work.
 5. Other identifiable changes.
 6. Revised projections of progress and completion.
 7. Report of changed logic.
- O. The CONTRACTOR shall produce detailed subschedules during the Project upon request of CONSTRUCTION CONTRACT ADMINISTRATOR to further define critical portions of the Work.
- P. If the CONTRACTOR fails to complete activity by its latest scheduled completion date and this failure is anticipated to extend Contract Times, the CONTRACTOR shall, within 7 days of such failure, submit a written statement as to how CONTRACTOR intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by CONTRACTOR to complete the Work within the Contract Times will not be justification for adjustment of Contract Price or Contract Times.
- Q. OWNER may order CONTRACTOR to increase plant, equipment, labor force, or working hours if CONTRACTOR fails to satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to OWNER.

1.10 NARRATIVE PROGRESS REPORT

- A. The CONTRACTOR shall prepare a monthly narrative progress report in the following format and submit with each progress payment:
1. Organize same as Progress Schedule.
 2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.
 3. On 8-1/2-inch by 11-inch white paper, unless otherwise approved.
 4. List information for each activity in tabular format, including at a minimum:
 - a. Activity Identification Number.
 - b. Activity Description.
 - c. Original Duration.
 - d. Remaining Duration.
 - e. Early Start Date (Actual start on Updated Progress Schedules).
 - f. Early Finish Date (Actual finish on Updated Progress Schedules).
 - g. Late Start Date.
 - h. Late Finish Date.
 - i. Total Float.
 5. Sort reports, in ascending order, as listed below:
 - a. Activity number sequence with predecessor and successor activity.

- b. Activity number sequence.
- c. Early-start.
- d. Total float.

B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. CONTRACTOR's plan for management of Site (e.g., lay down and staging areas, construction traffic), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes.
4. Identification of new activities and sequences as a result of executed Contract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from CONTRACTOR-caused delays.

1.11 SCHEDULE ACCEPTANCE

A. CONSTRUCTION CONTRACT ADMINISTRATOR's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
 - a. Contract Times, including Final Completion and all intermediate Milestones are within the specified times.
 - b. Specified Work sequences and constraints are shown as specified.
 - c. Specified OWNER-furnished Equipment or Material arrival dates, or range of dates, are included.
 - d. Access restrictions are accurately reflected.
 - e. Startup and testing times are as specified.
 - f. Submittal review times are as specified.
 - g. Startup testing duration is as specified and timing is acceptable.
2. In all other respects, CONSTRUCTION CONTRACT ADMINISTRATOR's acceptance of CONTRACTOR's schedule indicates that, in CONSTRUCTION CONTRACT ADMINISTRATOR's judgement, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. CONSTRUCTION CONTRACT ADMINISTRATOR's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract

Documents will not thereby indicate acceptance of that change, unless CONTRACTOR has explicitly called the nonconformance to CONSTRUCTION CONTRACT ADMINISTRATOR's attention in submittal. Schedule remains CONTRACTOR's responsibility and CONTRACTOR retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

- B. Unacceptable Preliminary Progress Schedule:
 - 1. Make requested corrections; resubmit within 10 days.
 - 2. Until acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR as Baseline Progress Schedule, continue review and revision process, during which time CONTRACTOR shall update schedule on a monthly basis to reflect actual progress and occurrences to date.
- C. Unacceptable Detailed Progress Schedule:
 - 1. Make requested corrections; resubmit within 10 days.
 - 2. Until acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR as Baseline Progress Schedule, continue review and revision process.
- D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to CONSTRUCTION CONTRACT ADMINISTRATOR's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.12 ADJUSTMENT OF CONTRACT TIMES

- A. Reference General Conditions.
- B. Evaluation and reconciliation of Adjustments of Contract Times shall be based on the Updated Progress Schedule at the time of proposed adjustment or claimed delay.
- C. Float:
 - 1. Float time is a Project resource available to both parties to meet contract Milestones and Contract Times.
 - 2. Use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited, and use of float time disclosed or implied by use of alternate float-suppression techniques shall be shared to proportionate benefit of OWNER and CONTRACTOR.
 - 3. Pursuant to above float-sharing requirement, no time extensions will be granted nor delay damages paid until a delay occurs which (i) impacts Project's critical path, (ii) consumes available float or contingency time, and (iii) extends Work beyond contract completion date.

D. Claims Based on Contract Times:

1. Where CONSTRUCTION CONTRACT ADMINISTRATOR has not yet rendered formal decision on CONTRACTOR's Claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Progress Schedule, CONTRACTOR shall reflect an interim adjustment in the Progress Schedule as acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR.
2. It is understood and agreed that such interim acceptance will not be binding on either CONTRACTOR or OWNER, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.
3. CONTRACTOR shall revise Progress Schedule prepared thereafter in accordance with CONSTRUCTION CONTRACT ADMINISTRATOR's formal decision.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall perform services specified, including:
 - 1. Digital photography.
 - 2. Videography.

- B. Provide photographic documentation for the following:
 - 1. Pre-construction.
 - 2. Construction progress.
 - 3. Final.

- C. Image Quality:
 - 1. All photographic documentation shall be in color.
 - 2. Photographic images shall be suitably staged and set up (“framed”), focused, and with adequate lighting.
 - 3. For still photographs, use camera with minimum 6.0-megapixel resolution.

- D. If the requirements of this section conflict the requirements of Section 01 32 22, Project Documentation, Section 01 32 22, shall take precedence and CONTRACTOR shall coordinate with the CONSTRUCTION CONTRACT ADMINISTRATOR and the OWNER so the project management software system may be utilized for document tracking and control.

1.2 QUALITY ASSURANCE

- A. CONSTRUCTION CONTRACT ADMINISTRATOR will approve the views to be taken and select time at which images will be taken. Photographic subjects, views, and angles will vary with progress of the Work.

1.3 SUBMITTALS

- A. Informational Submittals:
 - 1. Frequency of Photographic Documentation Submittals:
 - a. Pre-construction: Submit pre-construction photographic documentation (prints and discs) prior to mobilizing and disturbing the Site. Provide pre-construction photographic documentation no later than first

- Application for Payment, unless other schedule is accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
- b. Provide construction progress photographic documentation (prints and discs) monthly. Submit with each Application for Payment, unless otherwise agreed to by CONSTRUCTION CONTRACT ADMINISTRATOR.
 - c. Submit acceptable final photographic documentation (prints and discs) prior to submitting final Application for Payment.
2. Photographic Prints:
- a. Quantity: For each photograph taken, provide to CONSTRUCTION CONTRACT ADMINISTRATOR one set of prints bound in a 3 ring binder or if required by OWNER, submit through documentation control software.
 - b. Print Size and Finish:
 - 1) Photographs: Provide 5-inch by 7-inch prints on professional-grade, 9-mil thick, photograph paper with semi-gloss or satin finish, unless specified otherwise.
 - c. Provide the following information on back of each print and front of each disc containing photographic documentation:
 - 1) Date photograph was taken.
 - 2) Name of OWNER.
 - 3) Name of Site.
 - 4) Project name.
 - 5) Description of view shown in photograph.
 - 6) Name and address of photographer.
3. Digital Files of Photographs:
- a. For each photograph taken, provide high-quality digital image on compact disc (CD) in “*.JPG” file format compatible with Microsoft Windows XP and Microsoft Windows Vista.
 - b. Image resolution shall be sufficient for clear, high-resolution prints. Minimum resolution shall be 150 dots per inch (dpi). Minimum size of digital images shall be equal to specified print size.
 - c. Imprint date and time in the image.
 - d. Electronic image filename shall describe the image; do not submit filenames automatically created by digital camera. For example, an acceptable electronic filename would be, “Dewatering Building – Looking West at Centrifuge No. 2.jpg”.
 - e. Provide one copy of each disc with photographic images.
 - f. Label each CD as specified in Paragraph 1.3.A.3.c of this Section.
4. Videography:
- a. Video shall be high-resolution, high-quality video of the Site and Project work in standard DVD-R format.
 - b. Video image shall have imprinted date and time that video was taken.
 - c. Include audio narration sufficient to explain the scenes shown. Audio shall be done clearly, precisely, and at a moderate pace. CONTRACTOR

shall review audio before submitting to verify the spoken words are audible over background noises. If the CONSTRUCTION CONTRACT ADMINISTRATOR finds the audio is not of said quality and clarity the CONTRACTOR shall create new video discs.

- d. Provide three copies of each video disc.
- e. Label each video disc as specified in Paragraph 1.3.A.3.c of this Section.

1.4 PRE-CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

A. Pre-construction Photographic Documentation:

1. Obtain and submit sufficient pre-construction photographic documentation to record Site conditions prior to construction. Photographs shall document work areas of all prime contracts.
2. Furnish to CONSTRUCTION CONTRACT ADMINISTRATOR specified number of photographs. Pre-construction photographs are not part of required number of construction progress photographs specified in Article 1.5 of this Section.
3. Provide pre-construction video of all work areas included in all prime contracts on the Project, including indoor and outdoor work areas and staging areas.

B. If dispute arises and pre-construction photographic documentation was not submitted prior to the dispute, restore disputed area to extent directed by CONSTRUCTION CONTRACT ADMINISTRATOR and to complete satisfaction of CONSTRUCTION CONTRACT ADMINISTRATOR.

1.5 CONSTRUCTION PROGRESS PHOTOGRAPHIC DOCUMENTATION

A. Progress Photographs:

1. Take a minimum of 20 photographs each month during the construction period or as directed by the OWNER.
2. Provide interior and exterior photographic documentation of each structure as directed by CONSTRUCTION CONTRACT ADMINISTRATOR at the time photographic documentation is taken.

1.6 FINAL PHOTOGRAPHIC DOCUMENTATION

A. Final Photographs:

1. Take photographs at time and day acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR. Do not take final photographs prior to Substantial Completion. Work documented in final photographs shall be generally complete, including painting, furnishings, landscaping, and other visible Work.
2. Take at least 50 final photographs, based on scope of Work at the time Contract Times commence running. Proportionately modify the number of final

photographs if scope of Project is modified. Final photographs are not part of construction progress photographs required under Paragraph 1.5.A of this Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide submittals in accordance with the General Conditions as modified by the Supplementary Conditions, and this Section.
2. Provide submittals well in advance of need for the material or equipment, or procedure (as applicable), in the Work and with ample time required for delivery of material or equipment and to implement procedures following ENGINEER's approval or acceptance of the associated submittal. Work covered by a submittal will not be included in progress payments until approval or acceptance of related submittals has been obtained in accordance with the Contract Documents.
3. CONTRACTOR is responsible for dimensions to be confirmed and corrected at the Site, for information pertaining solely to the fabrication processes and to techniques of construction, and for coordinating the work of all trades. CONTRACTOR's signature of submittal's stamp and letter of transmittal shall be CONTRACTOR's representation that CONTRACTOR has met his obligations under the Contract Documents relative to that submittal.

B. Samples:

1. Conform submittal of Samples to the General Conditions as modified by the Supplementary Conditions, this Section, and the Specification Section in which the Sample is specified.
2. Furnish at the same time Samples and submittals that are related to the same unit of Work or Specification Section. ENGINEER will not review submittals without associated Samples, and will not review Samples without associated submittals.
3. Samples shall clearly illustrate functional characteristics of product, all related parts and attachments, and full range of color, texture, pattern, and material.

1.2 TYPES OF SUBMITTALS

A. Submittal types are classified as follows: 1) Action Submittals, 2) Informational Submittals, 3) Closeout Submittals, and 4) Maintenance Material submittals. Type of each required submittal is designated in the respective Specification Sections; when type of submittal is not specified in the associated Specification Section, submittal will be classified as follows:

1. Action Submittals include:

- a. Shop Drawings.
 - b. Product data.
 - c. Delegated design submittals, which include documents prepared, sealed, and signed by a design professional retained by CONTRACTOR, Subcontractor, or Supplier for materials and equipment to be incorporated into the completed Work. Delegated design submittals do not include submittals related to temporary construction unless specified otherwise in the related Specification Section. Delegated design submittals include: design drawings, design data including calculations, specifications, certifications, and other submittals prepared by such design professional.
 - d. Samples.
 - e. Testing plans, procedures, and testing limitations.
2. Informational Submittals include:
- a. Certificates.
 - b. Design data not sealed and signed by a design professional retained by CONTRACTOR, Subcontractor, or Supplier.
 - c. Pre-construction test and evaluation reports, such as reports on pilot testing, subsurface investigations, potential Hazardous Environmental Condition, and similar reports.
 - d. Supplier instructions, including installation data, and instructions for handling, starting-up, and troubleshooting.
 - e. Source quality control submittals (other than testing plans, procedures, and testing limitations), including results of shop testing.
 - f. Field or Site quality control submittals (other than testing plans, procedures, and testing limitations), including results of operating and acceptability tests at the Site.
 - g. Supplier reports.
 - h. Sustainable design submittals (other than sustainable design closeout documentation).
 - i. Special procedure submittals, including health and safety plans and other procedural submittals.
 - j. Qualifications statements.
3. Closeout Submittals include:
- a. Maintenance contracts.
 - b. Operations and maintenance data.
 - c. Bonds, such as maintenance bonds and bonds for a specific product or system.
 - d. Warranty documentation.
 - e. Record documentation.
 - f. Sustainable design closeout documentation.
 - g. Software.
4. Maintenance Material Submittals include:
- a. Spare parts.
 - b. Extra stock materials.

- c. Tools.
- 5. When type of submittal is not specified and is not included in the list above, ENGINEER will determine the type of submittal.

B. Not Included in this Section: Administrative and procedural requirements for following are covered elsewhere in the Contract Documents:

- 1. Requests for interpretations of the Contract Documents.
- 2. Change Orders, Work Change Directives, and Field Orders.
- 3. Applications for Payment
- 4. Progress Schedules.
- 5. Photographic documentation.
- 6. Reports and documentation required in accordance with applicable permits
- 7. Site survey data

1.3 SUBMITTALS REQUIRED IN THIS SECTION

A. Informational Submittals: Provide the following:

- 1. Schedule of Submittals:
 - a. Timing:
 - 1) Provide submittal within time frames specified in the Contract Documents.
 - 2) Provide updated Schedule of Submittals with each submittal of the updated Progress Schedule.
 - b. Content: In accordance with the General Conditions as modified by the Supplementary Conditions, and this Section. Requirements for content of preliminary Schedule of Submittals and subsequent submittals of the Schedule of Submittals are identical. Identify on Schedule of Submittals all submittals required in the Contract Documents. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Indicate submittals that are on the Project's critical path. Indicate the following for each submittal:
 - 1) Date by which submittal will be provided to ENGINEER.
 - 2) Whether submittal will be for a substitution or "equal". Procedures for substitutions and "or equals" are specified in the General Conditions and the Division 01 Specifications.
 - 3) Date by which ENGINEER's response is required. At least 14 days shall be allowed from ENGINEER's receipt of each submittal. CONTRACTOR shall allow increased time for large or complex submittals.
 - 4) For submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of other contractors.
 - c. Prepare Schedule of Submittals using same software, and in same format, specified for Progress Schedules.
 - d. Coordinate Schedule of Submittals with the Progress Schedule.

- e. Schedule of Submittals that is not compatible with the Progress Schedule, or that does not indicate submittals on the Project’s critical path, or that that places extraordinary demands on ENGINEER for time and resources, is unacceptable. Do not include submittals not required by the Contract Documents.
- f. In preparing Schedule of Submittals:
 - 1) Considering the nature and complexity of each submittal, allow sufficient time for review and revision.
 - 2) Reasonable time shall be allowed for: ENGINEER’s review and processing of submittals, for submittals to be revised and resubmitted, and for returning submittals to CONTRACTOR.
 - 3) Identify and accordingly schedule submittals that are expected to have long anticipated review times.

1.4 PROCEDURE FOR SUBMITTALS

- A. Submittal Identification System: Use the following submittal identification system, consisting of submittal number and review cycle number.
 - 1. Submittal Number: Shall be separate and unique number correlating to each individual submittal required. CONTRACTOR shall assign submittal number as follows:
 - a. First part of submittal number shall be the applicable Specification Section number, followed by a hyphen.
 - b. Second part of submittal number shall be a three-digit number (sequentially numbered from 001 through 999) assigned to each separate and unique submittal provided under the associated Specification Section.
 - c. Typical submittal number for the third submittal provided for Section 40 05 19, Ductile Iron Process Pipe, would be “40 05 19-003”.
 - 2. Review Cycle Number: Shall be a letter designation indicating the initial submittal or re-submittal associated with each submittal number:
 - a. “001” = Initial (first) submittal.
 - b. “002” = Second submittal (e.g., first re-submittal).
 - c. “003” = Third submittal (e.g., second re-submittal).
 - 3. Examples:

Example Description	Submittal Identification	
	Submittal No.	Review Cycle
Initial (first) review cycle of the third submittal provided under Section 40 05 19, Ductile Iron Process Pipe	40 05 19-003-	001
Second review cycle (first re-submittal) of third submittal provided under Section 40 05 19, Ductile Iron Process Pipe	40 05 19-003-	002

- B. Letter of Transmittal for Submittals:
 - 1. Provide separate letter of transmittal with each submittal. Each submittal shall be for one Specification Section.

2. At beginning of each letter of transmittal, provide a reference heading indicating: CONTRACTOR's name, OWNER's name, Project name, Contract name and number, transmittal number, and submittal number.
3. For submittals with proposed deviations from requirements of the Contract Documents, letter of transmittal shall specifically describe each proposed variation.

C. Contractor's Review and Stamp:

1. Contractor's Review: Before transmitting submittals to ENGINEER, review submittals to:
 - a. assure proper coordination of the Work;
 - b. determine that each submittal is in accordance with CONTRACTOR's desires;
 - c. verify that submittal contains sufficient information for ENGINEER to determine compliance with the Contract Documents.
2. Incomplete or inadequate submittals will be returned without review.
3. Contractor's Stamp and Signature:
 - a. Each submittal provided shall bear CONTRACTOR's stamp of approval and signature, as evidence that submittal has been reviewed by CONTRACTOR and verified as complete and in accordance with the Contract Documents.
 - b. Submittals without CONTRACTOR's stamp and signature will be returned without review. Signatures that appear to be computer-generated will be regarded as unsigned and the associated submittal will be returned without review.
 - c. CONTRACTOR's stamp shall contain the following:

"Project Name: _____

Contractor's Name: _____

Date: _____

----- *Reference* -----

Item/Submittal Title: _____

Specifications:

Section: _____

Page No.: _____

Paragraph No.: _____

Drawing No.: _____ of _____

Location of Work: _____

Submittal No. and Review Cycle: _____

Coordinated by Contractor with Submittal Nos.: _____

I hereby certify that the Contractor has satisfied Contractor's obligations under the Contract Documents relative to Contractor's review and approval of this submittal.

Approved By (for Contractor): _____”

D. Submittal Marking and Organization:

1. Mark on each page of submittal and each individual component submitted with submittal number and applicable Specification paragraph.
2. Arrange submittal information in same order as requirements are written in the associated Specification Section.
3. Each Shop Drawing sheet shall have title block with complete identifying information satisfactory to ENGINEER.
4. Package together submittals for the same Specification Section. Do not provide required information piecemeal.

E. Format of Submittal and Recipients:

1. Action Submittals and Informational Submittals: Furnish in accordance with Table 01 33 00-A, except that submittals of Samples shall be as specified elsewhere in this Section:

**TABLE 01 33 00-A: SUBMITTAL CONTACTS
AND REQUIRED COPIES**

	Address for Deliveries	Contact Person	E-mail Address	No. of Hard-copies	Remarks
a.	Engineer: Malcolm Pirnie, The Water Division of Arcadis.	TBD	TBD	8	
b.	Resident Project Representative: At the Site.	TBD	TBD	1	Stamped “Preliminary – Not for Construction”
Notes: TBD = To Be Determined					

2. Samples:

- a. Securely label or tag Samples with submittal identification number. Label or tag shall include clear space at least three inches by three inches in size for affixing ENGINEER's review stamp. Label or tag shall not cover, conceal, or alter appearance or features of Sample. Label or tag shall not be separated from the Sample.
- b. Submit number of Samples required in Specifications. If number of Samples is not specified in the associated Specification Section, provide at least three identical Samples of each item required for ENGINEER's approval. Samples will not be returned to CONTRACTOR. If CONTRACTOR requires Sample(s) for CONTRACTOR's use, notify ENGINEER in writing and provide additional Sample(s).

CONTRACTOR is responsible for furnishing, shipping, and transporting additional Samples.

- c. Deliver one Sample to ENGINEER's field office at the Site. Deliver balance of Samples to ENGINEER at address listed in Table 01 33 00-A, unless otherwise directed by ENGINEER.
3. Closeout Submittals:
- a. Provide the following Closeout Submittals in accordance with maintenance contracts; bonds for specific products or systems; warranty documentation; and sustainable design closeout documentation. On documents such as maintenance contracts and bonds, include on each document furnished original signature of entity issuing the document.
 - b. Operations and Maintenance Data: Submit in accordance with Section 01 78 23, Operations and Maintenance Data.
 - c. Record Documentation: Submit in accordance with Section 01 78 39, Project Record Documentation.
 - d. Software: Submit number of copies required in Specification Section where the software is specified. If number of copies is not specified, provide two copies on compact disc in addition to software loaded on to OWNER's computer(s) or microprocessor(s).
4. Maintenance Material Submittals: For spare parts, extra stock materials, and tools, submit quantity of items specified in associated Specification Section. Furnish in accordance with Section 01 78 43, Spare Parts and Extra Materials.

F. Distribution:

- 1. Distribution of Hardcopies: ENGINEER will distribute each reviewed submittal requiring ENGINEER's written response as follows:
 - a. CONTRACTOR: Three copies (except closeout submittals and maintenance material submittals).
 - b. OWNER: Three copies.
 - c. Resident Project Representative: One copy (except closeout submittals and maintenance material submittals).
 - d. ENGINEER's File: One copy.

G. Resubmittals: Refer to the General Conditions for requirements regarding resubmitting required submittals.

1.5 ENGINEER'S REVIEW

- A. Timing: ENGINEER's review will conform to timing accepted by ENGINEER in the accepted Schedule of Submittals.
- B. Submittals not required in the Contract Documents will not be reviewed by ENGINEER and will not be recorded in ENGINEER's submittal log. All hardcopies of such submittals will be returned to CONTRACTOR.

C. Action Submittals, Results of ENGINEER's Review: Each submittal will be given one of the following dispositions:

1. Approved: Upon return of submittal marked "Approved", order, ship, or fabricate materials and equipment included in the submittal (pending ENGINEER's approval or acceptance, as applicable, of source quality control submittals) or otherwise proceed with the Work in accordance with the submittal and the Contract Documents.
2. Approved as Corrected: Upon return of submittal marked "Approved as Corrected", order, ship, or fabricate materials and equipment included in the submittal (pending ENGINEER's approval or acceptance, as applicable, of source quality control submittals) or otherwise proceed with the Work in accordance with the submittal and the Contract Documents, provided it is in accordance with corrections indicated.
3. Approved as Corrected – Resubmit: Upon return of submittal marked "Approved as Corrected – Resubmit", order, ship, or fabricate materials and equipment included in the submittal (pending ENGINEER's approval or acceptance, as applicable, of source quality control submittals) or otherwise proceed with the Work in accordance with the submittal and the Contract Documents, provided it is in accordance with corrections indicated. Provide to ENGINEER record re-submittal with all corrections made. Receipt of corrected re-submittal is required before materials or equipment covered in the submittal will be eligible for payment.
4. Revise and Resubmit: Upon return of submittal marked "Revise and Resubmit", make the corrections indicated and re-submit to ENGINEER for approval. Only 2 of the 7 copies returned will be marked up and sent to the CONTRACTOR. Copies will not be provided to OWNER and RPR.
5. Not Approved: This disposition indicates material or equipment that cannot be approved. Upon return of submittal marked "Not Approved", repeat initial submittal procedure utilizing approvable material or equipment. Only 2 of the 7 copies returned will be marked up and sent to the CONTRACTOR. Copies will not be provided to OWNER and RPR.

D. Informational Submittals, Results of ENGINEER's Review:

1. Each submittal will be given one of the following dispositions:
 - a. Accepted: Information included in submittal conforms to the applicable requirements of the Contract Documents, and is acceptable. No further action by CONTRACTOR is required relative to this submittal, and the Work covered by the submittal may proceed, and products with submittals with this disposition may be shipped or operated, as applicable.
 - b. Not Accepted: Submittal does not conform to applicable requirements of the Contract Documents and is not acceptable. Revise submittal and re-submit to indicate acceptability and conformance with the Contract Documents.

2. The following types of Informational Submittals, when acceptable to ENGINEER, will not receive a written response from ENGINEER. Disposition as “accepted” will be recorded in ENGINEER’s submittal log. When submittals of the following are not acceptable, ENGINEER will provide written response to CONTRACTOR
 - a. Material safety data sheets (MSDS).
 - b. Compaction testing reports.
 - c. Concrete testing reports.
 - d. Manufacturer’s instructions.
- E. Closeout Submittals, Results of ENGINEER’s Review: Dispositions and meanings are the same as specified for Informational Submittals. When acceptable, Closeout Submittals will not receive a written response from ENGINEER. Disposition as “accepted” will be recorded in ENGINEER’s submittal log. When Closeout Submittal is not acceptable, ENGINEER will provide written response to CONTRACTOR.
- F. Maintenance Material Submittals, Results of ENGINEER’s Review: Dispositions and meanings are the same as specified for Informational Submittals. When acceptable, Maintenance Material Submittals will not receive a written response from ENGINEER. Disposition as “accepted” will be recorded in ENGINEER’s submittal log. When Maintenance Material Submittal is not acceptable, ENGINEER will provide written response to CONTRACTOR, and CONTRACTOR is responsible for costs associated with transporting and handling of maintenance materials until compliance with the Contract Documents is achieved.

1.6 EQUIPMENT AND MATERIALS CHECKLIST

- A. A copy of Equipment and Materials Checklist is provided at the end of this section for CONTRACTOR’s convenience when creating a submittal log. CONTRACTOR may use a copy of this form for the Shop Drawing schedule required by Paragraph 2.05.B of the General Conditions and enter dates in this column for submittal of Shop Drawings to ENGINEER. Equipment and Materials Checklist is provided for CONTRACTOR’S Convenience. CONTRACTOR shall meet submittal requirements provided under each Section of the Contract Documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

(This page was left blank intentionally.)

SECTION 01 33 13

REFERENCE FORMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section contains the required forms for CONTRACTOR use. The document testing forms included herein, do not supersede specific testing requirements found elsewhere in the Contract Documents.
- B. If the requirements of this section conflict the requirements of Section 01 32 22, Project Documentation, section 01 32 22 shall take precedence and CONTRACTOR shall coordinate with the CONSTRUCTION CONTRACT ADMINISTRATOR and the OWNER so the project management software system may be utilized for document tracking and control.
- C. The forms listed below are included in this Section are referenced from other Sections in the Contract Documents. Forms include, but are not necessarily be limited to the following:

	<u>Form No.</u>	<u>Title</u>
1.	00 73 01-A	Certificate of Substantial Completion.
2.	00 73 01-B	Contractor's Affidavit Regarding Settlement of Claims.
3.	01 33 00-A	Schedule of Values.
4.	01 33 00-B	Shop Drawings, Product Data and Sample Transmittal Schedule.
5.	01 33 00-C	Authorized Signatures Form.
6.	01 33 00-D	Application for Payment.
7.	01 33 00-E	MBE/WBE Utilization Form.
8.	01 33 00-F	Request for Change Order Proposal.
9.	01 33 00-G	Change Order Proposal.
10.	01 33 00-H	Work Change Directive.
11.	01 33 00-I	Change Order.
12.	01 33 00-J	Request for Information.
13.	01 33 00-K	Request for Alteration.
14.	01 33 00-L	Contractor's Daily Construction Report.
15.	01 33 00-N	Submittal Transmittal Form.
16.	01 35 26-A	Confined Space Data Sheet.
17.	01 35 26-B	Confined Space Entry Permit.
18.	01 35 26-C	Confined Space Hot Work Permit.
19.	01 61 00-B	Unit Responsibility Certification Form.
20.	01 61 00-C	Manufacturer's Installation Certification Form.
21.	01 79 13-A	Equipment Test Report Form.
22.	01 78 23-A	Operation and Maintenance Transmittal Form.
23.	01 79 23-A	Manufacturer's Instruction Certification Form.
24.	40 05 93-A	Motor Data Form.
25.	40 60 05-A	Loop Wiring and Insulation Resistance Test Data Form.

26. 26 05 05-A Wire and Cable Resistance Test Data Form.
27. 26 05 05-B Installed Motor Test Data Form.
28. 26 05 05-D Motor Control Center Test Form.
29. 26 05 05-E Medium Voltage Motor Starter Test Form.
30. 26 05 05-F Medium Voltage Switchgear Test Form.
31. 26 05 05-G Protective Relay Test Form.
32. 26 05 05-H Low Voltage Switchgear Test Form.
33. 26 05 05-I Medium Voltage Load Interrupter Switch Test Form.
34. 26 05 05-K Automatic Transfer Switch Test Form.
35. -- -- -- -- NKWD Early Submittal of Time Sensitive Shop Drawings Letter.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

00 73 01-A CERTIFICATE OF SUBSTANTIAL COMPLETION

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT NUMBER	PROJECT TITLE
----------------	---------------

DATE OF ISSUANCE: _____ OWNER'S CONTRACT NO.: _____

OWNER: _____

CONSTRUCTION CONTRACT ADMINISTRATOR: _____

CONTRACTOR: _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

OVERALL PROJECT

To: _____
OWNER

And to: _____
CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and CONSTRUCTION CONTRACT ADMINISTRATOR, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR by Final Completion.

**CONTRACTOR'S AFFIDAVIT
REGARDING SETTLEMENT OF CLAIMS**

Project No.: _____

Contract No.: _____

Gentlemen:

This is to certify that all lawful claims for materials, rental of equipment and labor used in connection with the construction of the above project, whether by subcontractor or claimant in person, have been duly discharged.

The undersigned, for the consideration of \$ _____ as set out in the final pay estimate, as full and complete payment under the terms of the contract, hereby waives and relinquishes any and all further claims or right of lien under, in connection with, or as a result of the above described project. The undersigned further agrees to indemnify and save harmless the **(type in owner here)** against any and all liens, suits, damages, charges and expenses whatsoever, which said **(type in owner here)** may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said installation.

Contractor

By

Title

State of _____

County of _____

The forgoing instrument was subscribed and sworn to before me this ____ day of _____, 20____.

Notary Public

Commission Expiration Date

01 33 00-A SCHEDULE OF VALUES

SCHEDULE OF VALUES

Sheet _____ of _____

Section No. _____

Item Description	Material	Labor	Equipment	Total

**AUTHORIZED SIGNATURES FORM
(Corporation)**

Gentlemen:

WHEREAS, _____, a(n) (Name of State) _____ Corporation, is required to execute certain documents which are necessary for the prompt and efficient execution of the corporate business:

NOW, THEREFORE, BE IT RESOLVED, by the Board of Directors of the (Corporate Name) _____ that name of parties listed below be authorized to execute and sign on behalf of said corporation the following documents:

- | | |
|-----------------|---|
| 1. The Proposal | 6. Change Orders |
| 2. The Contract | 7. Application for Payment |
| 3. The Bond | 8. Work Change Directives |
| 4. Payrolls | 9. All other papers necessary for the conduct of the corporation's affairs and the execution of the contract. |
| 5. Claims | |

The powers and duties herein granted shall be and is hereby granted for the duration of the contract for the construction of the _____, Project No. _____, or until express notice of revocation has been duly given in writing, whichever is the lesser period. Dated and passed by the Board of Directors this _____ day of _____, 20__.

<u>NAME</u>	<u>SIGNATURE</u>	<u>TITLE</u>	<u>DOCUMENTS</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

I, _____ of the _____, a corporation, do hereby certify that the above is a true and correct copy of a resolution adopted by the Board of Directors of said corporation, at a meeting of said board held on _____, 20__, and that the same is in full force and effect at this time.

(Seal of Corporation)

(OFFICER OF CORPORATION)

(NAME & TITLE)

STATE OF _____
COUNTY OF _____

This instrument was acknowledged before me this _____ day of _____, 20__ by _____ appearing before the undersigned Notary Public, and stated that he executed such instrument on behalf of said corporation for the purpose and consideration therein expressed.

My Commission Expires: _____
(NOTARY PUBLIC)

01 33 00-D APPLICATION FOR PAYMENT

DISTRIBUTION:
 ACCOUNTS
 PAYABLE
 CENTRAL FILES
 PAYMENT FILE

**APPLICATION FOR PAYMENT
 TYPE ADDRESS**

To: Project Manager

Progress Payment No.

Payment Period: From mm/dd/yy to mm/dd/yy

Project No.	Project Name NAME OF PROJECT			Contract No. XXXXX			
Name of Contractor NAME OF CONTRACTOR			Telephone (XXX) XXX-XXXX	Fax (XXX) XXX-XXXX			
Address CONTRACTOR'S ADDRESS				Notice To Proceed Date MM/DD/YY			
ITEM NO.	DESCRIPTION List Contract Items, Change Order Items, and Deductions, Each with Subtotals	CONTRACT AMOUNT	ESTIMATED AMOUNT THIS PERIOD	AMOUNT PREVIOUSLY INVOICED	AMOUNT COMPLETED TO DATE		
XXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx		
ATTACHMENTS: SCHEDULE OF VALUES			GROSS AMOUNT DUE: \$xx,xxx,xxx.xx				
			<input type="checkbox"/> RETAINAGE - 10%		\$xx,xxx,xxx.xx		
			<input type="checkbox"/> SECURITIES - 10%		\$xx,xxx,xxx.xx		
			NET AMOUNT DUE TO DATE:			\$xx,xxx,xxx.xx	
			LESS AMOUNT PREVIOUSLY PAID:			\$xx,xxx,xxx.xx	
AMOUNT DUE THIS APPLICATION:			\$xx,xxx,xxx.xx				
CERTIFICATION OF CONTRACTOR: I certify that all items and amounts shown on the face of this Application for Payment are correct, that to the best of my knowledge and belief, all work has been performed and/or material supplied in full accordance with the requirements of the referenced contract, and/or duly authorized deviations, substitutions, alterations, and/or additions; that the foregoing is true and correct statement of the contract account up to and including the last day of the period covered by this Application that no part of the "Amount Due This Application" has been received, and that the undersigned and subcontractors have: (check applicable line). <input type="checkbox"/> a. Complied with all labor provisions of said contract. <input type="checkbox"/> b. Complied with all the labor provisions of said contract except in those instances where a dispute exists with respect to said labor provisions. (If "b" is checked, include attachment briefly describing nature of dispute.)			CERTIFICATION OF CONSTRUCTION CONTRACT ADMINISTRATOR: I certify that all work described was inspected, and that to the best of my knowledge and belief the work was performed and/or supplied in full accordance with the requirements of this contract. Resident Project Representative _____ Date _____ I certify that I have checked and verified the above and foregoing Application for Payment; that to the best of my knowledge and belief it is a true and correct statement of work performed and/or material supplied by the contractor; that all work and/or material included in this Application has been inspected and that it has been performed and/or supplied in full accordance with the requirements of the referenced contract; and that payment claimed and requested by the Contractor is correctly computed on the basis of work performed and/or material supplied to date.				
						Contractor Representative _____ Date _____	Project Manager/Engineer _____ Date _____
Title _____	Firm _____						
OWNER USE ONLY BELOW THIS LINE							
RECOMMENDED BY:			APPROVED BY:				
Project Manager _____ Date _____			Superintendent _____ Date _____				

01 33 00-F REQUEST FOR CHANGE ORDER PROPOSAL

REQUEST FOR CHANGE ORDER PROPOSAL

Date: _____

CONTRACTOR _____

Project Name _____

Project No. _____

Change Order No. _____

NOTICE TO CONTRACTOR: Please submit a Change Order Proposal for the proposed modifications to the Contract Documents as described below. If acceptable, a Change Order will be issued to authorize the work. **THIS IS NOT A CHANGE ORDER FOR AUTHORIZATION TO PROCEED WITH THE WORK AS DESCRIBED!**

SCOPE OF WORK:

OWNER _____

CHANGE ORDER PROPOSAL

Date _____

Subject: Project Name _____
Project No. _____
Change Order No. _____

Dear Sir:

Certain items of extra work have been found necessary which are not covered by the Contract for the above referenced Project. Therefore, we submit the following amounts as the basis of compensation for such extra work:

JUSTIFICATION:

The Contract completion time will be (increased)(decreased) ____ consecutive calendar days.

Total Cost of Extra Work Covered by Above: \$ _____
Previously Approved Extra Work: \$ _____
Original Contract Amount: \$ _____

TOTAL: \$ _____

By: _____

Title: _____

CONTRACTOR: _____

01 33 00-I CHANGE ORDER

(OWNER)

CONTRACT CHANGE ORDER NO. X

Page 1 of 1

PROJECT NUMBER XXXXXXXX	PROJECT TITLE NAME OF PROJECT		
CONTRACT NUMBER XXXXX	NAME OF CONTRACTOR XXXXX	% COMPLETE(\$) XX%	% TIME USED XX%

In accordance with this contract, the following change is ordered, resulting in: (Check all that apply).

- | | | |
|--|---|--|
| <input type="checkbox"/> Increase in Contract Amount | <input type="checkbox"/> No Change in Contract Amount | <input type="checkbox"/> Decrease in Contract Amount |
| <input type="checkbox"/> Increase in Contract Time | <input type="checkbox"/> No Change in Contract Time | <input type="checkbox"/> Decrease in Contract Time |

DESCRIPTION:

COST:

Work Change Directive No. X-

Prepared by: Project Manager

THIS CHANGE ORDER: AMOUNT: \$ _____ TIME (Days): _____	PRIOR CHANGE ORDER(S): AMOUNT: \$ _____ TIME (Days): _____	ORIGINAL CONTRACT: AMOUNT: \$ _____ TIME (Days): _____	ADJUSTED CONTRACT: AMOUNT: \$ _____ TIME (Days): _____
Notice to Proceed Date:	Original Contract Completion Date:	Adjusted Contract Completion Date:	
We, the undersigned, have given careful consideration to the change proposed, and hereby agree, if this proposal is approved, that we will provide all equipment, furnish all materials, except as may otherwise be noted above, and perform all services necessary for the work specified, and will therefore, accept as full payment, the fees or prices and adjustments in contract time shown above. This Change Order includes all direct costs such as labor, material, job overhead, profit, costs for modifications or changes in sequence of work to be performed, delays, rescheduling, disruptions, extended direct overhead or general overhead, acceleration, material or other escalation which include wages and other impact costs.		REVIEWED BY: _____ (Construction Contract Administrator) DATE	
		RECOMMENDED BY: _____ (A or B - Project Manager) (C - Superintendent) DATE	
		RECOMMENDED BY: _____ (A or B - Project Manager) (C - Superintendent) DATE	
ACCEPTED (Contractor): COMPANY/FIRM: NAME OF CONTRACTOR SIGNATURE: _____ TITLE: _____ DATE: _____		RECOMMENDED BY: _____ (A or B - Project Manager) (C - Superintendent) DATE	
		APPROVED BY: _____ (A or B - Superintendent) (C - Assistant Director) DATE	
		AUTHORIZED FOR THE CITY MANAGER BY: _____ (A or B - Assistant Director) (C - Director) DATE	

01 33 00-I CHANGE ORDER

(OWNER)
CONTRACT CHANGE ORDER NO. X
SUPPLEMENTARY REPORT

Page 1 of 1

PROJECT NUMBER XXXXXXXX	PROJECT TITLE NAME OF PROJECT		
CONTRACT NUMBER XXXXX	NAME OF CONTRACTOR XXXXX	% COMPLETE(\$) XX%	% TIME USED XX%

REASON:

Work Change Directive No. X

Prepared By: Project Manager

BASIS FOR CHANGE: (Check all that apply).

- | | | |
|---|--|---|
| <input type="checkbox"/> City Request
Item 1 | <input type="checkbox"/> Negotiated Cost
Item 1 | <input type="checkbox"/> Contractor Request |
| <input type="checkbox"/> Use of Allowances | <input type="checkbox"/> Unforeseen Site Condition | <input type="checkbox"/> Final Quantity Adjustment |
| <input type="checkbox"/> Error or Omission | <input type="checkbox"/> Engineer Request | <input type="checkbox"/> Added Value for Added Cost |

Reviewed by: _____ Date: _____

01 33 00-J REQUEST FOR INFORMATION

(OWNER)

REQUEST FOR INFORMATION

CONTRACTOR _____
Requested By _____
Subject _____
Spec. Section _____
Drawing References _____
Date Reply Needed _____

RFI# _____
Directed to _____
Date Received _____
Date Transmitted _____
Date Reply Received _____
Date Reply Transmitted _____

INFORMATION NEEDED:

Date _____ Signature _____

REPLY:

Date _____ Signature _____

01 33 00-K REQUEST FOR ALTERATION

(OWNER)

REQUEST FOR ALTERATION

CONTRACTOR _____
Requested By _____
Subject _____
Spec. Section _____
Drawing References _____
Date Reply Needed _____

RFA# _____
Directed to _____
Date Received _____
Date Transmitted _____
Date Reply Received _____
Date Reply Transmitted _____

REQUESTED ALTERATION:

Date _____ Signature _____

REPLY:

Date _____ Signature _____

01 33 00-L CONTRACTOR'S DAILY CONSTRUCTION REPORT

CONTRACTOR _____

CONTRACTOR'S DAILY CONSTRUCTION REPORT

Project Name _____	Report No. _____	Date _____
Project No. _____		

CONTRACTORS WORK FORCE:	SUBCONTRACTORS WORK FORCE:	EQUIPMENT ON SITE:
		In Use Not in Use
Administrative _____	Mechanical _____	Cranes _____
Supervisors _____	Electrical _____	Loaders _____
Carpenters _____	Instrumentation _____	Dozers _____
Iron Workers _____	Sitework _____	Scrapers _____
Operators _____	Masonry _____	Compactors _____
Finishers _____	Roofing _____	Compressors _____
Welders _____	Rebar _____	Welders _____
Electricians _____	Foundation _____	Graders _____
Laborers _____	Painting _____	Trucks _____
_____	_____	Backhoe _____
_____	_____	_____
_____	_____	_____

Work Performed: _____

Material and Equipment Delivered: _____

Remarks: _____

By: _____

Title: _____

SUBMITTAL TRANSMITTAL

Submittal Description: _____ Submittal No: _____

Spec Section: _____

	Routing	Sent	Received
OWNER:	Contractor/RPR		
PROJECT:	RPR/CCA		
	CCA/RPR		
CONTRACTOR:	RPR/Contractor		

We are sending you Attached Under separate cover via _____.
 Submittals for review and comment
 Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action ¹	Reviewer initials	Review comments attached

¹Note: A = Approved; AC = Approved as Corrected; ACR = Approved as corrected Resubmit; RR - Revise and Resubmit; NR - Not Reviewed; NA - Not Approved; I - For Information Only Attach additional sheets if necessary.

Contractor

Certify either A or B:

- ___ A. We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).
- ___ B. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.

Deviation

Certified by: _____

01 35 26-A CONFINED SPACE DATA SHEET
(OWNER)
Confined Space Data Sheet

Name of Confined Space: _____

Location of Confined Space: _____

Division/Section Responsible for Confined Space: _____

PRE-ENTRY SYSTEM CONTROL

	<u>Check</u>
Mechanical: Isolate, lockout and de-energize to zero potential energy.	<input type="checkbox"/>
Engulfment: Blank/block/cap/bleed off lines. Lock out gates, valves, pumps.	<input type="checkbox"/>
Electrical: Lockout/Tagout	<input type="checkbox"/>
Inerting: Flush/Purge/Vent	<input type="checkbox"/>
Special precautions: _____	

ATMOSPHERE

Date of least measured values: _____

Constituent	O ₂	Explosive	H ₂ S/Toxic	CO	Date/Time	Initials
Permissible Range	19.5%-23.5%	<10% LFL	<10ppm H ₂ S	<35ppm	Completed	
Last Measured Values	_____	_____	_____	_____	_____	_____

SITE AND PERSONAL SAFETY (check if required, list type where applicable)

Personal Protective Equipment:

Safety Harness Life Lines Hard Hats Fall Protection Retrieval Eye Ear Face Hand
 Foot Respiratory (type) _____ Clothing (type) _____
 Other: _____

Rescue and Emergency Equipment:

Retrieval Equipment Fire Extinguishers Radios/Telephone Ladder Other _____
 Equipment on Standby for Rescue Personnel _____

Site Safety:

Explosion-Proof Lighting Barriers/Shield/Barricades (type) _____ Postings/Flagging
 Other _____

List specific equipment isolated, de-energized, and locked out.

01 35 26-B CONFINED SPACE ENTRY PERMIT
(OWNER)
Confined Space Entry Permit

ENTRY TEAM

Division: _____ Facility: _____
Specific confined space being entered: _____
Purpose of entry (describe the work to be done): _____

Date: _____ Time: _____ Expected Job Duration (days/hours): _____
Entry Supervisor: _____ Designated Attendant: _____
Authorized/Qualified Entrants: _____

Entry-Team Rotation:

Date: _____ Time: _____
Entry Supervisor: _____ Designated Attendant: _____
Authorized/Qualified Entrants: _____

Entry-Team Rotation:

Date: _____ Time: _____
Entry Supervisor: _____ Designated Attendant: _____
Authorized/Qualified Entrants: _____

Communication Procedures:

Entry Team: _____

Standby/Rescue Personnel: _____

Sign Offs:

Person authorizing this entry: _____
Entry Supervisor: _____
Person terminating permit: _____ Date: _____ Time: _____
Distribution to: _____

01 35 26-B CONFINED SPACE ENTRY PERMIT

Confined Space Entry Permit

PRE-ENTRY SYSTEM CONTROL

	<u>Check</u>	<u>Date/Initials</u>
Mechanical: Isolate, lockout and de-energize to zero potential energy.	Completed <input type="checkbox"/>	_____
Engulfment: Blank/block/cap/bleed off lines. Lock out gates, valves, pumps.	Completed <input type="checkbox"/>	_____
Electrical: Lockout/Tagout	Completed <input type="checkbox"/>	_____
Inerting: Flush/Purge/Vent	Completed <input type="checkbox"/>	_____
Special precautions: _____		

ATMOSPHERE - Tested by portable atmospheric monitor with audible and visual alarms.
No one will enter a space with an unsafe atmosphere without approval from the Division Superintendent/Assistant Superintendent.

Constituent	O ₂	Explosive	H ₂ S/Toxic	CO	Date/Time	Initials
Permissible Range	19.5%-23.5%	<10% LFL	<10ppm H ₂ S	<35ppm	Completed	
Pre-Entry	_____	_____	_____	_____	_____	_____
Post Ventilation	_____	_____	_____	_____	_____	_____
Continuous	_____	_____	_____	_____	_____	_____
Continuous	_____	_____	_____	_____	_____	_____
Continuous	_____	_____	_____	_____	_____	_____

Ventilation Used (circle one): **Mechanical** **Natural**
Special Precautions: (See Confined Space Data Sheet) _____

SITE AND PERSONAL SAFETY (check if required, list type where applicable)

Personal Protective Equipment:
 Safety Harness Life Lines Hard Hats Fall Protection Retrieval Eye Ear Face Hand
 Foot Respiratory (type) _____ Clothing (type) _____
 Other: _____

Rescue and Emergency Equipment:
 Retrieval Equipment Fire Extinguishers Radios/Telephone Other _____
 Equipment on Standby for Rescue Personnel _____

Site Safety:
 Explosion-Proof Lighting Barriers/Shield/Barricades (type) _____ Postings/Flagging
 Other _____

List specific equipment isolated, de-energized, and locked out.

01 35 26-C CONFINED SPACE HOT WORK PERMIT
(OWNER)

Confined Space Hot Work Permit

Division: _____ **Facility:** _____

Specific Confined Space Being Entered: _____

Date: _____ **Time:** _____

Expected Job Duration (days/hours): _____

Purpose of Entry (describe the work to be done): _____

Explain why work cannot be done outside of the confined space: _____

Safety Equipment Required:

Fire Extinguishers: **Yes** _____ **No** _____ **Number** _____
Type _____

Respirators: **Yes** _____ **No** _____ **Number** _____
Type _____

Other Equipment: _____

Authorizing Supervisor:

Print Name _____

Signature _____

Date Signed _____

(Project Name)

CERTIFICATE OF UNIT RESPONSIBILITY
for Section _____

(Section title)

In accordance with Paragraph 01 61 00.1.2.B of the Contract Documents, the undersigned manufacturer accepts unit responsibility for all components of equipment furnished under specification Section _____.

We hereby certify that these components are compatible and comprise a functional unit suitable for the specified performance and design requirements.

Notary Public

Name of Corporation

Commission expiration date

Address

Seal:

By: _____
Duly Authorized Official

Legal Title of Official

Date: _____

01 61 00-C MANUFACTURER'S INSTALLATION CERTIFICATION FORM

MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No.: _____ Section: _____

Equipment Name: _____

CONTRACTOR: _____

Manufacturer of Equipment Item: _____

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the Contract Documents, has been provided in accordance with the manufacturer's recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments: _____

Date

Manufacturer

Signature of Authorized Representative

Date

CONTRACTOR

Signature of Authorized Representative

EQUIPMENT TEST REPORT FORM

NOTE: This example equipment test report is provided for the benefit of CONTRACTOR and is not specific to any piece of equipment to be installed as a part of this Project. The example is furnished as a means of illustrating the level of detail required for the preparation of equipment test report forms for this project.

 NTS: INSERT AT NO. 1 AND 2 PROJECT TITLE. INSERT AT NO. 3 CONSTRUCTION CONTRACT ADMINISTRATOR'S NAME.

(OWNER)
 (--1--)
 (--2--)
 _____ CONTRACTOR
 (--3--)

EQUIPMENT/SYSTEM TEST REPORT

Equipment Name: _____
 Equipment Number: _____
 Specification Ref: _____
 Location: _____
 System: _____

	CONTRACTOR	ENGINEER
	Verified	Date

PRE-OPERATIONAL CHECKLIST

Mechanical

Lubrication.	_____	_____	_____	_____
Alignment.	_____	_____	_____	_____
Anchor bolts.	_____	_____	_____	_____
Seal water system operational.	_____	_____	_____	_____
Equipment rotates freely.	_____	_____	_____	_____
Safety guards.	_____	_____	_____	_____
Valves operational.	_____	_____	_____	_____
Hopper purge systems operational.	_____	_____	_____	_____
Sedimentation tank/hopper clean.	_____	_____	_____	_____
O&M Manual information complete.	_____	_____	_____	_____
Manufacturer's installation certificate complete.	_____	_____	_____	_____

EQUIPMENT TEST REPORT FORM

	CONTRACTOR		ENGINEER	
	Verified	Date	Verified	Date

Electrical (circuit ring-out and high-pot tests)

Circuits:

Power to MCC __.	_____	_____	_____	_____
Control to HOA.	_____	_____	_____	_____
Indicators at MCC:				
Red (running).	_____	_____	_____	_____
Green (power).	_____	_____	_____	_____
Amber (auto).	_____	_____	_____	_____
Indicators at local control panel.	_____	_____	_____	_____
Wiring labels complete:	_____	_____	_____	_____
Nameplates:				
MCC.	_____	_____	_____	_____
Control station.	_____	_____	_____	_____
Control panel.	_____	_____	_____	_____
Equipment bumped for rotation:	_____	_____	_____	_____

Piping Systems

Cleaned and flushed:				
Suction.	_____	_____	_____	_____
Discharge.	_____	_____	_____	_____
Pressure tests:	_____	_____	_____	_____
Temporary piping screens in place:	_____	_____	_____	_____

Instrumentation and Controls

Flowmeter FE____ calibration:	_____	_____	_____	_____
Calibration Report No. _____				
Flow recorder FR____ calibrated against transmitter:	_____	_____	_____	_____
VFD speed indicator calibrated against independent reference:	_____	_____	_____	_____
Discharge overpressure shutdown switch calibration:	_____	_____	_____	_____
Simulate discharge overpressure Shutdown:	_____	_____	_____	_____

EQUIPMENT TEST REPORT FORM

CONTRACTOR		ENGINEER	
Verified	Date	Verified	Date

EQUIPMENT/SYSTEM PERFORMANCE TESTS (Section 01 79 13)

Mechanical

Motor operation temperature				
Satisfactory:	_____	_____	_____	_____
Pump operating temperature				
Satisfactory:	_____	_____	_____	_____
Unusual noise, etc?	_____	_____	_____	_____
Pump operation: 75 gpm/50 psig:	_____	_____	_____	_____
Measurement:				
Flow _____				
Pressure _____		Test gage number _____		
Alignment hot:	_____	_____	_____	_____
Dowelled in:	_____	_____	_____	_____

Remarks: _____

Electrical

Local switch function:				
Runs in <i>HAND</i>	_____	_____	_____	_____
No control power in <i>OFF</i>	_____	_____	_____	_____
Timer control in <i>AUTO</i>	_____	_____	_____	_____
Overpressure protection switch				
PS _____ functional in both				
<i>HAND</i> and <i>AUTO</i> :	_____	_____	_____	_____
Overpressure protection switch				
PS _____ set at 75 psig:	_____	_____	_____	_____
PLC 2500 set at 24-hour cycle,				
25 min <i>ON</i> :	_____	_____	_____	_____

Equipment/System Performance Test Completed

Contractor _____ Date _____

Equipment/System Performance Test Accepted

Engineer _____ Date _____

01 78 23-A OPERATION AND MAINTENANCE TRANSMITTAL FORM

OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date: _____

Submittal No.¹: _____

To: _____

Contract No.: _____

Spec. Section: _____

Submittal Description: _____

From: _____

Attention: _____

Checklist	CONTRACTOR		ENGINEER	
	Satisfactory	N/A	Accept	Deficient
1. Table of Contents				
2. Equipment forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and post-shutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks: _____

CONTRACTOR'S Signature

¹ Refer to Paragraph 01340-1.2 A, Transmittal Procedure.

MANUFACTURER'S INSTRUCTION CERTIFICATION FORM

Contract No: _____ Section: _____ Equipment Name: _____

CONTRACTOR: _____

Manufacturer of equipment item: _____

The undersigned manufacturer certifies that a service engineer has instructed the Plant operating personnel in the proper maintenance and operation of the equipment designated herein.

Operations Check List (check appropriate spaces)

Start-up procedure reviewed.	_____
Shutdown procedure reviewed.	_____
Normal operation procedure reviewed.	_____
Others: _____	_____
_____	_____

Maintenance Check List (check appropriate spaces)

Described normal oil changes (frequency).	_____
Described special tools required.	_____
Described normal items to be reviewed for wear.	_____
Described preventive maintenance instructions.	_____
Described greasing frequency.	_____
Others: _____	_____
_____	_____

Date

Manufacturer

Signature of Authorized Representative

Date

Signature of OWNER'S Representative

Date

Signature of CONTRACTOR'S Representative

40 05 93-A MOTOR DATA FORM

MOTOR DATA FORM

Equipment Name: _____

Equipment No.(s): _____

Site Location: _____

Nameplate Markings

Mfr _____ Mfr Model _____ Frame _____ HP _____
 Volts _____ Phase _____ RPM _____ Service factor _____
 FLA _____ LRA _____ Freq _____ Amb temp rating _____ degrees C
 Time rating _____ Design letter _____
 (NEMA MG1-10.35) (NEMA MG-1.16)
 KVA code letter _____ Insulation class _____

The following information is required for explosionproof motors only:

- A. Approved by UL for installation in Class _____, Div _____
- B. UL frame temperature code _____; Group _____ Atmosphere
 (NEC Tables 500-2 and 500-2(b))

The following information is required for all motors 1/2 horsepower and larger:

- A. Guaranteed minimum efficiency _____
 (Section 40 05 93)
- B. Nameplate or nominal efficiency _____

Data Not Necessarily Marked on Nameplate

Type of enclosure _____ Enclosure material _____
 Temp rise _____ degrees C (NEMA MG1-12.41,42)
 Space heater included? _____ Yes _____ No; if Yes, _____ watts _____ volts
 Type of motor winding overtemperature protection, if specified: _____

Use the space below to provide additional information on other motor modifications, if specified:

40 60 05-A LOOP WIRING AND INSULATION RESISTANCE TEST DATA FORM

LOOP WIRING AND INSULATION RESISTANCE TEST DATA FORM

Loop No.: _____

List all wiring associated with a loop in table below. Make applicable measurements as indicated after disconnecting wiring.

Wire No.	Panel Tie	Field TB	Continuity Resistance ¹		Insulation Resistance ²			
			Cond./Cond.	Cond./Shield	Shield/Gnd.	Shield/Cond.	Cond./Gnd.	Shield/Shield
A	_____	_____	--	(A/SH)	_____	_____	_____	_____
B	_____	_____	(A/B)	--	_____	_____	_____	_____
C	_____	_____	(A/C)	--	_____	_____	_____	_____
D	_____	_____	(A/D)	--	_____	_____	_____	_____
etc	_____	_____						

1. Continuity Test. Connect ohmmeter leads between wires A and B and jumper opposite ends together. Record resistance in table. Repeat procedure between A and C, A and D, etc. Any deviation of +2 ohms between any reading and the average of a particular run indicates a poor conductor, and corrective action shall be taken before continuing with the loop test.
2. Insulation Test. Connect one end of a 500 volt megger to the panel ground bus and the other sequentially to each completely disconnected wire and shield. Test the insulation resistance and record each reading.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

26 05 05-A WIRE AND CABLE RESISTANCE TEST DATA FORM

WIRE AND CABLE RESISTANCE TEST DATA FORM

Wire or Cable No.: _____

Temperature, °F : _____

<u>Location of Test</u>	<u>Insulation resistance, megohms</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____

Date _____

26 05 05-A WIRE AND CABLE RESISTANCE TEST DATA FORM

OWNER'S Representative

26 05 05-B INSTALLED MOTOR TEST DATA FORM

INSTALLED MOTOR TEST DATA FORM

Motor Equipment Number: _____ Date of test: _____

Equipment Driven: _____

MCC Location: _____ Ambient temp: _____ °F

Resistance:

Insulation resistance phase-to-ground megohms:

Phase A _____, Phase B _____, Phase C _____

Current at Full Load:

Phase _____ Current, amps _____

Phase _____ Current, amps _____

Phase _____ Current, amps _____

Thermal Overload Device: Manufacturer/Catalog No. _____ Amperes _____

Circuit breaker (MCP) setting: _____

Motor Nameplate Markings:

Mfr _____ Mfr type _____ Frame _____ HP _____

Volts _____ Phase _____ RPM _____ **Service factor _____

Amps _____ Freq _____ Ambient temp rating _____ °C

Time rating _____ **Design letter _____
(NEMA 1-10.35) (NEMA MG-1.16)

Code letter _____ Insulation class _____

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED _____ Date _____
CONTRACTOR'S Representative

WITNESSED _____ Date _____
OWNER'S Representative

26 05 05-D MOTOR CONTROL CENTER TEST FORM

MOTOR CONTROL CENTER TEST FORM

Equipment No.: _____ Ambient room temperature: _____

Location: _____

A. MECHANICAL CHECK:

1. All bolted connections either bus to bus or cable to bus shall be torqued to the manufacturer's recommendations.

B. ELECTRICAL TESTS:

1. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute using a megohmmeter at 1000 volts.

Test results (megohms)

<u>Phase</u>	<u>Phase</u>
A-GRD _____	A-B _____
B-GRD _____	B-C _____
C-GRD _____	C-A _____

2. Set the circuit breaker in the starter unit to comply with the requirements of NEC, Article 430-52 and Table 430-152.
3. Motor overload heater elements shall be sized and installed based on the actual nameplate full load amperes of the motor connected to the starter.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

26 05 05-E MEDIUM VOLTAGE MOTOR STARTER TEST FORM

MEDIUM VOLTAGE MOTOR STARTER TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

A. The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms).

Phase: A _____ B _____ C _____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>	
Pole to ground	___	___	___	megohms
Across open pole	___	___	___	megohms
Pole to pole	AB _____	BC _____	CA _____	megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Motor RTDs shall be tested by using a hot oil bath. The temperature at which the sensor trips shall be recorded for each RTD.

5. The Contactor shall be tripped by operation of each protective device.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

MEDIUM VOLTAGE SWITCHGEAR TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

A. The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms).

Phase: A___ B___ C___

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>	
Pole to ground	___	___	___	megohms
Across open pole	___	___	___	megohms
Pole to pole	AB___	BC___	CA___	megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Verify the instrument transformer ratios. Check the transformer's polarity electrically.

5. The Contactor shall be tripped by operation of each protective device.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

26 05 05-G PROTECTIVE RELAY TEST FORM

PROTECTIVE RELAY TEST FORM

Location: _____

Switchgear Breaker No.: _____

Protective Relay Description: _____

- A. The protective relays shall be tested in the following manner:
 - 1. Each protective relay circuit shall have its insulation resistance tested to ground.
 - 2. Perform the following tests on the specified relay setting:
 - a. Pickup parameters on each operating element.
 - b. Timing test shall be performed at three points on the time dial curve.
 - c. Pickup target and seal-in units.

- B. The results shall be recorded and signed by CONTRACTOR and CONSTRUCTION CONTRACT ADMINISTRATOR. A copy shall be provided to the CONSTRUCTION CONTRACT ADMINISTRATOR in accordance with Section 01 79 13, Equipment and System Startup and Performance Testing.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

26 05 05-H LOW VOLTAGE SWITCHGEAR TEST FORM

LOW VOLTAGE SWITCHGEAR TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

A. The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms).

Phase: A _____ B _____ C _____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>	
Pole to ground	_____	_____	_____	megohms
Across open pole	_____	_____	_____	megohms
Pole to pole	AB _____	BC _____	CA _____	megohms

3. Minimum pickup current shall be determined by primary current injection.

4. Long time delay shall be determined by primary injection at 300 percent pickup current.

5. Short time pickup and time delay shall be determined by primary injection of current.

6. Instantaneous pickup current shall be determined by primary injection.

7. Trip unit reset characteristics shall be verified.

8. Auxiliary protective devices, such as ground fault or under voltage relays, shall be activated to ensure operation of shunt trip devices.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

26 05 05-1 MEDIUM VOLTAGE LOAD INTERRUPTER SWITCH TEST FORM

MEDIUM VOLTAGE LOAD INTERRUPTER SWITCH TEST FORM

Equipment Number: _____

Location: _____

Date: _____

1. Measure switch blade resistance (micro-ohms).

Phase: A _____ B _____ C _____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>
Pole to ground	—	—	— megohms
Across open pole	—	—	— megohms
Pole to pole	AB__	BC __	CA __ megohms

The results shall be recorded and signed by CONTRACTOR and CONSTRUCTION CONTRACT ADMINISTRATOR. A copy shall be provided to the CONSTRUCTION CONTRACT ADMINISTRATOR in accordance with Section 01 79 13, Equipment and System Startup and Performance Testing.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

Northern Kentucky Water District

January 23, 2014

Contact Name
Contractor Name
Street Name
City, State Zip

Re: Taylor Mill Treatment Plant Electrical and Basin Improvements

Project

Dear Contractor:

The Northern Kentucky Water District's Board of Commissioners approved award of the Taylor Mill Treatment Plant Electrical and Basin Improvements project on _____, 2014. At this time we are waiting on a response from the Kentucky Public Service Commission regarding approval of this project before we execute the Contract Documents.

You have requested that your company be permitted to prepare and submit shop drawings for review prior to the issuance and delivery of both the Notice of Award and the Notice to Proceed for the project. The District is willing to allow you to begin preparing and submitting shop drawings for review prior to the issuance and delivery of the Notice of Award and the Notice to Proceed as long as you understand and agree that there is no guarantee that your company will be awarded the project and that your company will bear all costs and expenses in the preparation and submission of the shop drawings should your company not be awarded the project.

At this time we do not have any reason to believe that _____ will not be awarded the project, however, we are sending this letter to clarify the District's position. If your company understands and agrees with these conditions, please so indicate by signing this letter below and returning it to me as soon as possible and prior to the preparation and submission of any shop drawings.

Sincerely yours,

Amy Kramer, P.E.
Engineering Manager

Understood and Agreed by:

CONTRACTOR NAME

Name: _____

Title: _____

SECTION 01 35 43

CONTRACTOR'S HAZARDOUS MATERIALS MANAGEMENT PROGRAM

PART 1 – GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall develop, implement, and maintain a Hazardous Materials management program (HMMP) throughout the Project, in accordance with Laws and Regulations.
1. Hazardous Materials Brought to Site by Contractor: Transport, handle, store, label, use, and dispose of in accordance with this Section, and Laws and Regulations.
 2. Hazardous Material Generated by Contractor:
 - a. Hazardous Material shall be properly handled, stored, labeled, transported and disposed of by CONTRACTOR in accordance with Laws and Regulations, and this Section.
 - b. If CONTRACTOR will generate or has generated Hazardous Material at the Site, obtain a United States Environmental Protection Agency (EPA) identification number listing CONTRACTOR's name and address of the Site as generator of the Hazardous Material. Obtain identification number from state environmental agency or similar authority having jurisdiction at the Site. Submit identification number within time frame specified in Article 1.3 of this Section.
 - c. CONTRACTOR shall be responsible for identifying, analysis of profiling, transporting, and disposing of Hazardous Material generated by CONTRACTOR.
 3. Fines or civil penalties levied against OWNER for violations committed at the Site by CONTRACTOR, and costs to OWNER (if any) associated with cleanup of Hazardous Materials shall be paid by CONTRACTOR.
- B. Enforcement of Laws and Regulations:
1. Interests of OWNER are that accidental spills and emissions, Site contamination, and injury of personnel at the Site are avoided.
 2. When OWNER is aware of suspected violations, OWNER will notify CONTRACTOR, and authorities having jurisdiction if OWNER reasonably concludes that doing so is required by Laws or Regulations.
- C. Related Sections:
1. Section 01 35 44, Spill Prevention Control and Countermeasures Plan.

1.2 DEFINITIONS

- A. The following terms are defined for this Section and supplement the terms defined in the General Conditions:
1. Hazardous Material: Material, whether solid, semi-solid, liquid, or gas, that, if not stored or used properly, may cause harm or injury to persons through inhalation, ingestion, absorption or injection, or that may negatively impact the environment through use or discharge of the material on the ground, in water (including groundwater), or to the air. Hazardous Material includes, but is not limited to, chemicals, Asbestos, Hazardous Waste, PCBs, Petroleum, Radioactive Material, and which is or becomes listed, regulated, or addressed pursuant to [a] the Comprehensive Environmental Response, Compensation and Liability Act, 42 United States Code (USC) §§9601 et seq. (“CERCLA”); [b] the Hazardous Materials Transportation Act, 49 USC §§1801 et seq.; [c] the Resource Conservation and Recovery Act, 42 USC §§6901 et seq. (“RCRA”); [d] the Toxic Substances Control Act, 15 USC §§2601 et seq.; [e] the Clean Water Act, 33 USC §§1251 et seq.; [f] the Clean Air Act, 42 USC §§7401 et seq.; and [g] any other Law or Regulation regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Laws and Regulations applying to the Work under this Section include:
1. Code of Federal Regulations (CFR), Title 29, Part 1910, Occupational Safety and Health Standards.
 2. CFR, Title 29, Part 1926, Safety and Health Regulations for Construction.
 3. CFR Title 40, Protection of Environment.
 4. CFR, Title 49, Transportation.
 5. Occupational health and safety requirements of state labor department or similar entity; environmental Laws and Regulations of state environmental agency, Laws and Regulations of state department of transportation.

1.4 SUBMITTALS

- A. Informational Submittals: Submit the following to the entity(ies) specified for each:
1. Hazardous Materials (including Chemicals) Proposed for Use at the Site: Submit current (dated within the past two years) material safety data sheets (MSDS) in accordance with 29 CFR 1910.1200 (OSHA Hazard Communication Standard), manufacturer, Supplier (if different than manufacturer), container size(s) and number of containers proposed to be at the Site, minimum and maximum volume of material intended to be stored at the Site, and description of process or procedures in which Hazardous Material will be used. Furnish information in sufficient time to obtain OWNER’s acceptance

- no later than least three days before bringing Hazardous Material to the Site. Submit to CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER's environmental representative.
2. Hazardous Material Generated at the Site: Submit for each Hazardous Material generated at the Site identification number, analysis results, and number and size of storage containers at the Site. Furnish information not less three days of CONTRACTOR's receipt of analytical results. Submit to CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER's environmental representative.
 3. Permits: Copies of permits for storing, handling, using, transporting, and disposing of Hazardous Materials, obtained from authorities having jurisdiction. Submit to OWNER's environmental representative and CONSTRUCTION CONTRACT ADMINISTRATOR.
 4. Other Documents required for the HMMP: Submit to OWNER's environmental representative requested documents within three days of CONTRACTOR's receipt of request. HMMP documents may include emergency/spill response plan, communication plan, and other documents.
 5. Qualifications Statements:
 - a. Contractor's Safety Representative: Submit qualifications of proposed safety representative, including summary of experience, training received and valid certifications applicable to the Project.

1.5 HAZARDOUS MATERIALS MANAGEMENT

- A. Obtain OWNER's environmental representative's acceptance before bringing each Hazardous Material to the Site.
- B. Communication Plan: CONTRACTOR shall develop a Hazardous Materials communication plan. At minimum, maintain at the Site two notebooks containing: 1) Inventory of Hazardous Materials (including all chemicals); and, 2) Current (dated within the past two years) material safety data sheets (MSDS) for all materials being used to accomplish the Work, whether or not defined as Hazardous Material in this Section. Keep one notebook in CONTRACTOR's field office at the Site; keep second notebook at location acceptable by OWNER's environmental representative. Keep notebooks up-to-date as materials are brought to and removed from the Site.
- C. Emergency/Spill Response Plan: Develop, implement, and maintain an emergency/spill response plan, for each Hazardous Material or each class/group of Hazardous Materials as applicable. At minimum, response plan shall include the following:
 1. Description of equipment available at the Site to contain or respond to emergency related to or spill of the material.
 2. Procedures for notifying, and contact information for: authorities having jurisdiction, emergency responders, OWNER, CONSTRUCTION

CONTRACT ADMINISTRATOR, the public as applicable, and other entities as required.

3. Response coordination procedures between CONTRACTOR, OWNER, and others as appropriate.
4. Site plan showing proposed location of Hazardous Materials storage area and location of spill containment/response equipment, and location of storm water drainage inlets and drainage routes.
5. Description of Hazardous Material handling and spill response training provided to CONTRACTOR's and Subcontractors' employees, in accordance with 29 CFR 1926.21(b) and other Laws and Regulations..
6. Comply with Section 01 35 44, Spill Prevention Control and Countermeasures Plan.

D. Storage of Hazardous Materials and Non-Hazardous Materials:

1. Hazardous Materials containers shall bear applicable hazard diamond(s).
2. Container Labeling:
 - a. Properly label each container of consumable materials, whether or not classified as Hazardous Materials under this Section.
 - b. Stencil CONTRACTOR's name and, as applicable, Subcontractor's name, on each vessel containing Hazardous Material and, for non-Hazardous Materials, on each container over five-gallon capacity. Containers shall bear securely-attached label clearly identifying contents. Label containers that are filled from larger containers.
 - c. If OWNER becomes aware of unlabeled containers at the Site, OWNER's environmental representative will notify CONTRACTOR. Properly label container(s) within one hour of receipt of notification or remove container from the Site.
3. To greatest extent possible, store Hazardous Materials off-Site until required for use in the Work.

E. Hazardous Materials Storage Area:

1. Maintain designated storage area for Hazardous Materials that includes secondary containment. Storage area shall include barriers to prevent vehicles from colliding with storage containers, and shall include protection from environmental factors such as weather.
2. Provide signage in accordance with Laws and Regulations, clearly identifying the Hazardous Materials storage area.

F. CONTRACTOR's safety representative shall meet at least monthly with OWNER's environmental representative to review CONTRACTOR's HMMP documents, procedures, and inspect storage areas and the Site in general, to verify compliance with this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 35 44

SPILL PREVENTION CONTROL AND COUNTERMEASURES PLAN

PART 1 – GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall provide all labor, materials, equipment, tools, professional engineering (when required), and incidentals as shown, specified, and required to comply with Laws and Regulations regarding spill prevention control and countermeasures (SPCC) planning and compliance, including 40 CFR Part 112.
- B. CONTRACTOR shall determine whether a SPCC Plan is required. If SPCC Plan is required, CONTRACTOR shall prepare, implement and maintain SPCC Plan as required by Laws and Regulations.
- C. Determination of Need for SPCC Plan:
 - 1. CONTRACTOR shall determine need for SPCC Plan.
 - 2. Professional Engineer:
 - a. If the Site will include storage of more than 10,000 gallons of oil in above-ground storage, or if the Site does not comply with oil discharge history criteria specified in 40 CFR 112, CONTRACTOR shall retain a qualified professional engineer to determine need for SPCC Plan and, if SPCC Plan is required, professional engineer shall prepare or supervise preparation of SPCC Plan.
 - b. If a professional engineer is not required to prepare the full SPCC Plan, but the SPCC Plan includes environmentally-equivalent SPCC measures, or impracticality determinations, CONTRACTOR shall retain a qualified professional engineer to prepare and certify those portions of the SPCC Plan dealing with environmentally equivalent measures and impracticality determinations; the balance of the SPCC Plan may be prepared by and self-certified by CONTRACTOR.
 - 3. Submit to CONSTRUCTION CONTRACT ADMINISTRATOR letter presenting results of evaluation of whether a SPCC Plan is required for the Project in accordance with Laws and Regulations.
- D. SPCC Plan is required if the Project activities at the Site meet the following criteria:
 - 1. the Site and activities thereon are not exempt from Laws and Regulations, and;
 - 2. oil is stored, used, transferred, or otherwise handled at the Site; and
 - 3. maximum oil storage capacity at the Site equals or exceeds either of the following thresholds: 42,000 gallons of completely buried capacity, or 1,320

- of above-ground capacity. Capacity includes total storage tank volume and operational storage volume at the Site for contractors and Subcontractors, including bulk storage tanks, containers with 55-gallon storage capacity and larger, mobile tanks located at the Site, and other containers covered by Laws and Regulations. Motive storage containers, such as those on construction equipment and vehicles, is not included. Oil includes petroleum products, fuel oil, hydraulic fluid, oil sludge, oil refuse, oil mixed with wastes other than dredged material, synthetic oil, vegetable oil, animal fats and oils, and other oils defined in Laws and Regulations; and
4. there is reasonable expectation, based on location of the Site, that oil spill would reach navigable waters of the United States or adjoining shorelines.
- E. If SPCC Plan is not required, CONTRACTOR shall ensure that conditions that preclude the need for SPCC Plan, including the activities of all contractors and Subcontractors at the Site, are maintained throughout duration of the Project. Should changes that affect the storage, use, or handling of oil at the Site occur, reassess the need for SPCC Plan at no additional cost to OWNER and provide to ENGINEER evaluation letter regarding need for SPCC Plan.
- F. If SPCC Plan is required, develop SPCC Plan and submit for acceptance by OWNER, with copy to CONSTRUCTION CONTRACT ADMINISTRATOR. SPCC Plan shall be specific to the Site and shall include the following:
1. Stamp, original signature, and license number of CONTRACTOR'S professional engineer, when self-certification by CONTRACTOR is not allowed by Laws and Regulations.
 2. Site plan identifying the name (or tag number) and location of each tank and container that will contain a substance regulated in 40 CFR 112 and other Laws and Regulations, including above-ground and buried tanks. Site plan shall indicate general directions of storm water runoff, including storm sewers and drainage inlets, and storm sewer outfall locations.
 3. For each tank and container on the Site plan, provide a table that lists the tank or container's name and tag number, type of oil stored, and maximum storage capacity. List total storage capacity of all tanks and containers at the Site covered by SPCC Laws and Regulations.
 4. Predictions of direction, rate of flow, and total quantity of oil that could be discharged from the Site as result of storage tank or container failure.
 5. Operating procedures that prevent oil spills, including procedures for oil handling, details of secondary containment structures at fuel and oil transfer areas, and details and descriptions of equipment to be used for oil handling, including piping.
 6. Details of and descriptions of control measures installed at the Site by CONTRACTOR to prevent spill from reaching navigable waters, including secondary containment and diversionary structures. For on-shore Sites, one of the following must be used, at minimum: dikes, berms, or retaining walls; curbing; culverts, gutters, or other drainage systems; weirs, booms, or other barriers; spill diversion ponds; retention ponds; sorbent materials. Where

appropriate, the SPCC Plan shall clearly demonstrate that containment or diversionary structures or equipment are not practical. Include brittle fracture evaluation, where required, for field-constructed above-ground storage containers undergoing repair, alteration, construction, or change in service.

7. Plans for countermeasures to contain, clean up, and mitigate effects of oil spill that reaches navigable waters, including written commitment of manpower, equipment, and materials to quickly control and remove spilled oil. Include estimation of time required to contain spill after spill occurs.
 8. Contact list and telephone numbers for facility response coordinator, National Response Center, cleanup contractors, and all appropriate federal, state, and local authorities having jurisdiction to be contacted in event of spill or discharge.
 9. Program for monthly inspections of the Site by CONTRACTOR for SPCC Plan compliance. Notify OWNER of each inspection at least 72 hours in advance.
 10. Measures for Site security relative to oil storage.
 11. Procedures for safely handling mobile containers such as totes, drums, and fueling vehicles and construction equipment that remain at the Site.
 12. Procedures and schedules for periodic testing of integrity of tanks and containers, and associated piping and valves.
 13. Plans for bulk storage container compliance.
 14. Plans for personnel training and oil spill prevention briefings.
 15. For SPCC Plans that do not follow the format listed in Laws and Regulations, provide cross-reference to requirements of Laws and Regulations, including 40 CFR 112.7.
- G. Obtain acceptance of SPCC Plan by OWNER, for coordination with OWNER's Site-specific SPCC Plan, if any.
- H. SPCC Plan shall be reviewed by CONTRACTOR's professional engineer (when professional engineer is required) and OWNER every five years, as applicable.
- I. Post a copy of accepted, certified SPCC Plan in conspicuous location at the Site and provide copies to OWNER, CONSTRUCTION CONTRACT ADMINISTRATOR, other contractors, and Subcontractors as appropriate. All contractors shall comply with SPCC Plan.
- J. In event of violation of SPCC Plan or release of oils attributable to construction operations, CONTRACTOR shall:
1. Immediately issue notifications in accordance with Laws and Regulations, including 40 CFR 110 and 40 CFR 112. When required by Laws and Regulations, report to National Response Center, US Environmental Protection Agency, and other authorities having jurisdiction, if any.
 2. Have spill clean-up performed in conformance with Laws and Regulations and the SPCC Plan.

3. Pay fines or civil penalties (or responsible portion thereof) imposed on OWNER by authorities having jurisdiction, and pay costs associated with clean-up of spills.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Professional Engineer:

- a. When required by Laws and Regulations, engage a registered professional engineer legally qualified to practice in the jurisdiction where the Site is located and experienced in providing engineering services of the kind indicated.
- b. Submit qualifications data.
- c. Responsibilities include but are not necessarily limited to:
 - 1) Carefully reviewing Laws and Regulations relative to SPCC.
 - 2) Preparing written requests for clarifications or interpretations of criteria specified in the Contract Documents for submittal to CONSTRUCTION CONTRACT ADMINISTRATOR by CONTRACTOR, and obtaining from authorities having jurisdiction clarifications regarding Laws and Regulations as required.
 - 3) Preparing or supervising the preparation of letter-report evaluation of need for SPCC Plan in accordance with the Contract Documents. Evaluation shall include professional engineer's seal, registration number, and original signature.
 - 4) When SPCC Plan is required, preparing, supervising the preparation of, or reviewing the SPCC Plan (or designated portions thereof when oil storage at the Site will be 10,000 gallons or less) in accordance with the Contract Documents. SPCC Plan (or designated portions thereof) shall include professional engineer's seal, registration number, and original signature.
 - 5) Periodically re-evaluating the need for SPCC Plan and issuing findings as letter-reports with seal, license number, and signature. When SPCC Plan is required, periodically evaluating the SPCC Plan and providing recommendations for compliance with Laws and Regulations, in accordance with the Contract Documents.
 - 6) Certifying that:
 - a) it is familiar with the Laws and Regulations, including 40 CFR 112, and
 - b) it has visited, examined, and is familiar with the Site, planned modifications to the Site under the Project as such modifications pertain to SPCC Laws and Regulations, and
 - c) it has performed the evaluations and prepared SPCC Plan in accordance with the Contract Documents, and
 - d) procedures for required testing and inspections have been established, and
 - e) the said evaluations and SPCC Plan are adequate for the Project,

- and
- f) the said evaluations and SPECC Plan conform to all Laws and Regulations, applicable industry standards, and to prevailing standards of practice.

1.3 SUBMITTALS

- A. Informational Submittals: Submit the following:
 - 1. Certifications: With each evaluation letter and SPCC Plan submittal, include certification signed by preparer of submittal that the submittal conforms to the Contract Documents and Laws and Regulations. Signature on all certifications shall be original.
 - 2. Evaluations:
 - a. Submit letter presenting results of evaluation of whether a SPCC Plan is required for the Project. Submit evaluation no later than fourteen days after the Contract Times commence running, unless longer time is allowed by CONSTRUCTION CONTRACT ADMINISTRATOR.
 - b. Submit updated evaluations as required when conditions at the Site change. Submit updated evaluation no later than seven days after the conditions at the Site change, or within seven days of CONSTRUCTION CONTRACT ADMINISTRATOR's request, unless longer time is allowed by CONSTRUCTION CONTRACT ADMINISTRATOR.
 - 3. SPCC Plan: When SPCC Plan is required:
 - a. Submit jointly to OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR. Submit within fourteen days of receipt of CONSTRUCTION CONTACT ADMINISTRATOR's acceptance of evaluation submittal.
 - b. Update CONSTRUCTION CONTRACT ADMINISTRATOR e and resubmit the SPCC Plan, or acceptable SPCC Plan amendments, as required when conditions at the Site change. Submit updated SPCC Plan or amendments no later than seven days after the change in conditions at the Site change giving rise to the SPCC Plan change or amendment, or within seven days of CONSTRUCTION CONTRACT ADMINISTRATOR's request, unless longer time is allowed by CONSTRUCTION CONTRACT ADMINISTRATOR.
 - 4. SPPC Plan Distribution: When SPCC Plan is required, submit copies of letters transmitting SPCC Plan and amendments (if any) to contractors and Subcontractors working at the Site.
 - 5. Qualifications Statements: CONTRACTOR's professional engineer, when requested by CONSTRUCTION CONTRACT ADMINISTRATOR.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 42 00

REFERENCES

PART 1 – GENERAL

1.1 DEFINITIONS

- A. Definitions and terminology applicable to all the Contract Documents are included in the General Conditions and Supplementary Conditions.
- B. Terminology used in the Specifications includes:
1. “Indicated” refers to graphic representations, notes, or schedules on the Drawings, or to other paragraphs or schedules in the Specifications and similar locations in the Contract Documents. Terminology such as “shown”, “noted”, “scheduled”, and “specified” are used to help the user locate the reference without limitation on the location.
 2. “Installer”, “applicator”, or “erector” is CONTRACTOR or another entity engaged by CONTRACTOR, either as an employee or Subcontractor, to perform a particular construction activity, including installation, erection, application or similar Work. Installers shall be experienced in the Work that installer is engaged to perform.
 - a. The term “experienced”, when used with the term “installer” means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; being familiar with Laws and Regulations; and having complied with requirements of authorities having jurisdiction, and complying with requirements of the Supplier of the material or equipment being installed.
 3. Trades: Use of a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter”, unless otherwise indicated in the Contract Documents or required by Laws or Regulations. Such terminology also does not imply that specified requirements apply exclusively to trade personnel of the corresponding generic name.
 4. “Assigned specialists” and similar terms: Certain Sections of the Specifications require that specific construction activities be performed by specialists recognized as experts in those operations. Engage said specialists for those activities, and their engagement is a requirement over which CONTRACTOR has no option. These requirements do not conflict with enforcement of building codes and other Laws and Regulations. Also, such requirements are not intended to interfere with local trade union jurisdictional settlements and similar conventions. Such assignments shall not relieve CONTRACTOR of responsibility for complying with the requirements of the Contract Documents.

1.2 ABBREVIATIONS

- A. Common abbreviations that may be found in the Contract Documents are listed below, alphabetically by their written-out meaning:

alternating current		a-c
ampere		A
ante meridian		a.m.
average		avg
biochemical oxygen demand		BOD
brake horsepower		bhp
British thermal unit		Btu
Centigrade (or Celsius)		C
chlorinated polyvinyl chloride		CPVC
Construction Contract Administration		CCA
cubic inch		cu in
cubic foot		cu ft
cubic yard		cu yd, or CY
cubic feet per minute		cfm
cubic feet per second		cfs
decibel		db
degree Centigrade (or Celsius)	(Write)	degrees C or °C
degrees Fahrenheit		degrees F or °F
diameter		dia
direct current		d-c
dollars		\$
each		ea
efficiency		eff
Fahrenheit		F
feet		ft
feet per hour		fph
feet per minute		fpm
feet per second		fps
figure		Fig
flange		flg
foot-pound		ft-lb
gallon		gal

gallons per hour	gph
gallons per minute	gpm
gallons per second	gps
gram	g
grams per liter	g/L
Hertz	Hz
horsepower	hp or HP
hour	hr
inch	in.
inches water gage	in. w.g.
inch-pound	in.-lb
inside diameter	ID
thousand pounds	kips
thousand pounds per square inch	ksi
kilovolt-ampere	kva
kilowatt	kw
kilowatt-hour	kwhr or kwh
linear foot	lin ft or LF
liter	L
maximum	max
mercury	Hg
milligram	mg
milligrams per liter	mg/l or mg/L
milliliter	ml
millimeter	mm
million gallons per day	mgd or MGD
million gallon	MG
minimum	min
National Pipe Threads	NPT
net positive suction head	NPSH
net positive suction head available	NPSHA
net positive suction head required	NPSHR
number	no.
ounce	oz
ounce-force	ozf
outside diameter	OD

parts per hundred	pph
parts per million	ppm
parts per billion	ppb
polyvinyl chloride	PVC
post meridian	p.m.
pound	lb
pounds per square inch	psi
pounds per square inch absolute	psia
pounds per square inch gauge	psig
pounds per square foot	psf
revolutions per minute	rpm
second	sec
specific gravity	sp gr, or SG
square	sq
square foot	sq ft, or sf
square inch	sq in.
square yard	sq yd, or SY
standard	std
standard cubic feet per minute	scfm
total dynamic head	TDH
totally-enclosed fan-cooled	TEFC
vertical foot	VF
volt	V
volts alternating current	vac
volts direct current	vdc
vertical foot	vf

1.3 REFERENCE STANDARDS

- A. Refer to Article 3 of the General Conditions, as may be modified by the Supplementary Conditions, relative to reference standards and resolving discrepancies between reference standards and the Contract Documents. Provisions of reference standards are in effect in accordance with the Specifications.
- B. Copies of Standards: Each entity engaged in the Work shall be familiar with reference standards applicable to its construction activity. Copies of applicable reference standards are not bound with the Contract Documents. Where reference

standards are needed for a construction activity, obtain copies of standards from the publication source.

- C. Abbreviations and Names: Where reference standards, specifications, codes, manuals, Laws or Regulations, or other published data of international, national, regional or local organizations are referred to in the Contract Documents, the organization issuing the standard may be referred to by their acronym or abbreviation only. Following acronyms or abbreviations that may appear in the Contract Documents shall have the meanings indicated below. Listing is alphabetical by acronym.

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACS	American Chemical Society
AEIC	Association of Edison Illuminating Companies
AF&PA	American Forest and Paper Association
ABMA	American Bearing Manufacturers Association (formerly Anti-Friction Bearing Manufacturers Association (AFBMA))
AGMA	American Gear Manufacturers Association
AI	Asphalt Institute
AIChE	American Institute of Chemical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standards Committee
AMA	Acoustical Materials Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
APA	The Engineered Wood Association
API	American Petroleum Institute
APHA	American Public Health Association
AREA	American Railway Engineering Association
ARI	Air Conditioning and Refrigeration Institute
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning

Engineers

ASME	American Society of Mechanical Engineers
ASNT	American Society for Non-Destructive Testing
ASTM	American Society for Testing and Materials
AWCI	Association of the Wall and Ceiling Industry
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BAAQMD	Bay Area Air Quality Management District
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association
CBMA	Certified Ballast Manufacturers Association
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturers Association
CGA	Compressed Gas Association
CISCA	Ceilings and Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute
DIN	Deutsches Institut für Normung eV (German Institute for Standardization)
DIPRA	Ductile Iron Pipe Research Association
EJMA	Expansion Joint Manufacturers Association, Inc.
ETL	Intertek Testing Services, Inc. (formerly ETL Testing Laboratories, Inc.)
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FM	Factory Mutual (FM Global)
FRPI	Fiberglass Reinforced Plastics Institute
FS	Federal Specification
GA	Gypsum Association
GANNA	Glass Association of North America
HEW	United States Department of Health, Education and Welfare
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute

HUD	United States Department of Housing and Urban Development
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IFI	Industrial Fasteners Institute
IRI	Industrial Risk Insurers
ISA	Instrumentation, Systems, and Automation Society (formerly Instrument Society of America)
ISO	Insurance Services Office
ISO	International Organization for Standardization
LEED	Leadership in Energy and Environmental Design (USGBC)
LPI	Lightning Protection Institute
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association
MS	Military Specifications
MSS	Manufacturers' Standardization Society
MMA	Monorail Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NAPF	National Association of Pipe Fabricators, Inc.
NARUC	National Association of Regulatory Utilities Commissioners
NBHA	National Builders Hardware Association
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NELMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NHPMA	Northern Hardwood and Pine Manufacturers Association
NIST	United States Department of Commerce, National Institute of Standards and Technology
NLGA	National Lumber Grades Authority

NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NSSGA	National Stone, Sand, and Gravel Association
NTMA	National Terrazzo and Mosaic Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PEI	Porcelain Enamel Institute
PFI	Pipe Fabrication Institute
PPI	Plastics Pipe Institute
PGMC	Primary Glass Manufacturers Council
PS	Product Standards Section, United States Department of Commerce
RCSC	Research Council on Structural Connections (part of AISC)
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SCAQMD	Southern California Air Quality Management District
SCPRF	Structural Clay Products Research Foundation
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturing Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SPI	Society of the Plastics Industry
SPIB	Southern Pine Inspection Bureau
SSPC	Society for Protective Coatings
SWI	Steel Window Institute
TEMA	Tubular Exchanger Manufacturers Association
TCNA	Tile Council of North America
UL	Underwriters Laboratories, Inc.
USEPA	United States Environmental Protection Agency
USGBC	United States Green Building Council
USGS	United States Geological Survey
USPHS	United States Public Health Service
WCLIB	West Coast Lumber Inspection Bureau
WDMA	Window and Door Manufacturers Association

WWEMA Water and Wastewater Equipment Manufacturers Association
WWPA Western Wood Products Association

1.4 APPLICABLE CODES

- A. References in the Contract Documents to local code(s) shall mean the following:
1. Kentucky Building Code, Latest Edition
 2. National Electric Code.
 3. NFPA 101, Life Safety Code.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. OWNER will employ and pay for an independent testing laboratory to perform specified services. Testing laboratory selected will be subject to ENGINEER's acceptance. CONTRACTOR shall coordinate with OWNER's special inspection and testing agency.
- B. Inspection, sampling and testing shall be as specified in the Specifications including but not limited to the following:
 - 1. Section 01 45 33, Code Required Special Inspections and Procedures.
 - 2. Section 03 00 05, Concrete, for concrete tests.
 - 3. Section 05 05 33, Anchor Systems.
 - 4. Section 09 91 00, Painting, for tests on paint and painting.
 - 5. Other tests in the Contract Documents that are not specifically assigned to others.
- C. CONTRACTOR shall pay for:
 - 1. Tests not specifically indicated in the Contract Documents as being OWNER's responsibility.
 - 2. Tests made for CONTRACTOR's convenience.
 - 3. Repeat tests required because of CONTRACTOR's negligence or defective Work
 - 4. Tests required after failure of two or more of the same test for the same item to comply with the Contract Documents, for tests initially paid for by OWNER.
- D. Testing laboratory is not authorized to approve or accept any portion of the Work or defective Work; rescind, alter, or augment requirements of Contract Documents; and perform duties of CONTRACTOR.

1.2 REFERENCES

- A. Standards referenced in this Section are:
 - 1. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
 - 2. ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories.
 - 3. NIST SRM, Standard Reference Materials.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Testing Laboratory:

- a. Testing laboratory will comply with applicable requirements of ASTM E329.
- b. Testing laboratory will be authorized to operate in the same state as the Site. Where applicable, laboratory will be certified by the authority having jurisdiction for the types of testing required.
- c. Testing equipment used by laboratory will be calibrated at maximum intervals of twelve months by devices of accuracy traceable to one of the following: NIST SRM, ISO/IEC 17025, certified by state or local bureau of weights and measures, or values of natural physical constants generally accepted in the engineering and scientific community.

1.4 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Quality Control Submittals and Test Reports: Promptly submit to ENGINEER and CONTRACTOR results of testing and inspections, in accordance with Section 01 33 00, Submittal Procedures, including:
 - a. Date issued.
 - b. Project title, number, and name of the Site.
 - c. Testing laboratory name and address.
 - d. Name and signature of inspector or person obtaining samples.
 - e. Date of inspection or sampling.
 - f. Record of temperature and weather.
 - g. Date of test.
 - h. Identification of material or product tested, and associated Specification Section.
 - i. Location in the Project.
 - j. Type of inspection or test.
 - k. Results of tests and observations regarding compliance with the Contract Documents.
2. Qualifications Statements: Upon CONTRACTOR's request, testing laboratory will submit the following:
 - a. Testing Laboratory:
 - 1) Qualifications statement indicating experience and facilities for tests required under the Contract Documents.
 - 2) Copy of report of inspection of facilities during most recent NIST inspection tour. Include memorandum of remedies of deficiencies reported during inspection.
 - 3) Copy of certificate of calibration for each instrument or measuring device proposed for use, by accredited calibration agency.

1.5 TESTING LABORATORY DUTIES

- A. OWNER-hired testing laboratory will:
1. Cooperate with CONTRACTOR and ENGINEER and provide qualified personnel promptly when notified.
 2. Perform required inspections, sampling, and testing of materials and methods of construction; comply with applicable reference standards and the Contract Documents; and ascertain compliance with requirements of the Contract Documents.
 3. Promptly advise ENGINEER and CONTRACTOR in writing of irregularities and deficiencies in the Work observed during performance of services.
 4. Submit to ENGINEER and CONTRACTOR written reports of inspections and tests required by the Contract Documents.
 5. Perform additional tests and services as required by OWNER or ENGINEER to verify compliance with the Contract Documents.

1.5 CONTRACTOR'S COORDINATION WITH LABORATORY

- A. CONTRACTOR shall perform and provide the following relative to OWNER-hired testing laboratory:
1. Provide to testing laboratory representative samples of materials to be tested, in required quantities.
 2. Provide labor and facilities:
 - a. For access to the Work to be tested, and where required, to Suppliers' operations.
 - b. For obtaining and handling samples at the Site.
 - c. For facilitating inspections and tests.
 - d. For laboratory's exclusive use for storing and curing of test samples.
 - e. Forms for preparing concrete test beams and cylinders.
 3. Notify testing laboratory and ENGINEER sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.
 4. Arrange with testing laboratory and pay for additional services, sampling, and testing required for CONTRACTOR's convenience.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 45 33

CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Scope
 - 1. CONTRACTOR shall provide labor, materials, tools, equipment, and incidentals as shown, specified, and required to cooperate with Coordinating Special Inspector, individual inspectors, and testing agencies employed by Owner to facilitate Special Inspections.
 - 2. Supplement A, Statement of Special Inspections, included with this Section, lists testing and inspections required.

1.2 DEFINITIONS

- A. Coordinating Special Inspector: Professional engineer or architect, hired by OWNER, registered in the same state as the Site, responsible for coordinating and verifying the inspection and testing required by the Statement of Special Inspections included in this Section and reporting to the Building Official.
- B. Building Official: Officer or other designated authority having jurisdiction charged with the administration and enforcement of the governing building code, or a duly authorized representative.
- C. Special Inspections: Testing and inspection required in Supplement A, Statement of Special Inspections, of this Section.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. OWNER will employ and pay for services of the Coordinating Special Inspector, who will have not less than five years of experience in managing, monitoring, and inspecting building construction.
 - 2. Inspectors shall be qualified in the responsibilities of the Special Inspection for which each is responsible to the satisfaction of the Building Official.
- B. Regulatory Requirements:
 - 1. Special Inspections shall be in accordance with applicable building code and other Laws and Regulations, and Supplement A, Statement of Special Inspections, of this Section.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Samples: Representative Samples of materials when required by ENGINEER.

1.5 CONTRACTOR'S RESPONSIBILITIES

- A. Provide safe access to the Work to be tested and inspected.
- B. Provide assistance in obtaining and handling test samples at the Site.
- C. Facilitate inspections and tests.
- D. Provide access to Suppliers' and Subcontractors' operations as required.
- E. Notify Coordinating Special Inspector and ENGINEER sufficiently in advance of operations to allow for coordination of personnel at the Site. Do not cover the Work to be inspected until inspection has been completed and results thereof are acceptable.
- F. Special Inspections required in this Section do not supersede or make unnecessary inspections and tests required under other Specification Sections or standard inspections required by Laws and Regulations.

1.6 COORDINATING SPECIAL INSPECTOR'S RESPONSIBILITIES

- A. Coordinating Special Inspector will:
 - 1. Complete Supplement A, Statement of Special Inspections, of this Section to provide names of each inspector and testing agency for each Special Inspection required
 - 2. Engage services of inspectors and testing agencies for Special Inspections in accordance with Supplement A, Statement of Special Inspections, of this Section and as required by Laws and Regulations.
 - 3. Coordinate activities of individual inspectors and testing agencies with CONTRACTOR.
 - 4. Provide interim reports of inspections and material testing to Building Official, OWNER, ENGINEER, and ENGINEER's consultants, including structural engineer and architect.
 - 5. To obtain certificate of use and occupancy from the Building Official, complete and provide to the Building Official, OWNER, and ENGINEER Supplement B, Final Report of Special Inspections, of this Section, documenting completion of Special Inspections and correction of discrepancies noted in the Special Inspections.

1.7 INSPECTOR RESPONSIBILITIES

- A. Perform specified inspections, sampling, and testing of materials and methods of construction; review and ascertain compliance with Laws and Regulations.
- B. Promptly notify Coordinating Special Inspector, OWNER, ENGINEER and CONTRACTOR of irregularities or deficiencies in the Work observed during Special Inspections. Corrective action, if required, will be determined by ENGINEER.
- C. Promptly submit two copies of each report of inspections and tests to Coordinating Special Inspector, ENGINEER, and CONTRACTOR including:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name and signature of inspector.
 - 4. Date of inspection or sampling and test.
 - 5. Record of temperature and weather.
 - 6. Identification of product and Specification Section.
 - 7. Location in Project.
 - 8. Type of inspection or test.
 - 9. Results of inspections and tests, and observations regarding compliance with Laws and Regulations, and standards.
- D. At the end of construction, each inspector and testing agency shall prepare an Agent's Final Report which is included in Supplement B.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SUPPLEMENTS

- A. The supplements listed below, following the “End of Section” designation, are part of this Section:
 - 1. Supplement A – Statement of Special Inspections
 - 2. Supplement B – Final Report of Special Inspections

++ END OF SECTION ++

Supplement A - Statement of Special Inspections

Project: Taylor Mill Water Treatment Plant: Electrical and Basin Improvements

Location: 608 Grand Avenue, Taylor Mill, KY 41015

Owner: Northern Kentucky Water District

Prepared By: Structural Engineer of Record: Imelda V. Cauley, P.E.

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to the Project as well as the name of the Coordinating Special Inspector and the identity of other approved agencies to be retained for conducting these inspections and tests.

The Coordinating Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Inspections listed are periodic unless indicated to be continuous or required by code to be continuous.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: As requested by Building Official

Quality Assurance Plan

Quality Assurance for Seismic Resistance (IBC 1705.3)

Seismic Design Category = B

Quality Assurance Plan is not required.

Quality Assurance for Wind Requirements (IBC 1705.4)

Basic Wind Speed = 90 mph

Wind Exposure Category = C

Quality Assurance Plan is not required.

Cast-in-Place Concrete

Item	Scope
1. Mix Design	<i>Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design.</i>
2. Material Certification	<i>Review trial batch or supporting test data to verify mix meets specified requirements. Confirm materials meet specified requirements.</i>
3. Reinforcement Installation	<i>Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters</i>
4. Formwork Geometry	<i>Inspect formwork for proper materials, dimensions and alignment.</i>
6. Anchor Rods	<i>Inspect size, positioning and embedment of anchor rods. Inspect concrete placement and consolidation around anchors. (continuous)</i>
7. Concrete Placement	<i>Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated. (continuous)</i>
8. Sampling and Testing of Concrete	<i>Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231) and temperature (ASTM C1064).</i>
9. Curing and Protection	<i>Inspect curing, cold weather protection and hot weather protection procedures.</i>

Anchor Systems

Item	Scope
1. Material Certification	<ul style="list-style-type: none"> • <i>Confirm anchor type (including product name), anchor dimensions, and anchor material grade for each anchor application.</i> • <i>Confirm post-installed anchor compliance with specified requirements and suitability for each application type by review of the anchor system ICC-ES Evaluation Service Report.</i> • <i>For adhesive anchors, confirm adhesive type</i>
2. Installation of Adhesive Anchors for Concrete	<ul style="list-style-type: none"> • <i>Review compliance with the installation requirements of the anchor system ICC Evaluation Service Report.</i> • <i>Verify and record anchor type (including product name), anchor dimensions, anchor material grade, adhesive type, adhesive expiration date, concrete or masonry type, base material compressive strength, drill bit type, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, base material thickness, anchor embedment, curing period prior to tightening, and tightening torque.</i> • <i>Inspect installation of each type and size of adhesive anchor by construction personnel on the site. (continuous)</i>
3. Installation of Concrete Wedge Expansion Anchors	<ul style="list-style-type: none"> • <i>Review compliance with the installation requirements of the anchor system ICC Evaluation Service Report.</i> • <i>Verify and record anchor type (including product name), anchor dimensions, anchor material grade, concrete or masonry type, base material compressive strength, drill bit type, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, base material thickness, anchor embedment and tightening torque.</i> • <i>Inspect installation of each type and size of wedge anchor by construction personnel on the site. (continuous)</i>
4. Anchor Testing	<ul style="list-style-type: none"> • <i>Perform tension pullout test on 10 percent of each post-installed anchor type and size.</i>

Supplement B - Final Report of Special Inspections

Project: Taylor Mill Water Treatment Plant: Electrical and Basin Improvements
Location: 608 Grand Avenue, Taylor Mill, KY 41015
Owner: Northern Kentucky Water District
Owner's Address:

To the best of my information, knowledge and belief, the Special Inspections required for this project, and itemized in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of corrections.)

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,
Special Inspector

(Type or print name)

Signature

Date

Agent's Final Report

Project: Taylor Mill Water Treatment Plant: Electrical and Basin Improvements

Agent:

Special Inspector:

To the best of my information, knowledge and belief, the Special Inspections or testing required for this project, and designated for this Agent in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of corrections.)

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,
Agent of the Special Inspector

(Type or print name)

Signature

Date

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SECTION 01 45 53

CLEANING, TESTING AND DISINFECTING HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide labor, material, tools, equipment, and incidentals as shown, specified, and required to clean, flush, disinfect, and test structures.
2. The Work also includes all labor and materials required to prepare structure for testing and disinfecting, conveying water to testing location, performing testing, and all labor and materials required to drain and dispose of water used for testing and disinfecting.

B. Water for Testing:

1. Water for initial testing will be furnished by OWNER.
2. CONTRACTOR shall provide temporary piping, hoses, valves, backflow preventers, appurtenances, and services required for testing.
3. CONTRACTOR shall convey the water to testing location.
4. Cost of water for re-testing shall be paid by CONTRACTOR to OWNER at OWNER's standard rates.

C. Provide chemicals for disinfection and dechlorination.

D. Related Sections:

1. Section 03 00 05, Concrete

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ACI 350.1/ACI 350.1R, Tightness Testing of Environmental Engineering Concrete Structures.
2. APHA/AWWA/Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater.
3. AWWA C652, Disinfection of Water-Storage Facilities.
4. AWWA C653, Disinfection of Water Treatment Plants.
5. NSF/ANSI 60, Drinking Water Treatment Chemicals – Health Effects.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have

the following meaning:

1. "Hydraulic structures" are tanks, channels, and other structures through which fluid is conveyed or that hold fluid. Hydraulic structures include structures open to the atmosphere and structures with closed tops. Hydraulic structures, include wet wells, junction chambers, equalization tanks, storage tanks, treatment process tanks such as grit chambers, clarifiers, aeration tanks, filter beds, contact tanks, and other channels and tanks designated in this Section. Excluded are structures that are to be cleaned or tested under other Specification Sections.

1.4 QUALITY ASSURANCE

A. Testing Laboratory:

1. Testing for bacteria and odor shall be by laboratory certified by authority having jurisdiction. Submit test results to CONSTRUCTION CONTRACT ADMINISTRATOR.
2. Refer to Section 01 45 29, Testing Laboratory Services, for testing laboratory qualifications requirements.

B. Regulatory Requirements:

1. Backflow preventers shall be tested by certified backflow prevention technician and certified by the authority having jurisdiction within one year or less of date of backflow preventer's use on the Project.

1.5 SUBMITTALS

A. Action Submittals: Provide the following:

1. Product Data:
 - a. Data sheets on chemicals used for disinfection and dechlorination.
 - b. Proof of NSF/ANSI 60 compliance for chemicals used in disinfection and dechlorination.
2. Procedure Submittals (including proposed plans for water conveyance, control, and disposal):
 - a. Cleaning procedures.
 - b. Hydrostatic testing procedures and equipment required, by structure to be tested.
 - c. Air testing procedures and equipment required, by structure to be tested.
 - d. Disinfection procedures and equipment required, by structure to be tested.

B. Informational Submittals: Provide the following:

1. Certifications:
 - a. Certification of each backflow preventer proposed for use.
 - b. Calibration certification for each flow meter proposed for use.

- c. Certification that tests were performed in compliance with referenced standards.
2. Special Procedure Submittals:
 - a. Schedule for each test required.
 - b. Procedure for disposal of chlorinated water, including proposed dechlorination chemical and methods.
 - c. Provide written notice of intent to test each structure at least 14 days prior to planned testing. Testing shall not commence without acceptance of CONSTRUCTION CONTRACT ADMINISTRATOR.
3. Site Quality Control Submittals:
 - a. Results of each test.
 - b. Chain of custody documentation for bacteriological and odor tests
4. Qualifications Statements:
 - a. Testing laboratory qualifications in accordance with Section 01 45 29, Testing Laboratory Services.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Provide and maintain temporary valves, plugs, and bulkheads, and other water control equipment suitable for the intended use. Do not use materials that would be injurious to the Work. Backflow preventers shall be reduced pressure zone-type.
- B. Chemicals:
 1. Chemicals used for disinfection and dechlorination shall conform to NSF/ANSI 60.

PART 3 – EXECUTION

3.1 CLEANING

- A. Cleaning Requirements:
 1. Prior to testing, remove all scaffolding, planks, tools, rags, dirt, debris, and material not part of the structure.
 2. Thoroughly clean walls, floors, and operating equipment by sweeping, high-pressure wash, scrubbing, or other methods that will not injure the Work and existing facilities.
 3. Remove from the hydraulic structure all water, dirt, and foreign material accumulated during cleaning. Provide temporary pumps, piping, and facilities as required to discharge water from the cleaning operation in

manner acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR and in conformance with Laws and Regulations.

4. Do not proceed with testing until CONSTRUCTION CONTRACT ADMINISTRATOR has accepted in the field results of cleaning.
5. Conform to Section 01 74 05, Cleaning.

3.2 TESTING AND DISINFECTION, GENERAL

- A. Conform to the following:
 1. Test each hydraulic structure separately.
- B. Hydraulic structures shall be free of visible leakage. Repair leaks in manner in accordance with the Contract Documents.
- C. Successfully test structure before applying exterior coating systems and before installing masonry block veneer (if any). Apply and cure protective coatings for concrete before starting disinfection.
- D. Provide disinfection as late as possible to provide maximum degree of sterility at the time the Work is placed into continuous service.
- E. Bacteriological and odor testing shall be performed by certified testing laboratory retained by CONTRACTOR. Testing laboratory shall be acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR. Samples shall be obtained and transported by testing laboratory employee. Results of bacteriological testing shall indicate conformance with the Contract Documents and shall be acceptable to the authority having jurisdiction.
- F. Release of water from structure after testing shall be as approved or accepted (as applicable) by CONSTRUCTION CONTRACT ADMINISTRATOR.

3.3 TESTING OF APPURTENANT PIPING

- A. Test piping appurtenant to hydraulic structures in accordance with the Contract Documents.

3.4 DISINFECTING HYDRAULIC STRUCTURES

- A. Hydraulic structures to be disinfected shall be chlorinated by CONTRACTOR in accordance with one of the methods in AWWA C652, unless otherwise specified or indicated in the Contract Documents.

- B. Disinfection:
1. Provide temporary taps, plugs, valves, drains, pumps, tanks, piping, facilities, and connections required to disinfect, dechlorinate, and remove chlorinated water as specified.
 2. Disinfect hydraulic structures immediately before each structure is placed in operation to prevent facility from becoming contaminated after disinfection.
 3. Use solution of water and liquid chlorine, calcium hypochlorite, or sodium hypochlorite. Placement of chlorine powder or tablets inside hydraulic structure as means of disinfection is not allowed.
 4. Introduce chlorine solution into hydraulic structure in manner accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
 5. Add potable water to hydraulic structure with the chlorine solution. Introduce water to hydraulic structure through backflow prevention device.
 6. Upon completion of disinfection of each hydraulic structure, dechlorinate contents of hydraulic structure until chlorine residual equals the residual in local potable water system. If residual of local potable water system is not available, dechlorinate to maximum chlorine residual of 0.5 mg/L. Dechlorination shall be in accordance with AWWA C653.
 7. Discharge of chlorinated water into a sewer will not be allowed without written approval of owner of wastewater conveyance system and wastewater treatment facility. Do not discharge chlorinated water onto roadways or into ditches, storm sewers, drainage culverts, streams, or wetlands.
- C. After disinfection is completed and before hydraulic structure is placed in service, test the hydraulic structure for odor and bacteria in accordance with AWWA C652 and "Standard Methods for Examination of Water and Wastewater".
- D. Samples for bacteriological and odor testing shall be obtained from each disinfected hydraulic structure as follows:
1. Immediately After Completion of Disinfection: Minimum of two samples.
 2. Twenty-four Hours after Obtaining First Set of Samples: Minimum of two samples.
- E. Sampling and testing for bacteriological and odor tests shall conform to Paragraph 3.2.E of this Section. Test results shall indicate satisfactory results for bacteria and odor, in accordance with requirements of authority having jurisdiction, before hydraulic structure will be Substantially Complete.
- F. Repeat the disinfection procedure at no additional cost to OWNER until test results indicate satisfactory results for bacteria and odor.

++ END OF SECTION ++

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SECTION 01 51 13

TEMPORARY ELECTRICITY

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

This section specifies administrative and procedural requirements for temporary electricity and lighting.

- A. Use Charges: No cost or usage charges for temporary electricity or lighting are chargeable to the Owner or Engineer. Cost or use charges for temporary electricity or lighting will not be accepted as a basis of claims for a change-order extra.

1.2 RELATED DOCUMENTS

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

1.3 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.
 - 1. 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 public nuisances or hazardous conditions to develop or persist on 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. Temporary services shall be separated into two service types:
1. Temporary Service for construction needs (number of services as required to meet this specification).
- 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. He 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.

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 and equipment upon completion of construction.
- B. Repair damage caused by installation, and restore to specified or original condition.

++ END OF SECTION ++

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SECTION 01 51 36

TEMPORARY WATER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Potable water for construction operators:

1. CONTRACTOR shall provide temporary water for entire Project, as specified in this Section.
 - a. Pay all costs for temporary water service facilities, including installation, maintenance, and removal.
 - 1) Obtain permits and pay fees and deposits required by owner of existing water system and authorities having jurisdiction
 - 2) Provide required facilities including piping, valves, meters if not provided by owner of existing waterline, backflow preventers, pressure regulators, and other appurtenances. Provide freeze-protection as required.
 - 3) Provide water for temporary sanitary facilities, field offices, Site cleaning and, when applicable, disinfecting and testing of systems.
 - 4) Continuously maintain adequate water flow and pressure for all purposes during Project, until removal of temporary water system. Provide temporary booster pumps, tanks, compressors, and appurtenances as required for maintaining flow and pressure.
 - 5) Should OWNER occupy part of Project prior to Substantial Completion, cost of water consumed via temporary water service will be shared proportionately between OWNER and CONTRACTOR per a mutually agreeable basis.
 - b. Maintain, service, and clean temporary water facilities and continuously provide consumables.
 - c. Facilities shall be adequate for personnel using the Site and requirements of Project.
 - d. Provide facilities in compliance with Laws and Regulations and, when applicable, requirements of water utility.

B. Water:

1. Temporary potable water for testing or other approved uses during project:
 - a. OWNER will provide the CONTRACTOR a connection to the plant water system using a 2 -inch diameter yard hydrant with a meter and backflow preventer for temporary needs that do not exceed 30 days per each use. The CONTRACTOR is responsible for safety and security of the meter and backflow assembly and for obtaining a hydrant permit from the OWNER.

- b. The OWNER will track the usage of water through the meter. The OWNER will not charge for water used for project purposes unless the CONTRACTOR is found careless with control of the usage. Secure written permission for connection and use from OWNER and met requirements for use. Notify fire department before obtaining water from fire hydrants.
 - c. Use only special hydrant operating wrenches to open hydrants. Make certain hydrant valve is open full, since cracking calve causes damage to hydrant. Repair damaged hydrants and notify OWNER as quickly as possible. Hydrants shall be completely accessible to fire department at all times.
- C. CONTRACTOR shall provide water hoses from hose bibs or hydrants, as applicable, to point of operations required for Work.
- D. Potable Water Source:
- 1. Provide temporary potable water by connecting to existing potable waterline as designated by OWNER. Do not connect to existing fire hydrants.
 - 2. Water Meter: Temporary water service shall have a calibrated meter suitable for the application. Temporary meter will be provided by CONTRACTOR.

1.2 USE OF OWNER'S SYSTEM

- A. Restrictions:
- 1. Existing Systems: Modify and extend existing system for temporary water service.
 - 2. Permanent System Provided Under the Project: Obtain OWNER's written permission for using permanent water system provided under the Project, indicating conditions of use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials may be new or used, and shall be adequate for purpose required.
- B. When connecting to existing waterline at location other than existing fitting, provide suitable stainless steel tapping sleeve with appropriate valve. Do not remove existing waterline from service for tapping.
- C. Temporary Backflow Preventers:
- 1. Shall be reduced pressure zone-type with an air gap between discharge point and drain.

2. Size and Capacity: Sufficient for the water flow and pressure requirements of the temporary water system.
3. Backflow preventers shall conform to Laws and Regulations and continually have a valid test certificate signed by a backflow preventer technician licensed by the authority having jurisdiction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install temporary water service in neat, orderly manner. Temporary water system shall be structurally and mechanically sound throughout.
2. Locate temporary piping, hose bibs, and hydrants as applicable to provide temporary water service convenient to work areas. Avoid interfering with the Work, traffic and work areas, materials handling equipment, OWNER's operating areas, storage areas, and work under other contracts.
3. Do not locate backflow preventers in basements or in underground chambers. When backflow preventer is outdoors, provide freeze protection.
4. Do not run piping on floor or on ground.
5. Provide drip pan or bucket under each hose bib located within building, and connect drain to sewer, or empty pan or bucket when half full.

B. Modify and extend temporary water service as required by progress of Project.

C. Disinfect temporary water service prior to use in accordance with requirements of authorities having jurisdiction.

3.2 USE

A. Properly supervise temporary water service:

1. Enforce conformance with Laws and Regulations.
2. Enforce sanitary practices.
3. Prevent abuse of services.
4. Prevent wasteful use of water.
5. Protect system from freezing.

3.3 REMOVAL

A. Completely remove temporary facilities and materials when no longer required. Repair damage caused by temporary facilities and their removal and restore Site to specified condition; if restoration of damaged areas is not specified, restore to pre-construction condition.

- B. Where temporary water service is disconnected from existing line, provide suitable, disinfected, watertight cap or blind flange, as applicable, on service line, per requirements of owner of the waterline.

++ END OF SECTION ++

SECTION 01 52 16

TEMPORARY SANITARY AND FIRST AID FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall provide temporary sanitary and first-aid facilities during the Project, including:
1. Paying all costs for temporary sanitary and first-aid facilities, including installation, maintenance, and removal.
 2. Maintain, service, and clean sanitary and first-aid facilities. Keep sanitary and first-aid facilities continuously supplied with consumables.
 3. Facilities shall be adequate for personnel using the Site.
 4. Provide facilities in compliance with Laws and Regulations.
- B. Temporary sanitary and first-aid facilities provided shall include:
1. Potable drinking water supply and cups.
 2. Enclosed Toilet Facilities: Temporary flush toilets or portable toilets.
 3. Suitable washing facilities for employees.
 4. First-aid stations at or immediately adjacent to Site's major work areas, and inside CONTRACTOR's temporary field office. Locations of first-aid stations shall be determined by CONTRACTOR's safety representative. Other contractors shall provide first-aid stations in their own field office.
 5. Post list of emergency telephone numbers at each hardwired telephone at Site, including emergency medical services, hospitals, and ambulance services.
 6. When Work is in progress, provide at the Site at least one person trained in first-aid. First-aid-trained personnel shall possess valid certificate indicating that they have successfully completed first-aid training course by the American Red Cross or similar entity.
- C. Restrictions:
1. Existing Facilities: Shall not be used by contractors without written permission of OWNER with conditions for use.
 2. Permanent Facilities Provided Under the Project: Shall not be used by contractors.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location of temporary toilets shall be acceptable to OWNER.

3.2 USE

- A. Use of Temporary Facilities:
 - 1. Properly supervise temporary facilities.
 - 2. Enforce proper use of sanitary facilities, including preventing the committing of nuisances in buildings at the Site.
 - 3. Properly dispose of wastes.

3.3 REMOVAL

- A. Completely remove temporary facilities and materials when no longer required. Repair damage caused by temporary facilities and their removal and restore Site to specified condition; if restoration of damaged areas is not specified, restore to pre-construction condition.

++ END OF SECTION ++

SECTION 01 55 26

MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 – GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall keep all streets and traffic ways open for passage of traffic and pedestrians during the Work, unless otherwise approved by owner of the street, traffic way, or right-of-way, as applicable. Construction traffic shall access the Site only via entrance(s) approved by OWNER.
- B. When required to cross, obstruct or temporarily close a street or traffic way, provide and maintain suitable bridges, detours or other approved temporary expedient for the accommodation of traffic. Closings shall be for shortest time practical, and passage shall be restored immediately after completion of backfill and temporary paving or bridging.
- C. Give required advance notice to fire department, police department, and other emergency services as applicable of proposed construction operations.
- D. Give reasonable notice to owners or tenants of private property who may be affected by construction operations. Give minimum 5 day notice.
- E. Provide signs, signals, barricades, flares, lights and other equipment, service, and personnel required to regulate and protect all traffic and warn of hazards. Such Work shall conform to requirements of OWNER and authority having jurisdiction at the Site. Remove temporary equipment and facilities when no longer required, and restore grounds to original or to specified conditions, as applicable.
- F. Howard Street shall not be closed to traffic as specified in Section 01 14 19, Use of Site. The St Anthony School 2013-2014 calendar may be obtained from the OWNER.

1.2 TRAFFIC SIGNALS AND SIGNS

- A. Provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under CONTRACTOR's control, and areas affected by CONTRACTOR's operations.
- B. Provide traffic control and directional signs, mounted on barricades or standard posts at the following locations:
 - 1. Each change of direction of a roadway and at each crossroad.

2. Detours and hazardous areas.
3. Parking areas.

1.3 FLAGMEN

- A. Provide qualified and suitably equipped flagmen when construction operations encroach on traffic lanes, as required for regulation of traffic and in accordance with requirements of the authority having jurisdiction.

1.4 FLARES AND LIGHTS

- A. Provide flares and lights during periods of low visibility, for the following:
 1. To clearly delineate traffic lanes, to guide traffic, and to warn of hazardous areas.
 2. For use by flagmen directing traffic.
- B. Provide adequate illumination of critical traffic and parking areas.

1.5 PARKING CONTROL

- A. Control all CONTRACTOR-related vehicular parking within limits of the Work to preclude interfering with: public traffic or parking, access by emergency vehicles, OWNER's operations, and construction operations. Provide temporary parking facilities for the public, as required because of construction or operations.
- B. Monitor parking of all construction and private vehicles at the Site:
 1. Maintain free vehicular access to and through parking areas.
 2. Prohibit parking on or adjacent to access roads, and in non-designated areas.
 3. Construction vehicles must possess current vehicle registration.
 4. Private vehicles shall park only in designated areas.

1.6 HAUL ROUTES

- A. Consult with authorities having jurisdiction to establish thoroughfares that will be used as haul routes and Site access.
- B. Drawings indicate haul routes, designated by authorities having jurisdiction, that shall be used for construction traffic.
- C. Submit proposed haul routes to CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER and obtain approval of authorities having jurisdiction.
- D. Confine construction traffic to designated haul routes.

- E. Provide traffic control at critical areas of haul routes to expedite traffic flow, and to minimize interference with normal traffic.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 57 05

TEMPORARY CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide and maintain methods, equipment, and temporary construction as required to control environmental conditions at the Site and adjacent areas.
2. Maintain controls until no longer required.
3. Upon completion of the Work, remove temporary controls and restore Site to specified condition; if condition is not specified, restore Site to pre-construction condition.

1.2 NOISE CONTROL

A. Noise Control – General:

1. CONTRACTOR's vehicles and equipment shall minimize noise to greatest degree practicable.
2. Noise levels shall conform to Laws and Regulations, including OSHA requirements and local ordinances.
3. Noise levels shall not interfere with the work of OWNER or others.

1.3 DUST CONTROL

- ###### A. Control objectionable dust caused by CONTRACTOR's operation of vehicles and equipment, clearing, or other actions. To minimize airborne dust, apply water or use other methods subject to acceptance of CONSTRUCTION CONTRACT ADMINISTRATOR and approval of authorities having jurisdiction.

1.4 PEST AND RODENT CONTROL

A. Pest and Rodent Control – General:

1. Provide rodent and pest control as required to prevent infestation of the Site and storage areas.
2. Employ methods and use materials that do not adversely affect conditions at the Site or on adjoining properties.

1.5 WATER CONTROL

A. Water Control – General:

1. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the Site, and adjoining properties.
 2. Control fill, grading, and ditching to direct water away from excavations, pits, tunnels and other construction areas and to direct drainage to proper runoff courses to prevent erosion, damage, or nuisance.
- B. Equipment and Facilities for Water Control: Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
- C. Discharge and Disposal: Dispose of drainage water in manner to prevent flooding, erosion, and other damage to any and all parts of the Site and adjoining areas, and that conforms to Laws and Regulations.

1.6 POLLUTION CONTROL

- A. Pollution Control – General:
1. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere caused by discharge of noxious substances from construction operations.
 2. Equipment used during construction shall conform to federal, state, and local Laws and Regulations.
 3. Refer to Section 01 35 43, Contractor’s Hazardous Materials Management Program.
- B. Spills and Contamination:
1. Provide equipment and personnel to perform emergency measures required to contain spillages, and to remove contaminated soils or liquids.
 2. Excavate contaminated earth and dispose of off-Site, and replace with suitable compacted fill and topsoil.
 3. Refer to Section 01 35 44, Spill Prevention Control and Countermeasures Plan
- C. Protection of Surface Waters: Implement special measures to prevent harmful substances from entering surface waters. Prevent disposal of wastes, effluents, chemicals, or other such substances in or adjacent to surface waters and open drainage routes, in sanitary sewers, or in storm sewers.
- D. Atmospheric Pollutants:
1. Provide systems for controlling atmospheric pollutants related to the Work.
 2. Prevent toxic concentrations of chemicals.
 3. Prevent harmful dispersal of pollutants into atmosphere.
- E. Solid Waste:
1. Provide systems for controlling and managing solid waste related to the Work.
 2. Prevent solid waste from becoming airborne, and from discharging to surface waters and drainage routes.

3. Properly handle and dispose of solid waste.

1.7 EROSION CONTROL

A. Erosion Control – General:

1. Plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
2. Coordinate erosion controls with requirements of Article 1.5 of this Section.
3. Hold to a minimum the areas of bare soil exposed at one time.
4. Provide temporary control measures such as berms, dikes, and drains.
5. Construct fills and waste areas by selective placement to eliminate surface silts or clays that will erode.
6. Periodically inspect earthwork to detect evidence of the start of erosion; apply corrective measures as required to control erosion. Continue inspections and corrective measures until permanent vegetation has been established

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 57 33

SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall safely guard all the Work, products, equipment, and property from loss, theft, damage, and vandalism until Substantial Completion. CONTRACTOR's duty includes safely guarding OWNER's property in vicinity of the Work and other private property from injury or loss in connection with performance of the Work.
2. Employ watchmen as required to provide required security and prevent unauthorized entry.
3. Costs for security specified in this Section shall be paid by CONTRACTOR.
4. Make no claim against OWNER for damage resulting from trespass.
5. Provide full compensation for damage to property of OWNER and others arising from failure to provide adequate security.
6. Provide temporary fencing in accordance with the Contract Documents.
7. CONTRACTOR's security measures shall be at least equal to those usually provided by OWNER to protect existing facilities during normal operation.

1.2 CONTRACTOR'S SITE ACCESS AND SECURITY PROCEDURES

- ###### A. Conform to OWNER's security procedures and access restrictions at Site throughout entire Project. CONTRACTOR, including Subcontractors and Suppliers, shall comply with the following:
1. Personnel Identification: All CONTRACTOR personnel shall wear at all times on-Site a badge bearing CONTRACTOR's name, employee's name and, as applicable, employee number.
 2. Vehicle Identification: While on-Site, all CONTRACTOR vehicles, including employee vehicles, shall display vehicle identification tag in the windshield. Vehicle tag shall include the following information: Site name, CONTRACTOR name, contract number, vehicle license plate number and state of issue, name and employer of vehicle owner, and vehicle owner contact telephone number.
 3. Parking: Do not park outside of designated CONTRACTOR parking area, which shall be coordinated with the OWNER.

1.3 TEMPORARY FENCING

- A. If security fencing or barriers are breached or temporarily removed for the Work, provide and maintain temporary security fencing equal to existing, unless otherwise specified, in manner satisfactory to CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER.

- B. Security fencing shall be installed around the construction area in a manner satisfactory to CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER. The security fencing along Grand Avenue and along the west property line shall incorporate green slats within the fencing for screening purposes.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 62 00

PRODUCT OPTIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR's options for selecting products.
 2. Requirements for consideration of "or-equal" products.

1.2 TERMINOLOGY

- A. The following words or terms are not defined but, when used in this Section, have the following meaning:
1. "Products" includes materials, equipment, machinery, components, fixtures, systems, and other goods incorporated in the Work. Products do not include machinery and equipment used for preparing, fabricating, conveying, erecting, or installing the Work. Products include OWNER-furnished goods incorporated in the Work where use of such goods is specifically required in the Contract Documents.

1.3 PRODUCT OPTIONS

- A. For products specified only by reference standard or description, without reference to Supplier, provide products meeting that standard, by a Supplier or from a source that complies with the Contract Documents.
- B. For products specified by naming one or more products or Suppliers, provide the named products that comply with the Contract Documents, unless an "or-equal" or substitute product is approved by ENGINEER.
- C. For products specified by naming only one product or manufacturer and followed by words indicating that no substitution is allowed, there is no option and no substitution will be allowed.

1.4 "OR EQUAL" PRODUCTS

- A. For proposed products not named in the Contract Documents and considered as an "or equal" as defined in the General Conditions, CONTRACTOR shall request in writing ENGINEER's approval of the "or equal". Request for approval of an "or equal" product shall accompany the Shop Drawing or product data submittal for the proposed product and shall include:

1. CONTRACTOR's request that the proposed product be considered as an "or equal" in accordance with the General Conditions, accompanied by CONTRACTOR's certifications required in the General Conditions.
2. Documentation adequate to show that proposed product does not require extensive revisions to the Contract Documents, that proposed product is consistent with the Contract Documents, and that proposed product will produce results and performance required in the Contract Documents, and that proposed product is compatible with other portions of the Work.
3. Detailed comparison of significant qualities of proposed product with the products and manufacturers named in the Contract Documents. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements shown or indicated.
4. Evidence that proposed product manufacturer will furnish warranty equal to or better than specified, if any.
5. List of similar installations for completed projects with project names and addresses, and names and address of design professionals and owners, if requested.
6. Samples, if requested.
7. Other information requested by ENGINEER.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 65 00

PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes the general requirements for transporting and handling of products.
2. CONTRACTOR shall make all arrangements for transporting, delivery, and handling of products required for prosecution and completion of the Work.
3. Move products stored, when necessary, them without additional compensation or changes to the Contract Times.

1.2 PREPARATION FOR SHIPMENT

- A. When practical, factory-assemble products. Match mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable, protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, OWNER's contract name and number, CONTRACTOR, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.
- C. Protect products from exposure to the elements and keep thoroughly dry and dust free at all times. Protect painted surfaces against impact, abrasion, discoloration, or other damage. Lubricate bearings and other items requiring lubrication.
- D. Advance Notice of Shipments:
 1. Keep CONSTRUCTION CONTRACT ADMINISTRATOR informed of delivery of all products to be incorporated in the Work.
 2. Upon receipt of Supplier's advance notice of shipment, at least seven days prior to delivery of products, provide CONSTRUCTION CONTRACT ADMINISTRATOR written notice of anticipated date and place of arrival of the following:
 - a. Tube Settler Modules.
 - b. Pump Control Valves.
 - c. Motors.
 - d. Motor Control Centers.

e. Variable Frequency Drives.

E. Do not have products shipped until:

1. Related Shop Drawings, Samples, and other submittals have been approved or accepted (as applicable) by CONSTRUCTION CONTRACT ADMINISTRATOR.
2. Related factory testing results, when required in individual Specification Sections, have been reviewed and accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
3. Required storage facilities have been provided.

1.3 DELIVERY

A. Scheduling and Timing of Deliveries:

1. Arrange deliveries of products in accordance with the accepted Progress Schedule and in ample time to facilitate inspection prior to installation.
2. Schedule deliveries to minimize space required for and duration of on-Site storage of products and equipment.
3. Coordinate deliveries to avoid conflicting with the Work and conditions at Site, and to accommodate the following:
 - a. Work of other contractors, and OWNER.
 - b. Storage space limitations.
 - c. Availability of equipment and personnel for handling products.
 - d. OWNER's use of premises.
4. Deliver products to the Site during regular working hours.

B. Deliveries:

1. Shipments shall be delivered with CONTRACTOR's name, Subcontractor's name (if applicable), Site name, Project name, and contract designation (e.g., "ABC Construction Co., City of Somewhere, Idaho, Wastewater Treatment Plant Clarifier Improvements, Contract 25, General Construction") clearly marked.
2. Site may be listed as the "Ship To" or "Delivery" address; but OWNER shall not be listed as recipient of shipment, unless otherwise directed in writing by CONSTRUCTION CONTRACT ADMINISTRATOR.
3. Provide CONTRACTOR's telephone number to shipper; do not provide OWNER's telephone number.
4. Arrange for deliveries while CONTRACTOR's personnel are on-Site. CONTRACTOR shall receive and coordinate shipment upon delivery. Shipments delivered to the Site when CONTRACTOR is not present will be refused by OWNER, and CONTRACTOR shall be responsible for delays and additional costs, if incurred.

C. Containers and Marking:

1. Have products delivered to Site in manufacturer's original, unopened, labeled containers.
 2. Clearly mark partial deliveries of component parts of equipment to identify equipment, to allow easy accumulation of parts, and to facilitate assembly.
- D. Immediately upon delivery, inspect shipment to verify that:
1. Products comply with the Contract Documents and approved or accepted (as applicable) submittals.
 2. Quantities are correct.
 3. Products are undamaged.
 4. Containers and packages are intact and labels are legible.
 5. Products are properly protected.
- E. Promptly remove damaged products from the Site and expedite delivery of new, undamaged products, and remedy incomplete or lost products to provide that specified, to avoid delaying progress of the Work.

1.4 PRODUCT HANDLING

- A. Provide equipment and personnel necessary to handle products, including those provided by OWNER, by methods that prevent soiling or damaging products and packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring, or otherwise damaging products or surrounding surfaces.
- C. Handle products by methods that prevent bending or overstressing.
- D. Lift heavy components only at designated lifting points.
- E. Handle products in safe manner and as recommended by manufacturer to prevent damage. Do not drop, roll, or skid products off delivery vehicles or at other times during handling. Hand-carry or use suitable materials handling equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 66 00

PRODUCT STORAGE AND HANDLING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section includes general requirements for storing and protecting materials and equipment.

1.2 STORAGE

- A. Store and protect materials and equipment in accordance with manufacturer's recommendations and the Contract Documents.
- B. CONTRACTOR shall make all arrangements and provisions necessary for, and pay all costs for, storing materials and equipment. Excavated materials, construction equipment, and materials and equipment to be incorporated into the Work shall be placed to avoid injuring the Work and existing facilities and property, and so that free access is maintained at all times to all parts of the Work and to public utility installations in vicinity of the Work. Store materials and equipment neatly and compactly in locations that cause minimum inconvenience to OWNER, other contractors, public travel, and owners, tenants, and occupants of adjoining property. Arrange storage in manner to provide easy access for inspection.
- C. Areas available at the Site for storing materials and equipment shall be as shown or indicated in the Contract Documents, or as approved by CONSTRUCTION CONTRACT ADMINISTRATOR.
- D. Store materials and equipment to become property of OWNER to facilitate their inspection and ensure preservation of quality and fitness of the Work, including proper protection against damage by freezing, moisture, and high temperatures with ambient temperatures as high as 100 degrees F. Store in indoor, climate-controlled storage areas all materials and equipment subject to damage by moisture, humidity, heat, cold, and other elements, unless otherwise acceptable to OWNER. When placing orders to Suppliers for equipment and controls containing computer chips, electronics, and solid-state devices, CONTRACTOR shall request, coordinate, and comply with specific temperature and humidity limitations on materials and equipment, because temperature inside cabinets and components stored in warm temperatures can approach 200 degrees F.
- E. CONTRACTOR shall be fully responsible for loss or damage (including theft) to

stored materials and equipment.

- F. Do not open manufacturer's containers until time of installation, unless recommended by the manufacturer or otherwise specified in the Contract Documents.
- G. Do not store materials or equipment in structures being constructed unless approved by CONSTRUCTION CONTRACT ADMINISTRATOR in writing.
- H. Do not use lawns or other private property for storage without written permission of the owner or other person in possession or control of such premises.

1.3 PROTECTION

- A. Equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipping, handling, and storage, in accordance with Section 01651, Transportation and Handling of Products.
- B. Store all materials and equipment off the ground or floor on raised supports such as skids or pallets.
- C. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Painted equipment surfaces that are damaged or marred shall be repainted in their entirety in accordance with equipment manufacturer and paint manufacturer requirements, to the satisfaction of CONSTRUCTION CONTRACT ADMINISTRATOR.
- D. Protect electrical equipment, controls, and instrumentation against moisture, water damage, heat, cold, and dust. Space heaters provided in equipment shall be connected and operating at all times until equipment is placed in operation and permanently connected.

1.4 UNCOVERED STORAGE

- A. The following types of materials may be stored outdoors without cover on supports so there is no contact with the ground:
 - 1. Reinforcing steel.
 - 2. Structural steel.
 - 3. Piping, except polyvinyl chloride (PVC) or chlorinated PVC (CPVC) pipe.
 - 4. Precast concrete materials.
 - 5. Castings.
 - 6. Handrails and railings.
 - 7. Grating.
 - 8. Checker plate.
 - 9. Metal stairs.

10. Metal access hatches.
11. Fiberglass products.
12. Rigid electrical conduit.

1.5 COVERED STORAGE

- A. The following materials and equipment may be stored outdoors on supports and completely covered with covering impervious to water:
 1. Rough lumber.
 2. PVC and CPVC pipe.
 3. Filter media.
 4. Masonry units.
 5. Grout and mortar materials.
- B. Tie down covers with rope, and slope covering to prevent accumulation of water.
- C. Store loose granular materials, with covering impervious to water, in well-drained area or on solid surfaces to prevent mixing with foreign matter.

1.6 FULLY PROTECTED STORAGE

- A. Store all material and equipment not named in Articles 1.4 and 1.5 of this Section in on supports in buildings or trailers that have concrete or wooden flooring, roof, and fully closed walls on all sides. Covering with visquine plastic sheeting or similar material in space without floor, roof, and walls is not acceptable. Comply with the following:
 1. Provide heated storage for materials and equipment that could be damaged by low temperatures or freezing.
 2. Provide air-conditioned storage for materials and equipment that could be damaged by high temperatures.
 3. Protect mechanical and electrical equipment from being contaminated by dust, dirt, and moisture.
 4. Maintain humidity at levels recommended by manufacturers for electrical and electronic equipment.

1.7 HAZARDOUS PRODUCTS

- A. Prevent contamination of personnel, storage area, and the Site. Comply with Laws and Regulations, manufacturer's instructions, and Section 01413, Contractor's Hazardous Materials Management Program.

1.8 MAINTENANCE OF STORAGE

- A. On scheduled basis, periodically inspect stored materials and equipment to ensure

that:

1. State of storage facilities is adequate to provide required conditions.
 2. Required environmental conditions are maintained on continuing basis.
 3. Materials and equipment exposed to elements are not adversely affected.
- B. Mechanical and electrical equipment requiring long-term storage shall have complete manufacturer's instructions for servicing each item, with notice of enclosed instructions shown on exterior of container or package.
1. Comply with manufacturer's instructions on scheduled basis.
 2. Space heaters that are part of electrical equipment, shall be connected and operated continuously until equipment is placed in service and permanently connected.

1.9 MICROPROCESSORS, PANELS, AND INSTRUMENTATION STORAGE

- A. Store panels, microprocessor-based equipment, electronics, and other devices subject to damage or decreased useful life because of temperatures below 40 degrees F or above 100 degrees F, relative humidity above 90 percent, or exposure to rain or exposure to blowing dust in climate-controlled storage space.
- B. Requirements:
1. Storage shall be in third-party owned, bonded, insured, climate-controlled warehouse in Kenton County.
 2. OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR have the right to inspect materials and equipment during normal working hours.
 3. Placed inside each panel or device a desiccant, volatile corrosion inhibitor blocks (VCI), moisture indicator, and maximum-minimum indicating thermometer.
 4. Check panels and equipment at least once per month. Replace desiccant, VCI, and moisture indicator as often as required, or every six months, whichever occurs first.
 5. Certified record of daily maximum and minimum temperature and humidity in storage facility shall be available for inspection by OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR. Certified record of monthly inspection, noting maximum and minimum temperature for month, condition of desiccant, VCI, and moisture indicator, shall be available for inspection by OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR.
- C. Costs for storing climate-sensitive materials and equipment shall be paid by CONTRACTOR. Replace panels and devices damaged during storage, or for which storage temperatures or humidity range has been exceeded, at no additional cost to OWNER. Delays resulting from such replacement are causes within CONTRACTOR's control.

- D. Do not ship panels and equipment to the Site until conditions at the Site are suitable for installation, including slabs and floors, walls, roofs, and environmental controls. Failure to have the Site ready for installation shall not relieve CONTRACTOR from complying with the Contract Documents.

1.10 RECORDS

- A. Keep up-to-date account of materials and equipment in storage to facilitate preparation of Applications for Payment, if the Contract Documents provide for payment for materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01 71 33

PROTECTION OF THE WORK AND PROPERTY

PART 1 – GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall be responsible for taking all precautions, providing all programs, and taking all actions necessary to protect the Work and all public and private property and facilities from damage, as specified in the General Conditions and this Section.
- B. To prevent damage, injury, or loss, CONTRACTOR's actions shall include the following:
 - 1. Storing apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with progress of the Work or work of other contractors or utility company.
 - 2. Providing suitable storage facilities for materials subject to injury by exposure to weather, theft, breakage, or otherwise.
 - 3. Placing upon the Work or any part thereof only loads consistent with the safety and integrity of that portion of the Work.
 - 4. Frequently cleaning up refuse, rubbish, scrap materials, and debris caused by CONTRACTOR's operations so that, at all times, the Site is safe and orderly, and workmanlike in appearance.
 - 5. Providing barricades and guard rails around the following: openings, for scaffolding, for temporary stairs and ramps, around excavations, for elevated walkways, and other hazardous areas.
- C. Do not, except after written consent from proper parties, enter or occupy privately-owned land with personnel, tools, materials or equipment, except on lands and easements provided by OWNER.
- D. CONTRACTOR has full responsibility for preserving public and private property and facilities on and adjacent to the Site. Direct or indirect damage done by, or on account of, any act, omission, neglect, or misconduct by CONTRACTOR in executing the Work, shall be restored by CONTRACTOR, at his expense to condition equal to that existing before damage was done.

1.2 BARRICADES AND WARNING SIGNALS

- A. Barricades and Warning Signals – General:
 - 1. Where Work is performed on or adjacent to roadway, access road, right-of-way, or public place, provide barricades, fences, lights, warning signs, danger

- signals, watchmen, and take other precautionary measures for protecting persons, property, and the Work.
2. Paint barricades to be visible at night.
 3. From sunset to sunrise, furnish and maintain at least one light at each barricade.
 4. Erect sufficient barricades to keep vehicles from being driven on or into Work under construction.
 5. Furnish watchmen in sufficient numbers to protect the Work.
 6. CONTRACTOR's responsibility for maintaining barricades, signs, lights, and for providing watchmen shall continue until the Work is accepted in accordance with the General Conditions.

B. Temporary Fencing: Refer to Section 01 57 33, Security.

1.3 TREE AND PLANT PROTECTION

A. Tree and Plant Protection – General:

1. Protect existing trees, shrubs, and plants on or adjacent to the Site, shown or designated to remain in place, against unnecessary cutting, breaking, or skinning of trunk, branches, bark, or roots.
2. Do not store materials or park equipment within the drip line.
3. In areas subject to traffic, provide temporary fencing or barricades to protect trees and plants.
4. Fires are not allowed.
5. Within the limits of the Work, water trees and plants that are to remain to maintain their health during construction operations.
6. Cover all exposed roots with burlap, which shall be kept continuously wet. Cover exposed roots with earth as soon as possible. Protect root systems from mechanical damage and damage by erosion, flooding, runoff, or noxious materials in solution.
7. If branches or trunks are damaged, prune branches immediately and protect cut or damaged areas with emulsified asphalt compounded specifically for horticultural use in manner acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR.
8. When directed by CONSTRUCTION CONTRACT ADMINISTRATOR, remove and dispose of off-Site damaged trees and plants that die or suffer permanent injury, and replace damaged tree or plant with specimen of equal or better quality.

1.4 PROTECTION OF EXISTING STRUCTURES

A. Underground Facilities:

1. Underground Facilities are defined in the General Conditions.

2. All Underground Facilities known to OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR, except water, gas, sewer, electric, and communications services to individual buildings and properties, are shown. This information is the best available to OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR but, in accordance with the General Conditions, is not guaranteed to be correct or complete.
3. CONTRACTOR shall explore ahead of trenching and excavation Work and shall uncover obstructing Underground Facilities sufficiently to determine their location, to prevent damage to Underground Facilities, and to prevent service interruption to building or parcels served by Underground Facilities. If CONTRACTOR damages an Underground Facility, CONTRACTOR shall restore it to original condition, in accordance with requirements of the owner of the damaged facility and the General Conditions.
4. Necessary changes in the location of the Work may be directed by OWNER or CONSTRUCTION CONTRACT ADMINISTRATOR to avoid Underground Facilities not shown or indicated on the Contract Documents.
5. If permanent relocation of an existing Underground Facilities is required and is not otherwise shown or indicated in the Contract Documents, CONTRACTOR will be directed in writing to perform the Work. When the relocation Work results in a change in the Contract Price, Contract Time, or both, the relocation Work shall be paid after execution of associated Change Order, in accordance with the Contract Documents.

B. Surface Structures:

1. Surface structures are existing buildings, structures, and other facilities at or above ground surface, including their foundations or any extension below ground surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, exposed piping and utilities, poles, exposed wires, posts, signs, markers, curbs, walks, and other facilities visible at or above ground surface.
2. Existing surface facilities, including but not limited to guard rails, posts, guard cables, signs, poles, markers, and curbs that are temporarily removed to facilitate the Work shall be replaced and restored to their original condition at CONTRACTOR'S expense.

C. Protection of Underground Facilities and Surface Structures:

1. CONTRACTOR shall sustain in their places and protect from direct or indirect injury all Underground Facilities and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure or facility. Before proceeding with the Work of sustaining and supporting such structure or facility, CONTRACTOR shall satisfy CONSTRUCTION CONTRACT ADMINISTRATOR that methods and procedures to be used have been approved by party owning same.

2. CONTRACTOR shall bear all risks attending the presence or proximity of all Underground Facilities and surface structures within or adjacent to limits of the Work, in accordance with the Contract Documents. CONTRACTOR shall be responsible for damage and expense for direct or indirect injury caused by his Work to structures and facilities. CONTRACTOR shall repair immediately damage caused by his Work, to the satisfaction of owner of damaged structure or facility.

1.5 PROTECTION OF FLOORS AND ROOFS

- A. Protection of Floors and Roofs – General:
 1. Protect floors and roofs until acceptance of the Work in accordance with the General Conditions.
 2. Use proper protective covering when moving heavy equipment, handling materials or other loads, when painting, handling mortar or grout, and when cleaning walls and ceilings.
 3. Use metal pans to collect oil and cuttings from pipe, conduit, and rod threading machines, and under metal cutting machines.
 4. Do not load concrete floors less than 28 days old without written permission of CONSTRUCTION CONTRACT ADMINISTRATOR. Do not load floors, roofs, or slabs in excess of design loading.
 5. Do not load roofs without written permission of CONSTRUCTION CONTRACT ADMINISTRATOR.
 6. Restrict access to roofs, and keep CONTRACTOR personnel off existing roofs, except as required for the Work.
 7. If access to roofs is required, roofing, parapets, openings, and all other construction on or adjacent to roof shall be protected with suitable plywood or other acceptable means.

1.6 PROTECTION OF INSTALLED PRODUCTS AND LANDSCAPING

- A. Protect installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed prior to completion of Work.
- B. Control traffic to prevent damage to equipment, materials, and surfaces.
- C. Coverings:
 1. Provide coverings to protect equipment and materials from damage.
 2. Cover projections, wall corners and jambs, sills, and soffits of openings, in areas used for traffic and for passage of products in subsequent work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 73 24

INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section describes general requirements for installing products. Additional product installation requirements are included in the Specification Sections.

1.2 INSTALLATION QUALITY ASSURANCE AND QUALITY CONTROL

- A. Provide appropriate quality assurance for installing products, and provide quality control over Suppliers, products, services, Site conditions, and workmanship to provide Work of specified quality.
- B. Install products in accordance with approved Shop Drawings, the Contract Documents, and Supplier's installation data. If Supplier's data conflict with the Contract Documents, obtain clarification from CONSTRUCTION CONTRACT ADMINISTRATOR before proceeding.
 - 1. Supplier's installation data includes Supplier's written instructions; drawings; illustrative, wiring and schematic diagrams; diagrams identifying external connections, terminal block numbers and internal wiring; and all other such information pertaining to installation of products and equipment that is not furnished with Shop Drawings. Included are all Supplier's printed installation instructions, including those that may be attached to equipment.
- C. CONTRACTOR's installers shall be experienced in the types of Work required.

1.3 SERVICES OF SUPPLIER'S REPRESENTATIVE

- A. When specified, provide competent, qualified representatives of product Supplier to provide services specified, including supervising installation, adjusting, and testing of products.

PART 2 - PRODUCTS

2.1 EQUIPMENT DRIVE GUARDS

- A. Equipment Drive Guards:

1. Unless otherwise shown or specified, provide all-metal guards conforming to 29 CFR 1910, Subpart O, with equipment driven by open shafts, belts, chains, pulleys, sheaves, or gears. Guards shall enclose drive and driven mechanism.
2. If material of guards is not otherwise specified, guards shall be galvanized sheet steel, galvanized woven wire, or expanded metal set in a frame of galvanized steel members, as appropriate.
3. Secure guards in position by steel braces or straps, securely fastened to frame of equipment, floor, or wall as required.
4. Fastenings shall permit removal of guards for servicing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Prior to installing products, complete preparation of surfaces on which products are to be installed. Prior to installing products on new concrete, concrete shall achieve sufficient compressive strength to support the products.
2. Maintain Work area in a broom-clean condition during installation of products.
3. Use proper tools to assemble products. Do not deform or mar surface of shafts, nuts, and other parts.
4. Do not support rigging from building or structure without written permission of CONSTRUCTION CONTRACT ADMINISTRATOR. CONTRACTOR is responsible for and shall repair all damage to building or structure resulting from his operations.
5. During installation, maintain products in neutral position and do not exert undue stress on products.
6. Tighten connections requiring gaskets evenly all around to ensure uniform stress over entire gasket.
7. Use only an oil bath heater to expand couplings, gears, and other mechanical components to be expanded for installation. Do not force or drive couplings, gears, and other mechanical components onto equipment shafts, or subject them to open flame or torch.
8. Do not alter or repair products and do not burn or weld products unless specified in the Contract Documents or allowed by CONSTRUCTION CONTRACT ADMINISTRATOR.
9. Provide plugs in lubrication holes to prevent entry of foreign material.

B. Setting and Erection:

1. Wedging is not allowed. Use minimum number of shims required in leveling equipment being installed. Shims shall be Type 304L stainless steel, clean and free of slag. Provide shims, filling pieces, keys, packing, red or white lead grout, and other products necessary to properly align, level, and secure apparatus in place. Install products plum and level, unless otherwise specified,

and demonstrate plumbness and level to CONSTRUCTION CONTRACT ADMINISTRATOR. Bring parts to proper bearing after installation and erection.

2. Using experienced millwrights, carefully set and align equipment on foundations, after equipment soleplates or baseplates, as applicable, have been shimmed to true alignment at anchorages. Set anchorages in place and tighten nuts against shims. Check bedplates or wing feet of equipment after securing to foundations and, after confirming alignments, grout soleplates or baseplates, as applicable, in place.
3. Anchorages:
 - a. Provide anchorage setting drawings in time to coordinate with fabrication of products and the Work at the Site.
 - b. Anchorages shall conform to Section 05 05 33, Anchor Systems. Requests for approval of alternate anchorage methods shall be per the General Conditions and Section 01 25 00, Substitution Procedures.
4. Ream misaligned holes. Do not “force” bolts or keys.
5. Where applicable, properly align equipment with associated piping and utility connections, without exerting undue stress on connecting piping and utilities.

C. Alignment and Leveling:

1. Verify that all shafts, couplings, and sheaves are properly aligned and adjust to required tolerances.
2. Align couplings while equipment is free from external loads.
3. Check angular and parallel alignment and record actual alignment and submit to CONSTRUCTION CONTRACT ADMINISTRATOR. Alignment shall be within tolerances specified in Contract Documents and as recommended by Supplier of the product.
4. Use laser indicators or dial indicators for checking angular and parallel alignment. Using dial indicators requires that, during rotation of half couplings in performance of test, dial indicator shall be maintained in same relative position, and dial indicator readings taken at same place on circumference of coupling.

D. Threaded Connections:

1. Apply a molybdenum disulfide, anti-seize compound to threads in mechanical connections such as bolts, studs, cap screws, tubing, and other threads, unless otherwise specified.

++ END OF SECTION ++

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SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall perform cutting and coring, and rough and finish patching of holes and openings in existing construction.
- B. Cutting, coring, rough patching, and finish patching shall be by CONTRACTOR.
- C. Provide cutting, coring, fitting and patching, including attendant excavation and backfill, required to complete the Work, and to:
 - 1. Remove and replace defective Work;
 - 2. Remove samples of installed Work as specified or required for testing;
 - 3. Remove construction required to provide for specified alterations or addition to existing work;
 - 4. Uncover Work to for CONSTRUCTION CONTRACT ADMINISTRATOR's observation of covered Work or observation by authorities having jurisdiction;
 - 5. Connect to completed Work not performed in proper sequence;
 - 6. Remove or relocate existing utilities and pipes that obstruct the Work in locations where connections must be made;
 - 7. Make connections or alterations to existing or new facilities.
- D. Structural Elements: Do not cut or patch structural elements in manner that would change structural element's load-carrying capacity as load deflection ratio.
- E. Operating Elements: Do not cut or patch operating elements in manner that would reduce their capacity to perform as intended. Do not cut or patch operating elements or related components in manner that would increase maintenance requirements or decrease operational life or safety.

1.2 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Cutting and Patching Request:
 - a. Submit written request to CONSTRUCTION CONTRACT ADMINISTRATOR well in advance of executing cutting or alteration affecting:
 - 1) Design function or intent of Project.
 - 2) Work of OWNER or other contractors.
 - 3) Structural value or integrity of an element of the Project.

- 4) Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - 5) Efficiency, operational life, maintenance, or safety of operational elements.
 - 6) Visual qualities of sight-exposed elements.
- b. Request shall include:
- 1) Identification of Project and contract name and number.
 - 2) Description of affected Work of CONTRACTOR and work of others.
 - 3) Necessity for cutting.
 - 4) Effect on work of OWNER or other contractors, or on structural or weatherproof integrity of Project.
 - 5) Description of proposed Work, describing: scope of cutting and patching; trades who will be executing the Work; products proposed to be used; extent of refinishing; schedule of operations; alternatives to cutting and patching, if any.
 - 6) Designation of party responsible for cost of cutting and patching, when applicable.
 - 7) Written permission of other contractors whose work will be affected.
2. Should conditions of Work, or schedule, indicate a change of materials or methods, submit written recommendation to CONSTRUCTION CONTRACT ADMINISTRATOR including:
- a. Conditions indicating change.
 - b. Recommendations for alternative materials or methods.
 - c. Submittals as required for substitutions.
- B. Informational Submittals: Submit the following:
1. Submit written notice designating time Work will be uncovered, to provide for observation. Do not begin cutting or patching operations until accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
- C. Conform to submittal requirements in Specifications for application and installation of materials used for patching.

1.4 WARRANTY

- A. Replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials in manner that does not void required or existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Materials:

1. Use materials in conformance with the Contract Documents.
2. If not shown or indicated in the Contract Documents, use materials and products that are identical to existing materials and products affected by cutting and patching Work.
3. For exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. If identical materials are unavailable or cannot be used, use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform cutting and coring in such manner that limits extent of patching.
- B. Core drill holes to be cut through concrete and masonry walls, slabs, or arches, unless otherwise accepted by CONSTRUCTION CONTRACT ADMINISTRATOR in writing.

3.2 INSPECTION

- A. Examine surfaces to be cut or patched and conditions under which cutting or patching are to be performed before starting cutting or patching Work.
- B. Report unsatisfactory or questionable conditions to CONSTRUCTION CONTRACT ADMINISTRATOR in writing. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.3 PREPARATION

- A. Provide temporary support as required to maintain structural integrity of Project, to protect adjacent Work from damage during cutting, and to support the Work to be cut.
- B. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that will be exposed during cutting and patching operations.
 1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
 2. Do not cut existing pipe, conduit, ductwork, or other utilities serving facilities scheduled to be removed or relocated until provisions have been made to bypass them.

3.4 CORING

- A. Perform coring with non-impact rotary tool using diamond core drills. Size holes for pipe, conduit, sleeves, equipment or mechanical seals, as required.
- B. Protect existing equipment, utilities and adjacent areas from water and other damage covered by drilling operations.
- C. Vacuum or otherwise remove slurry or tailings from the Work area following drilling.
- D. Do not core-drill through electrical conduit or other utility lines embedded in walls or floors without approval of CONSTRUCTION CONTRACT ADMINISTRATOR. To extent possible, avoid cutting reinforcing steel in floors and walls. After core-drilling, coat exposed concrete and steel with Sika 62 or equal before installing the utility or equipment through the penetration.

3.5 CUTTING

- A. Cut existing construction using methods least likely to damage elements retained or adjoining construction, and that will provide proper surfaces to receive installation or repair.
 - 1. In general, use hand or small power tools designed for sawing or grinding, not hammering and chopping.
 - 2. Cut through concrete and masonry using concrete wall saw with diamond saw blades.
 - a. Provide for control, on both sides of walls, of slurry generated by sawing.
- B. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Provide temporary covering over openings where not in use.
- C. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed side.
- D. Provide adequate bracing of area to be cut prior to start of cutting.
- E. Provide equipment of adequate size to remove cut panel.

3.6 PATCHING

- A. Patch construction by filling, repairing, refinishing, closing-up and similar operations following performance of other Work. Patch with durable seams that are as inconspicuous as possible. Provide materials and comply with installation requirements specified, in the Specifications.

- B. Where feasible, test patched areas to demonstrate integrity of installation.
- C. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- D. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that eliminates evidence of patching and refinishing.
 - 1. For continuous surfaces, refinish to nearest intersection.
 - 2. For an assembly, refinish entire unit.
- E. Patch, repair or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 CLEANING

- A. Clean areas and spaces where cutting, coring and patching are performed. Clean piping, conduit, or similar constructions before applying paint or other finishing materials. Restore damaged coverings of pipe and other utilities to original condition.

++ END OF SECTION ++

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SECTION 01 74 05

CLEANING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall execute cleaning during the Work, at completion of the Work, and as required by the General Conditions.
 2. Maintain in a clean manner the Site, the Work, and areas adjacent to or affected by the Work.

1.2 REFERENCES

- A. Standards referenced in this Section are:
1. NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.3 PROGRESS CLEANING

- A. General: Clean the Site, work areas, and other areas occupied by CONTRACTOR at least weekly. Dispose of materials in accordance with the General Conditions and the following:
1. Comply with NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold non-combustible materials at the Site more than three days if the temperature is expected to rise above 80 degrees F. When temperature is less than 80 degrees F, dispose of non-combustible materials within seven days of their generation.
 3. Provide suitable containers for storage of waste materials and debris.
 4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately.
- B. Site:
1. Keep outdoor, dust-generating areas wetted down or otherwise control dust emissions.
 2. At least weekly, brush-sweep roadways and paved areas at the Site that are used by construction vehicles or otherwise affected by the Work. On any day when activity of CONTRACTOR causes soil to be deposited or flow onto plant roads, parking, or public roadways, CONTRACTOR shall remove soil before end of workday.

- C. Work Areas:
1. Clean areas where Work is in progress to level of cleanliness necessary for proper execution of the Work.
 2. Remove liquid spills promptly and immediately report spills to OWNER, CONSTRUCTION CONTRACT ADMINISTRATOR, and authorities having jurisdiction.
 3. Where dust would impair proper execution of the Work, broom-clean or vacuum entire area of Work, as appropriate.
 4. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- D. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning agents and methods specifically recommended. If manufacturer does not recommend specific cleaning agents or methods, use cleaning agents and methods that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.
- F. Cutting and Patching:
1. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 2. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- G. Waste Disposal:
1. Properly dispose of waste materials, surplus materials, debris and rubbish off the Site.
 2. Do not burn or bury rubbish and waste materials at the Site.
 3. Do not discharge volatile or hazardous substances, such as mineral spirits, oil, or paint thinner, into storm sewers or sanitary sewers.
 4. Do not discharge wastes into surface waters or drainage routes.
 5. CONTRACTOR shall be solely responsible for complying with federal, state, and local Laws and Regulations regarding disposal of waste.
- H. During handling and installation of materials and equipment, clean and protect construction in progress and adjoining materials and equipment already in place. Apply protective covering where required for protection from damage or deterioration, until Substantial Completion.
- I. Clean completed construction as frequently as necessary throughout the construction period.

1.4 CLOSEOUT CLEANING

- A. Complete the following prior to requesting inspection for Substantial Completion:
1. Clean and remove from the Site rubbish, waste material, debris, and other foreign substances.
 2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 3. Hose-clean sidewalks and loading areas.
 4. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 5. Leave surface waterways, drainage routes, and gutters open and clean.
 6. Repair pavement, roads, sod, and all other areas affected by construction operations and restore them to specified condition; if condition is not specified, restore to original condition.
 7. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of spatter, grease, stains, fingerprints, films, and similar foreign substances.
 8. Clean, wax, and polish wood, vinyl, and painted floors.
 9. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, and similar spaces.
 10. In unoccupied spaces, sweep concrete floors broom-clean.
 11. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 12. Remove non-permanent tags and labels.
 13. Touch up and otherwise repair and restore chipped, scratched, dented or otherwise marred surfaces to specified finish and match adjacent surfaces.
 - a. Do not paint over "UL" or similar labels, including mechanical and electrical nameplates.
 14. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign substances.
 15. Clean plumbing fixtures to sanitary condition, free of stains, including stains resulting from water exposure.
 16. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 17. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace temporary lamps provided in permanent fixtures. Replace existing light fixture components that are burned out or noticeably dimmed from use during the Work. Replace defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 18. Leave the Site clean, and in neat, orderly condition, satisfactory to OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 75 11

CHECKOUT AND STARTUP PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall initially start up and place equipment installed under the Contract into successful operation, in accordance with manufacturer's written instructions and as instructed by Supplier at the Site.
 2. Provide all material, labor, tools, equipment, chemicals, lubricants, and expendables required to complete start-up.
- B. No system or subsystem shall be started up for continuous operation unless all components of that system or subsystem, including instrumentation, have been tested to the extent practicable and proven to be operable as intended by the Contract Documents.
- C. General Activities Include:
1. Cleaning.
 2. Removing temporary protective coatings.
 3. Flushing and replacing greases and lubricants, where required by manufacturer.
 4. Lubrication.
 5. Checking shaft and coupling alignments and resetting where required.
 6. Checking and setting motor, pump, and other equipment rotation, safety interlocks, and belt tensions.
 7. Checking and correcting (if necessary) leveling plates, grout, bearing plates, anchor bolts, fasteners, and alignment of piping, conduits, and ducts that may put stress on equipment connected to it.
 8. All adjustments required.
- D. Provide chemicals, lubricants, and other required operating fluids.
- E. Provide fuel, electricity, water, filters, and other expendables required for start-up of equipment, unless otherwise specified.
- F. OWNER will provide sufficient personnel to assist CONTRACTOR in starting up equipment, but responsibility for proper operation is CONTRACTOR's. Supplier shall be present during initial start-up and operation, unless otherwise acceptable to CONSTRUCTION CONTRACT ADMINISTRATOR.

- G. Start-up of heating and air conditioning systems is dependent upon the time of year. Return to Site at beginning of next heating or air conditioning season (as applicable) to start the appropriate system.
- H. Do not start up system, unit process, or equipment without submitting acceptable preliminary operations and maintenance manuals by CONTRACTOR, in accordance with Section 01 78 23, Operations and Maintenance Data.
- I. Prior to turning over to OWNER responsibility for operating and maintaining system or equipment:
 - 1. Provide training of operations and maintenance personnel in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
 - 2. Complete system performance testing in accordance with the Contract Documents.
 - 3. Submit acceptable final operations and maintenance manuals in accordance with Section 01 78 23, Operations and Maintenance Data.
 - 4. Submit request for Substantial Completion.
- J. OWNER shall assume responsibility for operation of the equipment upon completion of start-up and placing equipment in operation. If the OWNER does not assume operational responsibility and in the opinion of the CONSTRUCTION CONTRACT ADMINISTRATOR start-up tasks are completed, the CONSTRUCTION CONTRACT ADMINISTRATOR will notify CONTRACTOR, in writing, of the completion of the start-up period.

1.2 SERVICES OF SUPPLIER

- A. When specified, provide competent, qualified representatives of product Supplier to provide services specified, including supervising installation, adjusting, starting-up, and testing of materials and equipment.
- B. When services by Supplier are required at the Site, within fourteen days after first test operation of equipment, submit to CONSTRUCTION CONTRACT ADMINISTRATOR a letter from Supplier, on Supplier's letterhead, stating that materials and equipment are installed in accordance with Supplier's requirements and installation instructions, and in accordance with the Contract Documents. In lieu of Supplier letter, provide completed form attached to this Section. Also provide copy of letter or completed form, as applicable, with final operations and maintenance data.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 MINIMUM START-UP REQUIREMENTS

- A. Bearings and Shafting:
 - 1. Inspect for cleanliness, and clean and remove foreign matter.
 - 2. Verify alignment.
 - 3. Replace defective bearings and those that operate rough or noisy.
 - 4. Grease as necessary, in accordance with manufacturer's recommendations.

- B. Drives:
 - 1. Adjust tension in V-belt drives and adjust vari-pitch sheaves and drives for proper equipment speed.
 - 2. Adjust drives for alignment of sheaves and V-belts.
 - 3. Clean and remove foreign matter before starting operation.

- C. Motors:
 - 1. Check each motor for comparison to amperage nameplate value.
 - 2. Correct conditions that produce excessive current flow and conditions that exist due to equipment malfunction.

- D. Pumps:
 - 1. Check glands and seals for cleanliness and adjustment before running pump.
 - 2. Inspect shaft sleeves for scoring.
 - 3. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
 - 4. Verify that piping system is free of dirt and scale before circulating liquid through pump.

- E. Valves:
 - 1. Inspect manual and automatic control valves, and clean bonnets and stems.
 - 2. Tighten packing glands to ensure no leakage, but allow valve stems to operate without galling.
 - 3. Replace packing in valves to retain maximum adjustment after system is determined to be complete.
 - 4. Replace packing on valves that continue to leak.
 - 5. Remove and repair bonnets that leak.
 - 6. After cleaning, coat packing gland threads and valve stems with surface preparation of "Molycote" or "Fel-Pro".

- F. Verify that control valve seats are free from foreign matter and are properly positioned for intended service.

- G. Tighten flanges and other pipe joints after system has been placed in operation.
 - 1. Replace gaskets that show signs of leakage after tightening.

- H. Inspect all joints for leakage:
 - 1. Promptly remake each joint that appears to be faulty; do not wait for rust or other corrosion to form.
 - 2. Clean threads on both parts, and apply compound and remake joints.
- I. After system has been placed in operation, clean strainers, drives, pockets, orifices, valve seats, and headers in fluid system to ensure freedom from foreign matter.
- J. Open steam traps and air vents, where used, and remove operating elements.
 - 1. Clean thoroughly, replace internal parts, and place back into operation.
- K. Remove rust, scale, and foreign matter from equipment and renew defaced surfaces.
- L. Set and calibrate draft gauges of air filters and other equipment.
- M. Inspect fan wheels for clearance and balance.
 - 1. Provide factory-authorized personnel for adjustment when needed.
- N. Check each electrical control circuit to ensure that operation complies with the Contract Documents.
- O. Inspect each pressure gauge, thermometer, and other instruments for calibration.
 - 1. Replace items that are defaced, broken, or that read incorrectly.
- P. Repair damaged insulation.
- Q. Vent gasses trapped in systems.
 - 1. Verify that liquids are drained from all parts of gas or air systems.

3.2 ATTACHMENTS

- A. The attachment listed below, following the “End of Section” designation, is a part of this Specification Section.
 - 1. Supplier’s Installation Certification Form (one page).

++ END OF SECTION ++

SUPPLIER'S INSTALLATION CERTIFICATION

Contract No. and Name: _____

Specification Section of Equipment: _____

Equipment Name: _____

Contractor: _____

Manufacturer of Equipment: _____

The undersigned Supplier of the products described above hereby certifies that Supplier has checked the product installation and that the product, as specified in the Contract Documents, has been provided in accordance with the Supplier's recommendations and the Contract Documents, and that the trial operation of the equipment item has been satisfactory.

Comments: _____

Date

Supplier Name (print)

Signature of Supplier

Date

Contractor Name (print)

Signature of Contractor

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SECTION 01 78 23

OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide operation and maintenance data, as described in this Section, for use as instructional and reference manuals by operations and maintenance personnel at the Site. At minimum, provide operation and maintenance data for:
 - 1. All equipment and systems.
 - 2. Valves, gates, actuators, and related accessories.
 - 3. Instrumentation and control devices.
 - 4. Electrical gear.

- B. Required Operation and Maintenance Data: For each operation and maintenance manual required, provide the following:
 - 1. Preliminary Submittal: Printed and bound copy of entire operation and maintenance manual, except for test data, service reports by Supplier's representative, and electronic copies.
 - 2. Final Submittal: Printed and bound copy of complete operations and maintenance manual, including test data and service reports by Supplier's representative, with electronic copies.

- C. Prepare each operations and maintenance manual specifically for Project. Include in each manual all pertinent instructions, as-built drawings as applicable, bills of materials, technical bulletins, installation and handling requirements, maintenance and repair instructions, and other printed materials required to provide accurate and comprehensive information for safe and proper operation, maintenance, and repair of products furnished for Project. Include in manual all specific information required by applicable Specification Section, and all data required by Laws and Regulations and by authorities having jurisdiction.

1.2 NUMBER OF COPIES AND TIMING OF SUBMITTALS

- A. Number of Copies Required and Timing of Submittals:
 - 1. Preliminary Submittal:
 - a. Three copies, exclusive of copies required by CONTRACTOR.
 - b. Provide submittal to CONSTRUCTION CONTRACT ADMINISTRATOR by the earlier of: ninety days following approval of Shop Drawings and related submittals, or ten days prior to starting operations and maintenance personnel training and operational testing at the Site.

2. Final Submittal: Provide final submittal prior to Substantial Completion, unless submittal is specified as required prior to an interim Milestone.
 - a. Printed Copies: seven copies.
 - b. Electronic Copies: Two copies.

1.3 FORMAT OF HARDCOPIES

A. Binding and Cover:

1. Bind each operation and maintenance manual in durable, permanent, stiff-cover binder(s), comprising one or more volumes per copy as required. Binders shall be minimum one-inch wide and maximum of three-inch wide. Binders for each copy of each volume shall be identical.
2. Binders shall be locking three-ring/"D"-ring type, or three-post type. Three-ring binders shall be riveted to back cover and include plastic sheet lifter (page guard) at front of each volume.
3. Do not overfill binders.
4. Covers shall be oil, moisture, and wear resistant, including identifying information on cover and spine of manual.
5. Provide the following information on cover of each volume:
 - a. Title, "OPERATING AND MAINTENANCE INSTRUCTIONS".
 - b. Name or type of equipment covered in the manual.
 - c. Volume number, if more than one volume is required.
 - d. Name of Project and, if applicable, contract name and number.
 - e. Name of building or structure, as applicable.
6. Provide the following information on spine of each volume:
 - a. Title, "OPERATING AND MAINTENANCE INSTRUCTIONS".
 - b. Name or type of equipment covered in the manual.
 - c. Volume number, if more than one volume is required.
 - d. Project name and building or structure name.

B. Pages:

1. Print pages in manual on 30-pound (minimum) paper, 8.5 inches by 11 inches.
2. Reinforce binding holes in each individual sheet with plastic, cloth, or metal. When published, separately bound booklets or pamphlets are included in the manual, reinforcing of pages within booklet or pamphlet is not required.
3. Provide each page with binding margin of at least one inch wide. Punch each page with holes suitable for the associated binding.

C. Drawings:

1. Bind into the manual drawings, diagrams, and illustrations up to and including 11 by 17 inches in size, with reinforcing specified for pages.
2. Documents larger than 11 inches by 17 inches shall be folded and inserted into clear plastic pockets bound into the manual. Mark pockets with printed text indicating content and drawing numbers. Provide no more than three drawings per pocket.

- D. Copy Quality and Document Clarity:
1. All contents shall be original-quality copies, viz., material shall either be original manufacturer-printed materials or first-generation photocopies indistinguishable from originals. Manuals that contain copies that are not clear, not completely legible, off-center, skewed, or where text or drawings are cut by binding holes, will be rejected. Pages that contain approval or date stamps, comments, or other markings that cover text or drawing are unacceptable. Faxed copies are unacceptable.
 2. Clearly mark in ink all components of equipment on catalog pages for ease of identification. In standard or pre-printed documents, indicate options provided or cross out inapplicable material. Use of highlighters is unacceptable.
- E. Organization:
1. Coordinate with CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER to develop comprehensive, practical, and consistent indexing system for operations and maintenance data. CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER will review indexing system before operations and maintenance data is submitted.
 2. Table of Contents:
 - a. Provide table of contents in each volume of each operations and maintenance manual.
 - b. In table of contents and at least once in each chapter or section, identify products by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is explained in table bound at or near end of each volume. Using product model or catalog designations for identification is not acceptable.
 3. Use dividers and indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

1.4 FORMAT OF ELECTRONIC COPIES

- A. Electronic Copies of Manuals:
1. Electronic copy shall include all information provided in hardcopy.
 2. Provide each electronic copy on a separate compact disc (CD).
 3. File Format:
 - a. Files shall be in "portable document format (PDF)". Files shall be electronically searchable.
 - b. Provide separate file for each separate document in the hardcopy.
 - c. Within each file, provide bookmarks for the following:
 - 1) Each chapter and subsection listed in the hardcopy document's table of contents.
 - 2) Each figure.
 - 3) Each table.
 - 4) Each appendix.

4. Also provide drawings and figures in one of the following formats: “.bmp”, “.tif”, “.jpg”, or “.gif”. Provide files in separate directory on CD.
- B. Copies of Programming and Configuration Files:
1. Provide on CD copy of all software programming, such as programmable logic controller programs, prepared specifically for the Project. Third-party, commercially available software is excluded from requirements of this article; provide copies of commercially-available, third-party software as specified in the Contract Documents.
 2. Provide on CD copies of system configuration prepared specifically for the Project, such as SCADA display configurations.
 3. Provide number of programming and configuration files as specified for electronic copies of operation and maintenance data.

1.5 CONTENT

- A. Provide complete, detailed written operating instructions for each product including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by product and proper responses to such alarm conditions.
- B. Provide written explanations of all safety considerations relating to operation and maintenance procedures.
- C. Provide complete, detailed, written preventive maintenance instructions including all information and instructions to keep product or system properly lubricated, adjusted, and maintained so that products function economically throughout design life. Instructions shall include:
1. Written explanations with illustrations for each preventive maintenance task such as inspection, adjustment, lubrication, calibration, and cleaning. Provide pre-startup checklists for each equipment item and maintenance requirements for long-term shutdowns.
 2. Recommended schedule for each preventive maintenance task.
 3. Lubrication charts indicating recommended types of lubricants, frequency of application or change, and where each lubricant is to be used or applied.
 4. Table of alternative lubricants.
 5. Troubleshooting instructions.
 6. List of required maintenance tools and equipment.
- D. Complete bills of material or parts lists for products provided. Lists or bills of material may be provided on a per-drawing or per-equipment assembly basis. Bills of material shall indicate:
1. Manufacturer's name, address, telephone number, fax number, and Internet website address.

2. Manufacturer's local service representative's or local parts supplier's name, address, phone number, fax number, and Internet and e-mail addresses, if applicable.
 3. Manufacturer's shop order and/or serial number(s) for product or assembly furnished.
 4. For each part or piece provide:
 - a. Parts cross-reference number. Cross-reference number shall be used to identify the part on assembly drawing, Shop Drawing, or other type of illustration where the part is clearly shown.
 - b. Part name or description.
 - c. Manufacturer's part number.
 - d. Quantity of each part used in each assembly.
 - e. Current unit price of the part at the time the operations and maintenance manual is submitted. Price list shall be dated.
- E. Compete instructions for ordering of all replaceable parts, including reference numbers (e.g., shop order or serial number) that will expedite ordering process.
- F. Manufacturer's recommended inventory levels for spare parts and consumable supplies for the first two years of operation. Consumable supplies are those items consumed or worn by operation of equipment, and items used in maintaining the operation of product, including items such as lubricants, seals, reagents, and testing chemicals used for calibrating or operating the equipment. Provide estimated delivery times, shelf life limitations, and special storage requirements.
- G. Provide manufacturer's installation and operation bulletins, diagrams, schematics, and equipment cutaways. Avoid providing catalog excerpts unless they are the only material available showing identification or description of particular component of the equipment. Where materials pertain to multiple models or types, mark the literature to indicate specific product supplied. Marking may be in the form of checking, arrows, or underlining to show pertinent information, or by crossing out or other means of obliterating information that does not apply to the products furnished.
- H. Provide original-quality copies of each approved and accepted Shop Drawing and submittal, updated to as-installed condition. Reduced drawings are permissible only if reduction is to not less than one-half original size and all lines, dimensions, lettering, and text are completely legible on the reduction.
- I. Provide complete electrical schematic and wiring diagrams, including complete point-to-point wiring and wiring numbers or colors between all terminal points.
- J. Programmable Logic Controllers: If programmable logic controllers are provided under the Contract:
 1. Provide complete logic listings in "ladder diagram", "function block diagram", "sequential function chart", "instruction list" OR, "structured text" format.

2. For ladder diagram logic, include complete cross-referencing of all logic elements. Annotate all elements with clearly understandable tags or descriptive labels.
 3. Provide complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.
 4. Provide complete manufacturer's programming manuals.
- K. Copy of warranty bond and service contract as applicable.
- L. When copyrighted material is used in operations and maintenance manual, obtain copyright holder's written permission to use such material in the operation and maintenance manual.

1.6 SUBMITTALS REQUIRED

- A. Provide operation and maintenance data for the following:
1. All equipment and systems.
 2. Valves, gates, actuators, and related accessories.
 3. Instrumentation and control devices.
 4. Electrical gear.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 78 39

RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall maintain and provide CONSTRUCTION CONTRACT ADMINISTRATOR with record documents per the Specifications, General Conditions, and Supplementary Conditions.
- B. Maintenance of Record Documents:
1. Maintain in CONTRACTOR's field office, in clean, dry, legible condition, complete sets of the following record documents: Drawings, Specifications, and Addenda; Shop Drawings and submittals, including test records, approved or accepted as applicable, by CONSTRUCTION CONTRACT ADMINISTRATOR; Samples, Change Orders, Work Change Directives, Field Orders, photographic documentation, survey data, and all other documents pertinent to the Work.
 2. Provide files and racks for proper storage and easy access to record documents. File record documents in accordance with the 2004 edition of the Construction Specification Institute's *MasterFormat* used for organizing the Project Manual, unless otherwise accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
 3. Make record documents available for inspection upon request of CONSTRUCTION CONTRACT ADMINISTRATOR or OWNER.
 4. Do not use record documents for purpose other than serving as project record. Do not remove record documents from CONTRACTOR's field office without CONSTRUCTION CONTRACT ADMINISTRATOR's approval.
- C. Submittal of Record Documents:
1. Provide to CONSTRUCTION CONTRACT ADMINISTRATOR the following record documents:
 - a. Drawings.
 - b. Specifications and Addenda (bound).
 2. Prior to readiness for final payment, deliver to CONSTRUCTION CONTRACT ADMINISTRATOR one copy of final record documents. Submit complete record documents; do not make partial submittals.
 3. Submit record documents with transmittal letter on CONTRACTOR letterhead containing: date of transmittal, Project and Contract names, and title and number of each record document.
 4. With submittal of record documents, provide certification, with original signature of official authorized to execute legal agreements on behalf of CONTRACTOR, reading as follows:

“*[Insert Contractor’s corporate name]* has provided record documentation, per the Conditions of the Contract and Section 01 78 39 of the Contract Documents, for the Northern Kentucky Water District, Taylor Mill Treatment Plant Electrical and Basin Improvements Project. We certify that each record document submitted is complete, accurate, and legible relative to the Work performed under our Contract, and that the record documents conform to the requirements of the Contract Documents.

[Provide signature, print name, print signing party’s corporate title, and date]”

1.2 RECORDING CHANGES

A. General:

1. Label each document to be submitted as, “PROJECT RECORD” in two-inch high, legible, printed letters.
2. Keep record documents current. Make entries on record documents within two working days of receipt of information required to record the change.
3. Do not permanently conceal Work until required information has been recorded.
4. Accuracy of record documents shall be such that future searches for items shown on the record documents may rely reasonably on information obtained from CONSTRUCTION CONTRACT ADMINISTRATOR-accepted record documents.
5. Marking of Entries:
 - a. Use erasable, colored pencils (not ink or indelible pencil) for marking changes, revisions, additions, and deletions to record documents.
 - b. Clearly describe the change by graphic line and note as required. Use straight-edge to mark straight lines. Writing shall be legible and sufficiently dark to allow scanning of record documents into legible electronic files.
 - c. Date all entries.
 - d. Call attention to change by drawing a “cloud” around the area(s) affected.
 - e. Mark initial revisions in red. In the event of overlapping changes, use different colors for subsequent changes.

B. Drawings:

1. Record changes on copy of the Drawings. Submittal of CONTRACTOR-produced drawings as a substitute for recording changes on the Drawings is unacceptable.
2. Record changes on plans, sections, schematics, and details as required for clarity, providing reference dimensions and elevations (to Project datum) for complete record documentation.
3. Record actual construction including:
 - a. Depths of various elements of foundation relative to Project datum.
 - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements. For each

- buried pipe fitting, valve, or other improvement not visible at ground surface, provide dimensions to at least two permanent surface improvements.
- c. Location of exposed utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - d. Changes in structural and architectural elements of the Work, including changes in reinforcing.
 - e. Field changes of dimensions, arrangements, and details.
 - f. Changes made by Change Orders, Work Change Directives, and Field Orders.
 - g. Details on the Drawings.
4. Recording Changes for Schematic Layouts:
- a. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items is shown schematically and is not intended to portray physical layout. For such cases, final physical arrangement is determined by CONTRACTOR subject to acceptance by CONSTRUCTION CONTRACT ADMINISTRATOR.
 - b. Record on record documents all revisions to schematics on Drawings, including: piping schematics, ducting schematics, process and instrumentation diagrams, control and circuitry diagrams, electrical one-line diagrams, motor control center layouts, and other schematics when included in the Contract. Record actual locations of equipment, lighting fixtures, in-place grounding system, and other pertinent data.
 - c. When plans and sections on the Drawings show the Work schematically, show on the record documents, by dimensions accurate to within one inch in the field, centerline location of items of Work such as conduit, piping, ducts, and similar items
 - 1) Clearly identify the Work item by accurate notations such as “cast iron drain”, “rigid electrical conduit”, “copper waterline”, and similar descriptions.
 - 2) Show by symbol or note the vertical location of Work item; for example, “embedded in slab”, “under slab”, “in ceiling plenum”, “exposed”, and similar designations. For piping not embedded, also provide elevation dimension relative to Project datum.
 - 3) Descriptions shall be sufficiently detailed to be related to Specifications.
 - d. CONSTRUCTION CONTRACT ADMINISTRATOR may provide written waiver of requirements relative to schematic layouts shown on plans and sections when, in CONSTRUCTION CONTRACT ADMINISTRATOR’s judgment, dimensioned layouts of Work shown schematically will serve no useful purpose. Do not rely on waiver(s) being issued.
5. Supplemental Drawings:
- a. In some cases, drawings produced during construction by CONSTRUCTION CONTRACT ADMINISTRATOR or

CONTRACTOR supplement the Drawings and shall be included with record documents submitted by CONTRACTOR. Supplemental record drawings shall include drawings provided with Change Orders, Work Change Directives, and Field Orders and that cannot be incorporated into the Drawings due to space limitations.

- b. Supplemental drawings provided with record drawings shall be integrated with the Drawings and include necessary cross-references between drawings. Supplemental record drawings shall be on sheets the same size as the Drawings.
- c. When supplemental drawings developed by CONTRACTOR using computer-aided drafting/design (CADD) software are to be included in record drawings, provide electronic files for such drawings in AutoCAD 2007 format as part of record drawing submittal. Provide electronic files on compact disc labeled, "Supplemental Record Drawings", together with CONTRACTOR name, Project name, and Contract name and number.

C. Specifications and Addenda:

1. Mark each Section to record:
 - a. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually provided.
 - b. Changes made by Addendum, Change Orders, Work Change Directives, and Field Orders.

1.3 ELECTRONIC FILES FURNISHED BY ENGINEER

A. CADD files will be furnished by ENGINEER upon the following conditions:

1. CONTRACTOR shall provide to ENGINEER a letter on CONTRACTOR letterhead requesting CADD files and providing specific definition(s) or description(s) of how files will be used, and specific description of benefits to OWNER (including credit proposal, if applicable) if the request is granted.
2. CONTRACTOR shall execute ENGINEER's standard agreement for release of electronic files and shall abide by all provisions of the agreement for release of electronic files.
3. Layering system incorporated in CADD files shall be maintained as transmitted by ENGINEER. CADD files transmitted by ENGINEER containing cross-referenced files shall not be bound by CONTRACTOR. Drawing cross-references and paths shall be maintained at all times. If CONTRACTOR alters layers or cross-reference files, CONTRACTOR shall restore all layers and cross-references prior to submitting record documents to ENGINEER.
4. CONTRACTOR shall provide record drawings to ENGINEER same CADD format that files were furnished to CONTRACTOR.

PART 2 - PRODUCTS (NOT USED)

PART 3 -EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 78 43

SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall furnish spare parts data and maintenance materials for products per the Contract Documents.
- B. List of Spare Parts and Maintenance Materials: With the Shop Drawings and product data for each Specification Section, submit to CONSTRUCTION CONTRACT ADMINISTRATOR a complete list of spare parts, extra materials, maintenance supplies, and special tools required for maintenance (“spare parts and maintenance materials”) required for two years of operation, with current unit prices in U.S. funds, and source (or sources) of supply for each.
- C. Packaging and Labeling: Furnish spare parts and maintenance materials required per the Contract Documents in manufacturer’s unopened cartons, boxes, crates, or other original, protective covering suitable for preventing corrosion or deterioration for maximum length of storage normally anticipated by manufacturer. Packaging of spare parts and maintenance materials shall be clearly marked and identified with name of manufacturer or Supplier, applicable equipment, part number, part description, and part location in the equipment. Protect and package spare parts and maintenance materials for maximum shelf life normally anticipated by manufacturer.
- D. Storage Prior to Delivery to Owner: Prior to delivering spare parts and maintenance materials to OWNER, store spare parts and maintenance materials per the Contract Documents and manufacturers’ recommendations.
- E. Delivery Time and Eligibility for Payment:
 - 1. Deliver to OWNER spare parts and maintenance materials no later than date of Substantial Completion for products or system associated with spare parts and maintenance materials. Do not deliver spare parts and maintenance materials earlier than date that start-up commences for associated equipment or system.
 - 2. Spare parts and maintenance materials are not eligible for payment until delivered to OWNER and CONTRACTOR’s receipt of OWNER’s countersignature on letter of transmittal.
- F. Procedure for Delivery to OWNER: Deliver spare parts and maintenance materials to OWNER’s permanent storage rooms at the Site or area(s) at the Site designated by OWNER. When spare parts and maintenance materials are delivered, CONTRACTOR and OWNER will mutually inventory the products delivered to

verify compliance with the Contract Documents regarding quantity and part numbers. Additional procedures for delivering spare parts and maintenance materials to OWNER, if required, will be developed by CONSTRUCTION CONTRACT ADMINISTRATOR and complied with by CONTRACTOR.

G. Transfer Documentation:

1. Provide on CONTRACTOR letterhead a letter of transmittal for spare parts and maintenance materials furnished under each Specification Section. Letter of transmittal shall accompany spare parts and maintenance materials. Do not submit letter of transmittal separate from products.
2. Provide three original, identical, signed letters of transmittal for each Specification Section. Upon delivery of specified quantities and types of products to OWNER, designated person from OWNER will countersign each original letter of transmittal indicating OWNER's receipt of spare parts and maintenance materials. OWNER will retain one fully signed original, CONTRACTOR will furnish one fully signed original to CONSTRUCTION CONTRACT ADMINISTRATOR, and CONTRACTOR will retain one fully signed original for CONTRACTOR's file.
3. Letter of transmittal shall include the following:
 - a. Date of letter.
 - b. Project name, and contract name and number.
 - c. CONTRACTOR'S name and address.
 - d. Transmittal shall list for spare parts and maintenance materials furnished under each Specification Section. List each individual part or product and quantity provided.
 - e. Provide space for countersignature by OWNER as follows: space for signature, space for printed name, and date.

H. CONTRACTOR shall be fully responsible for loss or damage to spare parts and maintenance materials until products are received by OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01 79 13

EQUIPMENT AND SYSTEM PERFORMANCE TESTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, services, equipment, and incidentals required for performance testing as indicated in the Contract Documents.
2. Conduct performance testing for each item of process; mechanical; instrumentation and control; plumbing; heating, ventilating, and air conditioning (HVAC); electrical systems and equipment; and other systems and equipment, to demonstrate compliance with the performance requirements of the Contract Documents.
3. Objectives of performance testing are to:
 - a. Demonstrate to satisfaction of OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR that structures, systems, and equipment tested comply with all functional and performance requirements in the Contract Documents.
 - b. Demonstrate that facility is Substantially Complete
 - c. Establish baseline operating conditions for OWNER's use in establishing standard operating procedures and preventative maintenance programs.
4. Utilities and Consumables:
 - a. CONTRACTOR shall provide the following: electricity, fuel, compressed air, chemicals, temporary piping and appurtenances, and all other items and Work required for completing performance testing.
 - b. OWNER will provide the following: water for initial performance testing. CONTRACTOR shall provide temporary piping and appurtenances required to convey to the testing location utilities and consumables furnished by OWNER. If re-testing is required, cost of utilities and consumables furnished by OWNER for initial testing shall be paid by CONTRACTOR at OWNER's cost or standard rates, as applicable.
5. Sequence: The following general sequence applies to performance testing:
 - a. Furnish submittals required prior to performance testing, in accordance with this Section.
 - b. Complete the Work associated with starting and placing equipment in operation.
 - c. To the extent practicable, complete Site quality control Work specified in Specification Sections for individual equipment items and systems.

- d. Proceed with performance testing in accordance with this Section, simulating the range of actual operating conditions to the greatest extent possible.
- e. Successful completion of performance testing is required to achieve Substantial Completion.

B. Coordination:

- 1. Review procedures under this and other Sections and coordinate installation and testing of items that must be started up and tested with or before performance testing Work.

1.2 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:

- 1. A “system” includes all required items of equipment, devices, and appurtenances connected so that their operation or function complements, protects, or controls the operation or function of the others.

1.3 QUALITY ASSURANCE

A. Qualifications:

- 1. Contractor’s Performance Testing Manager:
 - a. Appoint a performance testing manager, who shall:
 - 1) Manage, coordinate, and supervise CONTRACTOR’s performance testing.
 - 2) Assist in coordinating and documenting Site quality control Work specified in individual Specifications Sections.
 - 3) Prepare, or review and approve, all submittals for the Work under this Section
 - 4) Coordinate activities of Subcontractors and Suppliers relative to performance testing.
 - 5) Be at the Site eight hours per day during performance testing.
 - b. Experience:
 - 1) Performance testing manager shall be an operations engineer or a qualified operations specialist, having at least five years of experience in work similar to that required, or experience on at least five separate projects, in managing performance testing of process, mechanical, instrumentation and control, HVAC, and electrical systems.
 - 2) Operations Engineer: Shall be a graduate of four-year course in mechanical or civil engineering at an accredited college or university.
 - 3) Operations Specialist: Shall have equivalent experience in operation and maintenance of facility similar to the Site.
- 2. Contractor’s Performance Testing Operators:

- a. Coordinate with requirements of authority having jurisdiction over the facility's operating permit.
- B. Pre-performance Testing Conference:
1. After initial submittal of documentation plan and performance testing plan and prior to starting performance testing, arrange a meeting at Site with CONTRACTOR's performance testing manager, CONTRACTOR's other key personnel, equipment Suppliers' technical representatives, authority having jurisdiction over operating permit(s), CONSTRUCTION CONTRACT ADMINISTRATOR, OWNER, and other representatives directly concerned with performance testing Work. Record discussions of conference and decisions and agreements and disagreements and furnish a copy of record to each party attending. Review foreseeable methods and procedures relating to performance testing Work including:
 - a. Review Project requirements including Contract Documents, submittals related to performance testing, requests for interpretations relative to performance testing, and other pertinent documents.
 - b. Review required submittals, both completed and to be completed.
 - c. Review status of the equipment and systems to be performance tested and work to be completed prior to performance testing.
 - d. Review Progress Schedule and testing schedule.
 - e. Review status of utilities and consumables required for performance testing.
 - f. Review required inspections, testing, certifying, and quality control procedures.
 - g. Review methods for complying with Laws and Regulations and requirements of authorities having jurisdiction, such as compliance with facility operating permit requirements, insurance requirements, environmental protection, health, safety, fire, and similar regulations.
 2. Reconvene meeting at earliest opportunity if additional information must be developed to conclude the required topics of the meeting.
 3. Record revisions or changes agreed upon, reasons therefor, and parties agreeing or disagreeing with them.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
1. Documentation plan, in accordance with Article 1.5 of this Section.
 2. Performance testing plans, in accordance with Article 1.5 of this Section.
- B. Informational Submittals: Submit the following:
1. Records of pre-performance testing conference.
 2. Testing schedules, in accordance with Article 1.5 of this Section.

3. Notices: Written notice to CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER at least 72 hours prior to beginning each test.
4. Site Quality Control Submittals: All records produced during, and results of, performance testing.
5. Qualifications Statements:
 - a. Testing laboratory qualifications and certifications, if not previously submitted under other Sections.
 - b. Qualifications of CONTRACTOR's performance testing manager and other required performance testing personnel, including copies of valid operators' licenses issued by authority having jurisdiction.

1.5 DOCUMENTATION PLAN, PERFORMANCE TESTING PLAN, AND TESTING SCHEDULE

- A. Documentation Plans: Develop recordkeeping system to document compliance with requirements of this Section and authorities having jurisdiction.
 1. Calibration documentation including identification (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, date(s) of subsequent calibrations, calibration method, and test laboratory verifying calibration.
 2. Documentation to be provided for each equipment item and system to be tested shall include date of test, equipment tag number or system name, nature of test, test objectives, test results, test instruments employed, and signature spaces for CONTRACTOR's performance testing manager and OWNER's and CONSTRUCTION CONTRACT ADMINISTRATOR's witnesses. Establish separate file for each system and equipment item to be tested. Files shall include the following information, as applicable, when associated tests, source quality control, or Site quality control measures are required in the Contract Documents:
 - a. Metallurgical tests, when required.
 - b. Source quality control (factory) tests.
 - c. Accelerometer recordings made during shipment, when such recordings are required.
 - d. Field calibration tests, in accordance with the Contract Documents.
 - e. Field hydrostatic tests for equipment and systems that operate under pressure, in accordance with the Contract Documents.
 - f. Site quality control testing, in accordance with the Contract Documents
 3. Forms:
 - a. Develop forms specific to each item of equipment and system being tested, to document results of testing.
 - b. c. Provide forms approved by CONSTRUCTION CONTRACT ADMINISTRATOR in sufficient quantity to document all testing Work.

B. Performance Testing Plans:

1. Develop performance testing plans describing in detail coordinated, sequential performance testing of each system and equipment item to be tested. Each performance testing plan shall be specific to the system or equipment item to be performance-tested, and shall identify by specific equipment or tag number each device or control station to be manipulated or observed during performance testing, and specific results to be observed or obtained. Performance testing plans shall also be specific regarding support systems required to complete the performance testing Work, temporary devices and systems required (if any) during performance testing, Subcontractors and Suppliers to be present during performance testing, and planned performance testing duration. Performance testing plans shall include:
 - a. Summary of start-up, check-out, and Site quality control testing required for each system or equipment item prior to starting performance testing.
 - b. Calibration of all field instruments and control devices.
 - c. Description of and information on temporary systems, equipment, and devices proposed for performance testing, including calibration data for temporary instrumentation and controls.
 - d. Plan and procedures for implementing performance testing of systems and equipment. Performance tests shall duplicate the operating conditions described in the Contract Documents.
 - e. Description of data reduction required, if any, and proposed time between collection of data and submittal of results to CONSTRUCTION CONTRACT ADMINISTRATOR.
 - f. Summary of criteria for acceptance of test results. Summary shall include performance tolerances (if any) included in the Contract Documents. Where performance tolerances are not included in the Contract Documents, testing plan shall include proposed performance tolerances.
2. Performance testing plans shall contain complete description of proposed procedures to achieve desired testing environment.
3. Following CONSTRUCTION CONTRACT ADMINISTRATOR's approval of performance testing plans, CONTRACTOR shall reproduce performance testing plans in sufficient quantity for CONTRACTOR'S purposes plus five copies to CONSTRUCTION CONTRACT ADMINISTRATOR and five copies to OWNER. Do not start performance testing until required quantity of approved performance testing plans is provided.

C. Testing Schedule:

1. Provide a testing schedule that sets forth the planned sequence for performance testing Work.
2. Testing schedule shall be part of the Progress Schedule and shall conform to requirements for Progress Schedule, except as specified in this Section.
3. Test schedule shall:
 - a. Detail the equipment and systems to be performance-tested, and the testing duration required for each.

- b. Show planned start date, duration, and completion of each performance test.
- c. Submitted no later than four weeks in advance of the date performance testing is to begin. CONSTRUCTION CONTRACT ADMINISTRATOR will not witness performance testing Work until test schedule is accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
- d. Be updated weekly and resubmitted to CONSTRUCTION CONTRACT ADMINISTRATOR. Updates shall indicate actual dates of performance testing Work, indicating systems and equipment for which performance testing is in progress, and that are satisfactorily completed in accordance with the Contract Documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PREPARATION

- A. Before starting the performance testing, complete the following:
 1. Prepare and align equipment in accordance with equipment Specifications and Section 01 73 24, Installation.
 2. To the extent practicable, complete equipment tests and check-out in accordance with the Contract Documents and manufacturers' recommendations.
 3. Complete other tests required by the Contract Documents, including instrumentation and controls calibration and testing, piping tests, electrical tests, and other tests required prior to full operation of the system or facility.
 4. Complete the Work required in Section 01 75 11, Checkout and Startup Procedures.
- B. Temporary Systems and Devices Required for Performance Testing:
 1. Minimize the need for temporary systems and devices required for performance testing.
 2. Provide temporary connections and bulkheads as required, and make other provisions to re-circulate process fluids and gasses as required or otherwise simulate the range of anticipated operating conditions for the systems and equipment being performance-tested. During performance testing, CONTRACTOR's performance testing manager and team shall monitor the characteristics of each equipment item and system and report unusual conditions to CONSTRUCTION CONTRACT ADMINISTRATOR.
 3. Properly install temporary systems. Test temporary equipment and devices in accordance with manufacturer's instructions to verify suitability for use in

performance testing. Test temporary piping using in accordance with requirements for associated permanent piping.

4. Calibration and Loop Testing of Temporary Instruments and Controls: Calibrate and test all loops and associated instruments and control devices, in accordance with instrumentation and controls Sections of Division 40, Process Integration.

3.2 PERFORMANCE TESTING

- A. CONTRACTOR's performance testing manager shall organize teams comprising qualified representatives of Suppliers, Subcontractors, CONTRACTOR's independent testing laboratory (if applicable), and others as appropriate, to efficiently and complete performance testing Work within the Contract Times and in accordance with the accepted Progress Schedule.
- B. Performance testing shall be done in accordance with the approved performance testing plan, approved documentation plan, and accepted testing schedule.
- C. System Performance Tests:
 1. Testing:
 - a. Duration:
 - 1) Operate and performance-test the system (or each portion thereof, as applicable) and equipment for sufficient period of time to determine: operating characteristics of system and equipment, including noise, temperatures, and vibration; observe its performance characteristics; and for initial adjustment of controls and appurtenances.
 - 2) List the proposed performance testing duration in the testing plan and testing schedule.
 - 3) Duration of performance testing shall be in accordance with the approved testing plan and accepted testing schedule.
 - b. When testing requires availability of temporary systems such as temporarily "looped" piping, temporary or standby electrical power, temporary compressed air, or temporary instrumentation and controls, provide acceptable alternate sources that meet the requirements of system and equipment being tested.
 - c. Disposal site for test media that have the potential, upon disposal, to create a Hazardous Environmental Condition, are subject to review and acceptance by OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR.
 - d. During performance testing, CONTRACTOR shall obtain baseline operating data on equipment with motors greater than one horsepower. Baseline data shall include amperage, bearing temperatures, and vibration data obtained at intervals in the approved testing plan. Methods of measurement shall be in accordance with industry standards applicable for the motors being tested.

2. Test Interruption: Should testing be halted for any reason, repeat the operational testing until specified continuous testing period is completed for the system or equipment item without interruption, in accordance with the Contract Documents.
3. Test Results and Re-testing: The following applies to the entire system tested and to portions thereof:
 - a. Successful test results shall indicate conformance in accordance with the Contract Documents. If performance tolerances are not specified in the Contract Documents, test results shall conform to tolerances established in approved testing plan submittal.
 - b. When results of performance testing fail to comply with the Contract Documents regarding such test, CONTRACTOR shall make adjustments and repairs as required and shall repeat the tests as required until conform with the Contract Documents is achieved.
 - c. Re-testing because of Disputed Testing Results or Procedures: In the case of an otherwise satisfactory performance test, when there is doubt, dispute, or difference between CONSTRUCTION CONTRACT ADMINISTRATOR and CONTRACTOR regarding testing results, methods, or equipment used in performance testing, CONSTRUCTION CONTRACT ADMINISTRATOR may order CONTRACTOR to repeat the testing. If repeat testing using such modified methods or equipment required by CONSTRUCTION CONTRACT ADMINISTRATOR confirms the previous test, all costs of repeat test will be paid by OWNER. Otherwise all costs, including costs of engineering, labor, testing agencies, and inspections, shall be paid by CONTRACTOR.
4. Post-test Inspection: After completing performance testing, check equipment for proper alignment and realign as required. Check equipment for loose connections, unusual movement, and other indication of improper operating characteristics. Disassemble and inspect equipment and devices that exhibit unusual or unacceptable operating characteristics. Repair or replace defective Work to conform to the Contract Documents at no additional cost to OWNER

++ END OF SECTION ++

SECTION 01 79 23

INSTRUCTION OF OPERATIONS AND MAINTENANCE PERSONNEL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall provide services of Supplier's operation and maintenance training specialists to instruct OWNER's personnel in recommended operation and maintenance procedures for products and equipment per the Specifications.
- B. Supplier shall provide a combination of classroom and field training. All training shall be conducted at the Site, unless otherwise stated in the Specifications.
- C. OWNER reserves the right to videotape training sessions.
- D. Scheduling of Training Sessions:
 - 1. General:
 - a. CONTRACTOR shall coordinate training services with start-up and initial operation of products and equipment on days and times, and in manner, acceptable to OWNER and per the Specifications.
 - b. Training may be required outside of normal business hours to accommodate schedules of operations and maintenance personnel. Provide services as necessary at no additional cost to OWNER.
 - 2. Prerequisites to Training:
 - a. Training of OWNER's personnel shall commence only after acceptable preliminary operation and maintenance data have been provided and Work described in Section 01 75 11, Checkout and Startup Procedures, and Section 01 79 13, Equipment and System Startup and Performance Testing, has been completed.
 - b. At option of OWNER or CONSTRUCTION CONTRACT ADMINISTRATOR, training may be allowed to take place before, during, or after equipment start-up.
 - 3. Training Schedule Submittal:
 - a. Training Schedule Required: CONTRACTOR shall prepare and submit proposed training schedule for review and acceptance by CONSTRUCTION CONTRACT ADMINISTRATOR and OWNER. Proposed training schedule shall show all training required under the Contract, and shall demonstrate compliance with specified training requirements relative to number of hours of training, number of training sessions, and scheduling.
 - b. Timing of Submittal: Submit initial training schedule at least sixty days prior to scheduled start of first training session. Submit final training

- schedule, incorporating revisions per comments of OWNER and CONSTRUCTION CONTRACT ADMINISTRATOR, no later than thirty days prior to start of first training session. CONSTRUCTION CONTRACT ADMINISTRATOR may reduce the number of days and otherwise modify requirements for submittal of training schedule.
- c. OWNER reserved the right to modify training schedule to meet process or emergency needs at the Site.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Supplier's instructors shall be factory-trained by manufacturer of equipment or product.
2. Supplier's instructors shall be proficient and experienced in conducting training of type required.
3. Qualifications of instructors are subject to acceptance by CONSTRUCTION CONTRACT ADMINISTRATOR. If CONSTRUCTION CONTRACT ADMINISTRATOR does not accept qualifications of proposed instructor, provide replacement instructor with acceptable qualifications.

B. Training Scheduling Conference:

1. Prior to preparing initial training schedule submittal, schedule and hold training scheduling conference at the Site, to review:
 - a. Training requirements per the Contract Documents.
 - b. Work to be completed prior to starting training.
 - c. Work progress and Progress Schedule relative to start-up and training.
 - d. Scheduling constraints for OWNER's personnel (i.e., days and times of training sessions).
 - e. Preferred days for training.
 - f. Training location and facilities available.
 - g. Required submittals.
 - h. Other issues relative to training of operations and maintenance personnel.
2. Attendance is mandatory for the following:
 - a. CONTRACTOR's project manager.
 - b. CONTRACTOR's Site superintendent.
 - c. Project manager of Subcontractors responsible for providing equipment and products for which training of OWNER's personnel is required.
 - d. Suppliers invited by CONTRACTOR.
 - f. CONSTRUCTION CONTRACT ADMINISTRATOR.
 - g. OWNER's staff responsible for training coordination, and staff responsible for scheduling operations and maintenance personnel.
3. If additional information must be developed to adequately cover agenda items, reconvene conference as soon as possible.

4. CONTRACTOR shall record discussions of conference and decisions and agreements (or disagreements) and provide copy of record to each conference attendee.

1.3 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Training Schedule: Detailed schedule of training sessions, demonstrating compliance with number of training sessions, hours required in the Contract Documents, and specified schedule requirements. Provide training schedule submittals per time frames specified in this Specification Section.
- B. Informational Submittals: Submit the following:
 1. Lesson Plan: Acceptable proposed lesson plan for training on each product or equipment item, per Specifications. Lesson plan shall conform to requirements of this Specification Section. Include with lesson plan copy of handouts that will be used during training sessions. Provide lesson plan submittals per time frames specified in this Specification Section.
 2. Qualifications: Credentials of Supplier's proposed operations and maintenance instructor(s). Credentials shall demonstrate compliance with requirements of this Specification Section and shall include brief resume and specific details of instructor's operation, maintenance, and training experience relative to the specific products for which instructor will provide training.
 3. Minutes of training scheduling conference.
- C. Closeout Submittals: Submit the following:
 1. Trainee sign-in sheet for each training session. Provide to OWNER's training coordinator.

1.4 LESSON PLAN

- A. Supplier's lesson plan shall describe specific instruction topics, system components for which training will be provided, and training procedures. Handouts to be used in training shall be attached to lesson plan when applicable. Describe in lesson plan "hands-on" demonstrations planned for training sessions.
- B. Provide acceptable lesson plan fourteen days prior to starting associated training.
- C. Lesson plan shall include estimated duration of each training segment.
- D. Lesson plan shall include the following:
 1. Equipment Overview (required for all types of operations and maintenance training):
 - a. Describe equipment's operating (process) function and performance objectives.

- b. Describe equipment's fundamental operating principles and dynamics.
 - c. Identify equipment's mechanical, electrical, and electronic components and features. Group related components into subsystems and describe function of subsystem and subsystem's interaction with other subsystems..
 - d. Identify all support equipment associated with operation of subject equipment (i.e., air intake filters, valve actuators, motors).
 - e. Identify and describe all safety precautions and potential hazards related to operation.
 - f. Identify and describe in detail safety and control interlocks.
2. Operations Personnel Training:
- a. Equipment Overview: As described above.
 - b. Operation:
 - 1) Describe operating principles and practices.
 - 2) Describe routine operating, start-up, and shutdown procedures.
 - 3) Describe abnormal or emergency start-up, operating, and shutdown procedures that may apply.
 - 4) Describe alarm conditions and responses to alarms.
 - 5) Describe routine monitoring and recordkeeping procedures.
 - 6) Describe recommended housekeeping procedures:
 - c. Troubleshooting:
 - 1) Describe how to determine if corrective maintenance or an operating parameter adjustment is required.
3. Mechanical Maintenance Training:
- a. Equipment Overview: As described above.
 - b. Equipment Preventive Maintenance:
 - 1) Describe preventative maintenance inspection procedures required to:
 - a) Inspect equipment in operation.
 - b) Spot potential trouble symptoms and anticipate breakdowns.
 - c) Forecast maintenance requirements (predictive maintenance).
 - 2) Define recommended preventative maintenance intervals for each component.
 - 3) Provide lubricant and replacement part recommendations and limitations.
 - 4) Describe appropriate cleaning practices and recommend intervals.
 - 5) Identify and describe use of special tools required for maintenance of equipment.
 - 6) Describe component removal/installation and disassembly/assembly procedures.
 - 7) Perform "hands-on" demonstrations of preventive maintenance procedures.
 - 8) Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.

- 9) Define recommended torquing, mounting, calibrating, and aligning procedures and settings, as appropriate.
 - 10) Describe recommended procedures to check and test equipment following corrective maintenance.
- c. Equipment Troubleshooting:
- 1) Define recommended systematic troubleshooting procedures.
 - 2) Provide component-specific troubleshooting checklists.
 - 3) Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
 - 4) Describe common corrective maintenance procedures with “hands on” demonstrations.
4. Instrumentation/Controls Maintenance Training:
- a. Equipment Overview: As described above.
 - b. Preventative Maintenance and Troubleshooting: Per Section 40 61 26, Process Control System Training. CONSTRUCTION CONTRACT ADMINISTRATOR may grant waiver(s) to allow all training for a given system to be at the Site.

1.5 TRAINING AIDS

- A. Supplier’s instructor shall incorporate training aids as appropriate to assist in the instruction. Provide text and figure handouts. Other appropriate training aids include:
1. Audio-Visual aids, such as videos, PowerPoint presentations, overhead transparencies, posters, blueprints, diagrams, catalog sheets.
 2. Equipment cutaways and samples, such spare parts and damaged equipment.
 3. Tools, such as repair tools, customized tools, measuring and calibrating instruments.
- B. Handouts:
1. Supplier’s instructor shall utilize descriptive class handouts during training. Customized handouts developed especially for training at the Site are encouraged.
 2. Photocopied handouts shall be good quality and completely legible.
 3. Handouts should accompany the instruction with frequent reference made to handouts.
 4. Provide at least fifteen copies of handouts per training session.
- C. Audio-visual Equipment: Supplier shall provide audio-visual equipment required for training sessions. If it is available at the Site, OWNER may make available OWNER’s audio-visual equipment; however, do not count on OWNER providing audio-visual equipment. Audio-visual equipment that Supplier shall provide, as required, includes:
1. Laptop computer, presentation software, and PowerPoint projector.
 2. As required, extension cords and spare bulb for projector.

3. As required, projection screen, DVD player, television monitor, and any other equipment that may be needed to complete training sessions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TRAINING DELIVERY

A. General:

1. Instructors shall be fully prepared for the training sessions. Training delivery shall be communicative, clear, and proceed according to lesson plan accepted by CONSTRUCTION CONTRACT ADMINISTRATOR, with lesson content appropriate for trainees. If OWNER or CONSTRUCTION CONTRACT ADMINISTRATOR deems that training delivery does not conform to requirements of Specifications, training shall be postponed, rescheduled, and re-performed in acceptable manner at no additional cost to OWNER.
2. Trainee Sign-in Sheets: In format acceptable to OWNER, provide sign-in sheet for trainees for each session. Sign-in sheets shall include the Project name, product or system for which training was provided, and type of training (e.g., operations, mechanical maintenance, instrumentation/controls maintenance, or other), and name of each trainee. Upon completion of training, provide copy of each sign-in sheet to OWNER's training coordinator.

B. "Hands-on" Demonstrations:

1. Supplier's instructor shall present "hands-on" demonstrations of operations and maintenance of equipment for each training session, per lesson plan accepted by CONSTRUCTION CONTRACT ADMINISTRATOR.
2. CONTRACTOR and Supplier shall all provide tools necessary for demonstrations.

++ END OF SECTION ++

SECTION 02 41 00

DEMOLITION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required for demolition, removal, and disposal Work.
2. The Work under this Section includes, but is not necessarily limited to:
 - a. Demolition and removal of existing materials and equipment as shown or indicated in the Contract Documents. The Work includes demolition of structural concrete, walls, structural steel, metals, roofs, attachments, appurtenances, piping, electrical and mechanical systems and equipment, and similar existing facilities.
3. Demolitions and removals specified under other Sections shall comply with requirements of this Section.
4. Perform demolition Work within areas shown or indicated.
5. Pay all costs associated with transporting and, as applicable, disposing of materials and equipment resulting from demolition.

B. Coordination:

1. Comply with Section 01 41 16, Coordination with Owner's Operations.
2. Review procedures under this and other Sections and coordinate the Work that will be performed with or before demolition and removals.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Electrical Removals: Entity and personnel performing electrical removals shall be electrician legally qualified to perform electrical construction and electrical work in the jurisdiction where the Site is located.
2. Plumbing Removals: Entity and personnel performing plumbing removals shall be plumber legally qualified to perform plumbing construction and plumbing work in the jurisdiction where the Site is located.

B. Regulatory Requirements:

1. Demolition, removal, and disposal Work shall be in accordance with 29 CFR 1926.850 through 29 CFR 1926.860 (Subpart T - Demolition), and all other Laws and Regulations.

2. Comply with requirements of authorities having jurisdiction.

1.3 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Procedure Submittals:
 - a. Demolition and Removal Plan: Not less than ten days prior to starting demolition Work, submit acceptable plan for demolition and removal Work, including:
 - 1) Plan for coordinating shut-offs, capping, temporary services, and continuing utility services.
 - 2) Other proposed procedures as applicable.
 - 3) Equipment proposed for use in demolition operations.
 - 4) Recycling/disposal facility(ies) proposed, including facility owner, facility name, location, and processes. Include copy of appropriate permits and licenses, and compliance status.
 - 5) Planned demolition operating sequences.
 - 6) Detailed schedule of demolition Work in accordance with the accepted Process Schedule.
2. Notification of Intended Demolition Start: Submit in accordance with Paragraph 3.1.A of this Section.
3. Qualifications Statements:
 - a. Name and qualifications of entity performing electrical removals, including copy of licenses required by authorities having jurisdiction.
 - b. Name and qualifications of entity performing plumbing removals, including copy of licenses required by authorities having jurisdiction.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PREPARATION

A. Notification:

1. At least 48 hours prior to commencing demolition or removal, notify ENGINEER in writing of planned start of demolition Work. Do not start removals without permission of ENGINEER.
2. CONTRACTOR shall coordinate with ENGINEER and OWNER so that the ENGINEER is on site when the tunnel and trough areas are demolished.

B. Protection of Surrounding Areas and Facilities:

1. Perform demolition and removal Work in manner that prevents damage and injury to property, structures, occupants, the public, and facilities. Do not

- interfere with use of, and free and safe access to and from, structures and properties.
2. Closing or obstructing of roads, drives, sidewalks, and passageways adjacent to the Work is not allowed unless indicated otherwise in the Contract Documents. Conduct the Work with minimum interference to vehicular and pedestrian traffic.
 3. Provide temporary barriers, lighting, sidewalk sheds, and other necessary protection.
 4. Repair damage to facilities that are to remain.
- C. Existing Utilities: In addition to requirements of the General Conditions, Supplementary Conditions, and Division 01 Specifications, do the following:
1. Should uncharted or incorrectly charted Underground Facilities be encountered, CONTRACTOR responsibilities shall be in accordance with the General Conditions as may be modified by the Supplementary Conditions. Cooperate with utility owners in keeping adjacent services and facilities in operation.
 2. Water Piping: Before proceeding with demolition, locate and cap all potable and non-potable waterlines and service laterals serving the building or structure being demolished.
 3. Other Utilities: Before proceeding with demolition, locate and cap as required all other utilities, such as fuel and gas; heating, ventilating, and air conditioning; electric; and communications; and service laterals serving the building or structure being demolished.
 4. Shutdown of utility services shall be coordinated by CONTRACTOR, assisted by OWNER as required relative to contacting utility owners.

3.2 DEMOLITION – GENERAL

- A. Locate construction equipment used for demolition Work and remove demolished materials and equipment to avoid imposing excessive loading on supporting and adjacent walls, floors, framing, facilities, and Underground Facilities.
- B. Pollution Controls:
1. Use water sprinkling, temporary enclosures, and other suitable methods to limit emissions of dust and dirt to lowest practical level. Comply with Section 01 57 05, Temporary Controls, and Laws and Regulations.
 2. Do not use water when water may create hazardous or objectionable conditions such as icing, flooding, or pollution.
 3. Clean adjacent structures, facilities, properties, and improvements of dust, dirt, and debris caused by demolition Work, in accordance with the General Conditions and Section 01 74 05, Cleaning.
- C. Salvage and Ownership:

1. Refer to Section 01 11 13, Summary of Work, for requirements on salvage, ownership, and handling of equipment and materials removed during demolition and removal Work.
 2. Materials and equipment to remain OWNER's property shall be carefully removed and appropriately handled by CONTRACTOR to avoid damage and invalidation of warranties in effect, and shall be cleaned and stored at the Site (or other site specified in the Contract Documents) at place designated by ENGINEER or OWNER.
- D. Finishing of Surfaces Exposed by Removals: Unless otherwise shown or indicated in the Contract Documents, surfaces of walls, floors, ceilings, and other areas exposed by removals, and that will remain as finished surfaces, shall be repaired and re-finished with materials that match existing adjacent surface, or as otherwise approved by ENGINEER.

3.3 STRUCTURAL REMOVALS

- A. Remove structures to lines and grades shown or indicated, unless otherwise directed by ENGINEER. Where limits are not shown or indicated, limits shall be four inches outside item to be installed. Removals beyond limits shown or indicated shall be at CONTRACTOR's expense and such excess removals shall be reconstructed to satisfaction of ENGINEER without additional cost to OWNER.
- B. Recycling and Reuse of Demolition Materials:
1. All concrete, brick, tile, masonry, roofing materials, reinforcing steel, structural metals, miscellaneous metals, plaster, wire mesh, and other items contained in or upon building or structure to be demolished shall be removed, transported, and disposed of away from the Site, unless otherwise approved by ENGINEER.
 2. Do not use demolished materials as fill or backfill adjacent to structures, in pipeline trenches, or as subbase under structures or pavement.
- C. After removing concrete and masonry walls or portions thereof, slabs, and similar construction that ties in to the Work or to existing construction, neatly repair the junction point to leave exposed only finished edges and finished surfaces.
- D. Where parts of existing structures are to remain in service following demolition, remove the portions shown or indicated for removal, repair damage, and leave the building or structure in proper condition for the intended use.
1. Remove concrete and masonry to the lines shown or indicated by sawing, drilling, chipping, and other suitable methods. Leave the resulting surfaces true and even, with sharp, straight corners that will result in neat joints with new construction and be satisfactory for the purpose intended.
 2. Do not damage reinforcing bars beyond the area of concrete and masonry removal. Do not saw-cut beyond the area to be removed.

3. Reinforcing bars that are exposed at surfaces of removed concrete and masonry that will not be covered with new concrete or masonry shall be removed to 1.5 inches below the final surface. Repair the resulting hole, with repair mortar for concrete and grout for masonry, to be flush with the surface.
 4. Where existing reinforcing bars are shown or indicated to extend into new construction, remove existing concrete so that reinforcing bars are clean and undamaged.
- E. Where equipment or material anchored to concrete or masonry are removed and anchors are not to be re-used, remove the anchors to not less than 1.5 inches beneath surface of concrete or masonry member. Repair the resulting hole, using repair mortar for concrete and grout for masonry, to be flush with the surface. Alternately, when the anchor is stainless steel, the anchor may be cut flush with the surface of the concrete or masonry, when so approved by ENGINEER.
- E. Jambs, sills and heads of windows, passageways, doors, or other openings (as applicable) cut-in to the Work or to existing construction shall be dressed with masonry, concrete, or metal to provide smooth, finished appearance.
- F. Where anchoring materials, including bolts, nuts, hangers, welds, and reinforcing steel, are required to attach the Work to existing construction, provide such materials under this Section, unless specified elsewhere in the Contract Documents.

3.4 MECHANICAL REMOVALS

- A. Mechanical demolition and removal Work includes dismantling and removing existing piping, ductwork, pumps, equipment, tanks, and appurtenances as shown, indicated, and required for completion of the Work. Mechanical removals include cutting and capping as required, except that cutting of existing piping and ductwork to make connections is included under Section 01 14 16, Coordination with Owner's Operations; Section 01 73 29, Cutting and Patching; and applicable Sections of Division 40, Process Integration.
- B. Demolition and Removals of Piping, Ductwork, and Similar Items:
1. Purge piping and tanks (as applicable) of chemicals or fuel (as applicable) and make safe for removal and capping. Remove to the extent shown or indicated existing process, water, waste and vent, chemical, gas, fuel, and other piping. Remove piping to the nearest solid piping support, and provide caps on ends of remaining piping. Where piping to be demolished passes through existing walls to remain, cut off and cap pipe on each side of the wall.
 2. Caps, Closures, Blind Flanges, and Plugs:
 - a. Provide closure pieces, such as blind flanges and caps, where shown or required to complete the Work.

- b. Where used in this Section, the term “cap” means the appropriate type closure for the piping or ductwork being closed, including caps, blind flanges, and other closures.
 - c. Caps shall be compatible with the piping or ductwork to which the cap is attached, fluid-tight and gastight, and appropriate for the fluid or gas conveyed in the pipe or duct.
 - d. Unless otherwise shown or indicated, caps shall be mechanically fastened, fused, or welded to pipe or duct. Plug piping with means other than specified in this Section only when so shown or indicated in the Contractor Documents or when allowed by ENGINEER.
3. When Underground Facilities are altered or removed, properly cut and cap piping left in place, unless otherwise shown or indicated.
 4. Remove waste and vent piping, and ductwork to extent shown and cap as required. Where demolished vent piping, stacks, and ductwork passes through existing roofing, patch the roof with the same or similar materials. Completed patch shall be watertight and comply with roofing manufacturer’s recommendations.
 5. Modifications to potable water piping and other plumbing and heating system work shall comply with Laws and Regulations. All portions of potable water system that have been modified or opened shall be hydrostatically tested and disinfected in accordance with the Contract Documents, and Laws and Regulations. Hydrostatically test other, normally-pressurized, plumbing piping and heating piping.

C. Equipment Demolition and Removals:

1. To the extent shown or indicated, remove existing process equipment; pumps; storage tanks; hoisting and conveying equipment; heating, ventilating, and air conditioning equipment; generators; and other equipment.
2. Where required, disassemble equipment to avoid imposing excessive loading on supporting walls, floors, framing, facilities, and Underground Facilities. Disassemble equipment as required for access through and egress from building or structure. Disassembly shall comply with Laws and Regulations. Provide required means to remove equipment from building or structure.
3. Remove control panels, operator stations, and instruments associated with equipment being removed, unless shown or indicated otherwise.
4. Remove fuel appurtenances as applicable, including fuel storage tanks. Dispose of tank contents in accordance with Laws and Regulations.
5. Remove equipment supports as applicable, anchorages, base, grout, and piping. Remove anchorage systems in accordance with the “Structural Removals” Article in this Section. Remove small-diameter piping back to header unless otherwise indicated.
6. Remove access platforms, ladders, and stairs related to equipment being removed, unless otherwise shown or indicated.

3.5 ELECTRICAL REMOVALS

- A. Electrical demolition Work includes removing existing transformers, distribution switchboards, control panels, motors, starters, conduit and raceways, cabling, poles and overhead cabling, panelboards, lighting fixtures, switches, and miscellaneous electrical equipment, as shown, specified, or required.
- B. Remove existing electrical equipment and fixtures to avoid damaging systems to remain, to keep existing systems in operation, and to maintain integrity of grounding systems.
- C. Remove or modify motor control centers and switchgear as shown or indicated. Modified openings shall be cut square and dressed smooth to dimensions required for installation of equipment.
- D. Disconnect and remove motors, control panels, and other electrical gear where shown or indicated. Motors, microprocessors and electronics, other electrical gear to be reused shall be stored in accordance with Section 01 66 00, Product Storage and Handling Requirements.
- E. Cables in conduits to be removed shall be removed back to the power source or control panel, unless otherwise shown or indicated. Verify the function of each cable before disconnecting and removing.
- F. Conduits, raceways, and cabling shall be removed where shown or indicated. Abandoned conduits concealed in floor, ceiling slabs, or in walls shall be cut flush with the slab or wall (as applicable) at point of entrance, suitably capped, and the area repaired in a flush, smooth manner acceptable to ENGINEER. Exposed conduits, junction boxes, other electrical appurtenances, and their supports shall be disassembled and removed. Repair all areas of the Work to prevent rusting on exposed surfaces.
- G. Conduits in Underground Facilities not scheduled for reuse shall be suitably capped watertight where each enters building or structure to remain.
- H. Where shown or indicated, remove direct burial cable. Openings in buildings for entrance of direct burial cable shall be patched with repair mortar or other material approved by ENGINEER for this purpose, and made watertight.
- I. Existing poles and overhead cables shall be removed or abandoned as shown and specified. Existing substation(s) and poles owned by electric utility will be removed by the electric utility. Completely remove from the Site poles not owned by electric utility and shown or indicated for removal. Make necessary arrangements with electric utility for removal of utility company's transformers and metering equipment after new electrical system has been installed and energized.

- J. Lighting fixtures, wall switches, receptacles, starters, and other miscellaneous electrical equipment, not designated as remaining as OWNER's property, shall be removed and properly disposed off-Site as required.

3.6 DISPOSAL OF DEMOLITION DEBRIS

- A. Remove from the Site all debris, waste, rubbish, and material resulting from demolition operations and equipment used in demolition Work. Comply with the General Conditions, Supplementary Conditions, and Section 01 74 05, Cleaning.
- B. Transportation and Disposal:
 - 1. Non-hazardous Material: Properly transport and dispose of non-hazardous demolition debris at appropriate landfill or other suitable location, in accordance with Laws and Regulations. Non-hazardous material does not contain Asbestos, PCBs, Petroleum, Hazardous Waste, Radioactive Material, or other material designated as hazardous in Laws and Regulations.
 - 2. Hazardous Material: When handling and disposal of hazardous materials is included in the Work, properly transport and dispose of hazardous materials in accordance with the Contract Documents and Laws and Regulations.
- C. Submit to ENGINEER information required in this Section on proposed facility(ies) where demolition material will be recycled. Upon request, ENGINEER or OWNER, shall be allowed to visit recycling facility(ies) to verify adequacy and compliance status. During such visits, recycling facility operator shall cooperate and assist ENGINEER and OWNER.

++ END OF SECTION ++

SECTION 03 00 05

CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete, reinforcing, and related materials.
2. The Work includes:
 - a. Providing concrete consisting of portland cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
 - b. Fabricating and placing reinforcing, including ties and supports.
 - c. Design, erection, and removal of formwork.
 - d. Building into the concrete all sleeves, frames, anchorage devices, inserts, and other items required to be embedded in concrete.
 - e. Providing openings in concrete as required to accommodate Work under this and other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.

C. Classifications of Concrete:

1. Class "A" concrete shall be steel-reinforced and includes all concrete unless otherwise shown or indicated.

B. Related Sections:

1. Section 05 05 33, Anchor Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ACI 224R, Control of Cracking in Concrete Structures.
2. ACI 301, Specifications for Structural Concrete for Buildings.
3. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305R, Specification for Hot Weather Concreting.
5. ACI 306R, Cold Weather Concreting.
6. ACI 309R, Guide for Consolidation of Concrete.

7. ACI 318, Building Code Requirements for Structural Concrete and Commentary.
8. ACI 347, Guide to Formwork for Concrete.
9. ACI SP-66, ACI Detailing Manual.
10. ASTM A82/A82M, Specification for Steel Wire, Plain, for Concrete Reinforcement.
11. ASTM A185/A185M, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
12. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
13. ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field.
14. ASTM C33/C33M, Specification for Concrete Aggregates.
15. ASTM C39/C39M, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
16. ASTM C42/C42M, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
16. ASTM C94/C94M, Specification for Ready-Mixed Concrete.
17. ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
18. ASTM C143/C143M, Test Method for Slump of Hydraulic-Cement Concrete.
19. ASTM C150/C150M, Specification for Portland Cement.
20. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
21. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
22. ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
23. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
24. ASTM C494/C494M, Specification for Chemical Admixtures for Concrete.
25. ASTM C579, Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
26. ASTM C1064/C1064M, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
27. ASTM D1752, Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
28. CRD-C 572, U. S. Army Corps of Engineers Specification for Polyvinylchloride Waterstops.
29. CRSI IMSP, Manual of Standard Practice.

1.3 QUALITY ASSURANCE

A. Laboratory Trial Batch:

1. Employ independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.

2. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
3. Perform the following testing on each trial batch:
 - a. Aggregate gradation for fine and coarse aggregates.
 - b. Slump.
 - c. Air content.
 - d. Compressive strength based on three cylinders each tested at seven days and at 28 days.
4. Submit for each trial batch the following information:
 - a. Project identification name and number (if applicable).
 - b. Date of test report.
 - c. Complete identification of aggregate source of supply.
 - d. Tests of aggregates for compliance with the Contract Documents.
 - e. Scale weight of each aggregate.
 - f. Absorbed water in each aggregate.
 - g. Brand, type, and composition of cementitious materials.
 - h. Brand, type, and amount of each admixture.
 - i. Amounts of water used in trial mixes.
 - j. Proportions of each material per cubic yard.
 - k. Gross weight and yield per cubic yard of trial mixtures.
 - l. Measured slump.
 - m. Measured air content.
 - n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28-day test, and for each design mix.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Shop Drawings:
 - a. List of concrete materials and concrete mix designs proposed for use. Include results of tests performed to qualify the materials and to establish the mix designs. Do not start laboratory trial batch testing until this submittal is approved by ENGINEER.
 - b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
 - c. Concrete placement drawings showing the location and type of all joints. For joints that require waterstops, submit layout of locations showing waterstop details. Indicate waterstop type, waterstop joint conditions, and details on how joint conditions will be handled.
 - d. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI SP-66. For walls and masonry construction, provide elevations to a minimum scale of 1/4-inch to one foot. Show bar schedules, stirrup spacing, adhesive dowels, splice lengths, diagrams of bent bars, arrangements, and assemblies, as required for fabricating and

- placing concrete reinforcing.
 - 2. Product Data:
 - a. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures, waterstops, non-shrink grout and bonding agents.
 - 3. Samples:
 - a. Samples: Submit samples of materials as specified and as otherwise requested by ENGINEER, including names, sources, and descriptions.
- B. Informational Submittals: Submit the following:
- 1. Delivery Tickets: Copies of all delivery tickets for each load of concrete delivered to or mixed at the Site. Each delivery tickets shall contain the information in accordance with ASTM C94/C94M along with project identification name and number (if any), date, mix type, mix time, quantity and amount of water introduced.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transportation, Delivery, and Handling:
- 1. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.
 - 2. Materials used for concrete shall be clean and free from foreign matter during transportation and handling, and kept separate until measured and placed into concrete mixer.
 - 3. Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur and grading is not affected.
 - 4. Deliver grout materials from manufacturers in unopened containers that bear intact manufacturer labeling.
- B. Storage:
- 1. Store formwork materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
 - 2. Store concrete reinforcing materials to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground. Space framework or blocking supports to prevent excessive deformation of stored materials.
 - 3. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight.
 - 4. For storage of concrete materials, provide bins or platforms with hard, clean surfaces.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All cementitious materials, admixtures, curing compounds, and other industrial-produced materials used in concrete, or for curing or repairing of concrete, that can contact potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.

2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type II.
- B. Aggregates: ASTM C33/C33M.
 - 1. Fine Aggregate: Clean, sharp, natural sand free of loam, clay, lumps, and other deleterious substances. Dune sand, bank run sand, and manufactured sand are unacceptable.
 - 2. Coarse Aggregate:
 - a. Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter.
 - b. Coarse aggregate shall comply with the following:
 - 1) Crushed stone, processed from natural rock or stone.
 - 2) Washed gravel, either natural or crushed. Slag, pit gravel, and bank-run gravel are not allowed.
 - c. Coarse Aggregate Size: ASTM C33/C33M, Nos. 57 or 67, unless otherwise approved by ENGINEER.
- C. Water: Clean, potable.
- D. Admixtures:
 - 1. Air-Entraining Admixture: ASTM C260.
 - 2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 3. Water Reducing and Set-Adjusting Admixtures: ASTM C494/C494M, Types D and E.
 - 4. High Range Water-Reducing Admixture: ASTM C494/C494M, Type F/G.
 - 5. Use only admixtures that have been tested and approved in the mix designs.
 - 6. Do not use calcium chloride or admixtures containing chloride ions.

2.3 CONCRETE MIXTURE

- A. General:
 - 1. Normal weight: 145 pounds per cubic foot.
 - 2. Use air-entraining admixture in all concrete. Provide not less than four percent, nor more than seven percent, entrained air for concrete.

- B. Proportioning and Design of Class "A" Concrete Mix:
 - 1. Minimum compressive strength at 28 days: 4,500 psi.
 - 2. Maximum water-cement ratio by weight: 0.42.
 - 3. Minimum cement content: 564 pounds per cubic yard.

- C. Slump Limits:
 - 1. Proportion and design mixes to result in concrete slump at point of placement of not less than one inch and not more than four inches.
 - 2. When using high-range water reducers, slump prior to addition of admixture shall not exceed three inches. Slump after adding admixture shall not exceed eight inches at point of placement.

- D. Adjustment of Concrete Mixes:
 - 1. Concrete mix design adjustments may be requested by CONTRACTOR when warranted by characteristics of materials, Site conditions, weather, test results, or other, similar circumstances.
 - 2. Submit for ENGINEER's approval laboratory test data for adjusted concrete mix designs, including compressive strength test results.
 - 3. Implement adjusted mix designs only after ENGINEER's approval.
 - 4. Adjustments to concrete mix designs shall not result in additional costs to OWNER.

2.4 FORM MATERIALS

- A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. CONTRACTOR shall be responsible for designing the formwork system to resist all applied loads including pressures from fluid concrete and construction loads.

- B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces in accordance with ACI 301.

- C. Unexposed Concrete Surfaces: Material to suit project conditions.

- D. Provide 3/4-inch chamfer at all external corners. Chamfer is not required at re-entrant corners unless otherwise shown or indicated.

- E. Form Ties:
 - 1. Provide factory-fabricated, removable, or snap-off metal form ties, that prevent form deflection and prevent spalling of concrete surfaces upon removal. Materials used for tying forms are subject to approval of ENGINEER.
 - 2. Unless otherwise shown or indicated, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5 inches from outer surface of concrete. Unless otherwise shown or indicated, provide form ties

that, upon removal, will leave a uniform, circular hole not larger than one-inch diameter in the concrete surface.

3. Ties for exterior walls, below-grade walls, and walls subject to hydrostatic pressure shall be provided with waterstops.
4. Wire ties are unacceptable.

2.5 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.
- B. Welded Wire Fabric: ASTM A185/A185M.
- C. Steel Wire: ASTM A82/A82M.
- D. Provide supports for reinforcing including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.
 1. Use wire bar-type supports complying with CRSI MSP1 recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
 2. For slabs on grade, use precast concrete blocks, four inches square minimum with compressive strength equal to or greater than the surrounding concrete, or supports with sand plates or horizontal runners where base materials will not support chair legs.
 3. For all concrete surfaces where legs of supports are in contact with forms, provide supports having either hot-dip galvanized, plastic-protected, or stainless steel legs in accordance with CRSI MSP1.
 4. Provide precast concrete supports over waterproof membranes.
- E. Adhesive Dowels:
 1. Dowels:
 - a. Dowel reinforcing bars shall comply with ASTM A615, Grade 60.
 2. Adhesive:
 - a. For requirements for adhesive, refer to Section 05 05 33, Anchor Systems.

2.6 RELATED MATERIALS

- A. Waterstops:
 1. PVC Waterstops:
 - a. Manufacturers: Provide products of one of the following:
 - 1) W.R. Meadows, Inc.
 - 2) Greenstreak Plastic Products Company.
 - 3) Or equal.
 - b. Waterstops shall comply with CRD-C 572. Do not use reclaimed or scrap material.

- c. Minimum Thickness: 3/8-inch.
 - d. Provide waterstops with minimum of seven ribs equally spaced at each end on each side with the first rib located at the edge. Each rib shall be minimum 1/8-inch in height.
 - e. Construction Joints: Waterstops shall be six-inch wide flat-strip type.
 - f. Expansion Joints: Waterstops shall be nine-inch wide centerbulb type.
2. Hydrophilic Waterstops:
- a. Products and Manufacturers: Provide one of the following:
 - 1) Duroseal Gasket, by BBZ USA, Inc.
 - 2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
 - 3) Hydrotite, by Greenstreak Plastic Products Company.
 - 4) Or equal.
 - b. Hydrophilic waterstop materials shall be bentonite-free and shall expand by minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
 - c. Waterstop material shall be composed of resins and polymers that absorb water and cause a completely reversible and repeatable increase in volume.
 - d. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
 - e. Select material in accordance with manufacturer's recommendations for type of liquid to be contained.
 - f. Maximum cross-sectional dimensions: 0.08-inch by 0.59-inch.
 - g. Location of hydrophilic waterstops shall be as shown or indicated on the Drawings, or where approved by ENGINEER.
 - h. Hydrophilic Sealant: Shall adhere firmly to concrete, metal, and PVC in dry or damp condition and be indefinitely elastic when cured.
 - 1) Products and Manufacturers: Provide one of the following:
 - a) Hydrotite, by Greenstreak Plastic Products Company.
 - b) Or equal.

B. Epoxy Bonding Agent:

- 1. Two-component epoxy resin bonding agent.
- 2. Products and Manufacturers: Provide one of the following:
 - a. Sikadur 32, Hi-Mod LPL, by Sika Corporation.
 - b. Eucopoxy LPL, by the Euclid Chemical Company.
 - c. Or equal.

C. Epoxy-Cement Bonding Agent:

- 1. Three-component blended epoxy resin-cement bonding agent.
- 2. Products and Manufacturers: Provide one of the following:
 - a. Sika Armatec 110 EpoCem, by Sika Corporation.
 - b. Duralprep A.C., by Euclid Chemical Company.
 - c. Or equal.

- D. Preformed Expansion Joint Filler:
 - 1. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).
- E. Joint Sealant and Accessories:
 - 1. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07 92 00, Joint Sealants.

2.7 GROUT

- A. Non-shrink Grout:
 - 1. Pre-packaged, non-metallic, cementitious grout requiring only the addition of water at the Site.
 - 2. Minimum 28-day Compressive Strength: 7,000 psi.
 - 3. Products and Manufacturers: Provide one of the following:
 - a. NS Grout by Euclid Chemical Company.
 - b. Construction Grout, by Master Builders, Inc.
 - c. FSP Construction Grout, by Five Star Products, Inc.
 - d. Or equal.
- B. Epoxy Grout:
 - 1. Pre-packaged, non-shrink, non-metallic, 100 percent solids, solvent-free, moisture-insensitive, three-component epoxy grouting system.
 - 2. Minimum Seven-day Compressive Strength: 14,000 psi, when tested in accordance with ASTM C579.
 - 3. Products and Manufacturers: Provide one of the following:
 - a. Euco High Strength Grout, by Euclid Chemical Company.
 - b. Sikadur 42, Grout Pak, by Sika Corporation.
 - c. Five Star Epoxy Grout, by Five Star Products, Inc.
 - d. Or equal.
- C. Grout Fill:
 - 1. Grout mix shall consist of cement, fine and coarse aggregates, water, and admixtures complying with requirements specified in this Section for similar materials in concrete.
 - 2. Proportion and mix grout fill as follows:
 - a. Minimum Cement Content: 564 pounds per cubic yard.
 - b. Maximum Water-Cement Ratio: 0.45.
 - c. Maximum Coarse Aggregate size: 1/2-inch, unless otherwise indicated.
 - d. Minimum 28-day Compressive Strength: 4,000 psi.

PART 3 – EXECUTION

3.1 INSPECTION

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- A. CONTRACTOR shall examine the substrate and the conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 FORMWORK

- A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation, and position.
- B. Provide openings in formwork to accommodate the Work of other trades. Accurately place and securely support items required to be built into formwork.
- C. Clean and adjust forms prior to placing concrete. Apply form release agents or wet forms as required. Re-tighten forms during and after concrete placing, when required, to eliminate cement paste leaks.
- D. Removing Formwork:
 - 1. Comply with ACI 301 and ACI 347, except as otherwise indicated in the Contract Documents.
 - 2. Do not remove formwork and shoring until supported concrete members have acquired minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field-cured specimens may be submitted to ENGINEER for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated in the Contract Documents.
 - 3. Removal time for formwork is subject to ENGINEER's acceptance.
 - 4. Repair form tie-holes following in accordance with ACI 301.

3.3 REINFORCING, JOINTS, AND EMBEDDED ITEMS

- A. Comply with the applicable recommendations of Laws and Regulations and standards referenced in this Section, including CRSI MSP1, for details and methods of placing and supporting reinforcing.
- B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials which act to reduce or destroy bond between reinforcing material and concrete.
- C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by means of metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 1. Place reinforcing to obtain minimum concrete coverages as shown on the Drawings and as required in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in

- position during concrete placing. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
2. Do not secure reinforcing to formwork using wire, nails or other ferrous metal. Metal supports subject to corrosion shall not be in contact with formed or exposed concrete surfaces.
- D. Provide sufficient quantity of supports of strength required to carry reinforcing. Do not place reinforcing more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- E. Splices: Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or indicated for minimum lap of spliced bars, as shown on the Drawings.
- F. Install welded wire fabric in lengths as long as practical, lapping adjoining sections a minimum of one full mesh.
- G. Do not place concrete until reinforcing is inspected and ENGINEER indicates that conditions are acceptable for placing concrete. Concrete placed in violation of this paragraph will be rejected. Notify ENGINEER in writing at least two working days prior to proposed concrete placement.
- H. Joints:
1. Provide construction, isolation, expansion, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
 2. In walls, locate joints at a maximum spacing of 40 feet and approximately 12 feet from corners.
 3. In foundation slabs and slabs-on-grade, locate joints at intervals of approximately 40 feet.
 4. In mats and structural slabs and beams, locate joints in compliance with ACI 224R.
 5. Locations of joints shall be in accordance with the Contract Documents and as approved by ENGINEER in the Shop Drawings.
 6. Provide waterstops in all joints where concrete construction is below grade or intended to retain liquid. Install waterstop to the higher of: at least 12 inches above grade, or 12 inches above overflow liquid level in tanks. Provide PVC waterstops, except where otherwise shown or indicated on the Drawings.
 7. Where construction joints are indicated to be roughened, intentionally roughen surfaces of previously-placed concrete to amplitude of 1/4-inch.
- I. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by, cast-in-

place concrete. Use setting diagrams, templates, and instructions provided under other Sections for locating and setting. Refer to Paragraph 1.1.B of this Section. Do not embed in concrete uncoated aluminum items. Where aluminum items are in contact with concrete surfaces, coat aluminum to prevent direct contact with concrete.

J. Adhesive Dowels:

1. Adhesive dowels shall be reinforcing bar dowels set in an adhesive in a hole drilled into hardened concrete. Comply with adhesive system manufacturer's installation instructions regarding hole diameter, drilling method, embedment depth required to fully develop required tensile strength, and hole cleaning and preparation instructions. Unless more-stringent standards are required by adhesive system manufacturer, comply with the following.
2. Drill holes to adhesive system manufacturer's recommended diameter and depth to develop required tensile strength. Holes shall not be more than 1/4-inch greater than nominal bar diameter, and hole depth shall not be less than twelve times nominal bar diameter. Hammer-drill holes. Cored holes are not allowed.
3. Embedment depths shall be based on concrete compressive strength of 4,000 psi when embedded in existing and new concrete.
4. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by ENGINEER.
5. Before setting adhesive dowel, hole shall be free of dust and debris using method recommended by adhesive system manufacturer. Hole shall be brushed, with manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
6. Inject adhesive into hole through injection system mixing nozzle and necessary extension tubes, placed to bottom of hole. Withdraw discharge end as adhesive is placed, but keep end of tube immersed to prevent forming air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placement.
7. Twist dowels during insertion into partially-filled hole to guarantee full wetting of bar surface with adhesive. Insert bar slowly to avoid developing air pockets.

3.4 BONDING AGENT

- A. Use epoxy bonding agent for bonding of fresh concrete to concrete that has been in place for at least 60 days, and for bonding to existing concrete.
- B. Use epoxy-cement bonding agent for the following:
 1. Bonding toppings and concrete fill to concrete that has been in place for at least 60 days, and for bonding to existing concrete.

2. For locations where bonding agent is required and concrete cannot be placed within open time period of epoxy bonding agent.

3.5 CONCRETE PLACING

- A. Site Mixing: When Site mixing of concrete is approved by ENGINEER , use drum-type batch machine mixer, mixing not less than 1.5 minutes for one cubic yard or smaller capacity. Increase required mixing time by minimum of 15 seconds for each additional cubic yard or fraction thereof.
- B. Ready-Mixed Concrete: Comply with ASTM C94/C94M.
- C. Concrete Placing:
 1. Place concrete in a continuous operation within planned joints or sections in accordance with ACI 304R.
 2. Do not begin placing concrete until work of other trades affecting concrete is completed.
 3. Wet concrete and subgrade surfaces to saturated surface dry condition immediately prior to placing concrete.
 4. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
 5. Avoid separation of the concrete mixture during transportation and placing. Concrete shall not free-fall for distance greater than four feet during placing.
 6. Complete concrete placing within 90 minutes of addition of water to the dry ingredients.
- D. Consolidate placed concrete in accordance with ACI 309R using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is worked around placing and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly-spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or placing is not allowed.
- E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
 1. In hot weather comply with ACI 305R.
 2. In cold weather comply with ACI 306R.

3.6 QUALITY OF CONCRETE WORK

- A. Make concrete solid, compact, smooth, and free of laitance, cracks, and cold joints.
- B. Concrete for liquid-retaining structures and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.

- C. Cut out and properly replace to extent directed by ENGINEER, or repair to satisfaction of ENGINEER, surfaces that contain cracks or voids, are unduly rough, or are in defective in any way. Patches or plastering are unacceptable.
- D. Repair, removal and replacement of defective concrete directed by ENGINEER shall be at no additional cost to OWNER.

3.7 CURING

A. General:

- 1. Protect freshly placed concrete from premature drying, excessive cold or hot temperatures, and maintain without drying at relatively constant temperature for period necessary for hydration of cement and proper hardening of concrete.
- 2. Start curing after placing and finishing concrete, as soon as free moisture has disappeared from concrete surface. Keep surface continuously moist during entire curing period. Cure for a minimum of 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- 3. For curing, use water that is free of impurities that could etch or discolor exposed concrete surfaces.
- 4. Confine water for curing to area being cured.

B. Curing Methods: Curing methods are specified below. Curing methods to be used on each type of concrete surface are specified elsewhere in this Article.

- 1. Water Curing. Cure by one of the following methods:
 - a. Keep concrete surface continuously wet.
 - b. Ponding or immersion.
 - c. Continuous water-fog spray.
 - d. Covering concrete surface with curing mats, thoroughly saturating mats with water, and keeping mats continuously wet with sprinklers or porous hoses. Place curing mats to cover concrete surfaces and edges with four-inch horizontal lap over adjacent mats; provide eight-inch lap over adjacent mats at vertical surfaces. If necessary, weigh down curing cover to maintain contact with concrete surface.
- 2. Form Curing. Cure by one of the following methods:
 - a. Forms shall be maintained and loosened during curing period.
 - b. Immediately after forms are loosened or removed, continue with the required curing method as applicable, for remainder of curing period.
 - c. Where wood forms are kept in place, apply water to keep forms wet.
- 3. Moisture Retaining Cover Curing. Cure as follows:
 - a. Cover concrete surfaces with the required moisture retaining cover for curing concrete, placed in widest practical width with sides and ends lapped at least three inches and sealed using waterproof tape or adhesive. Immediately repair holes or tears during curing period using cover material and waterproof tape.

- C. Formed Surfaces: Use the following curing methods:
1. Walls That Will Retain Liquid or That are Under Ground Surface:
 - a. If forms are wood, form curing is allowed for entire curing period. If forms are steel, form curing is allowed for maximum of three days after which forms shall be removed so that concrete is free of the forms for remainder of the curing process.
 - b. Immediately after the forms are loosened or removed, continue with water curing for remainder of curing period.
 - c. When wall surface will not receive surface treatment and when allowed by ENGINEER, use of liquid curing compound is allowed. Before using liquid compound curing, use water curing or form curing for at least the first three days of curing.
 2. Formed Slab Underside and Beam Surfaces Where Will Retain Liquid:
 - a. Form curing is allowed for the full curing period.
 - b. Immediately after forms are loosened or removed, continue with water curing for remainder of curing period.
 - c. When slab surface will not receive surface treatment and when allowed by ENGINEER, use of liquid curing compound is allowed.
 3. Vertical Joint Surfaces and Surfaces to Receive Surface Treatment:
 - a. Form curing is allowed for entire curing period.
 - b. Immediately after forms are loosened or removed, continue with water curing for remainder of curing period.
 4. Cure other formed surfaces using an appropriate curing method specified in the Contract Documents.
- D. Unformed Surfaces: Treat with one of the following curing methods:
1. Slabs and Mats That Will Retain Liquid or are Below Ground Surface:
 - a. Water curing.
 - b. Moisture-retaining cover curing when allowed by ENGINEER.
 - c. When slab or mat surface will not receive surface treatment and when allowed by ENGINEER, use of liquid curing compound is allowed. Before using liquid compound curing, use water curing or form curing for at least the first three days of curing.
 2. Construction Joint Surfaces and Slab and Mat Surfaces to Receive Surface Treatment.
 - a. Water curing.
 - b. Moisture-retaining cover curing.
 3. Cure other formed surfaces using an appropriate curing method specified in the Contract Documents.

3.8 FINISHING

- A. Slab Finish:
1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete

has stiffened sufficiently. Use a wood float only. Check and level surface plane to a tolerance not exceeding 1/4-inch in ten feet when tested with a ten foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture. Slab surfaces shall receive a float finish. Provide additional trowel finishing as required in this Section.

2. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
3. Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten-foot straightedge. Grind smooth surface defects that would telegraph through applied floor covering system.
4. Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or indicated.
 - b. Apply non-slip broom finish, after troweling, to exterior concrete slab and elsewhere as shown.

B. Formed Finish:

1. Provide smooth form concrete finish at exposed surfaces. Use largest practical form panel sizes to minimize form joints. Exposed surfaces include interior water-contacting surfaces of tanks, whether or not directly visible. All surfaces shall be considered as exposed, unless buried or covered with permanent structural or architectural material. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/8-inch in height. Where surface will be coated or will receive further treatment, remove all fins flush with concrete surface.
2. Provide rough form finish at all unexposed surfaces. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/2-inch in height.

C. Grout Cleaned Finish:

1. Provide grout cleaned finish to concrete surfaces that have received smooth form finish and where defects have been repaired, as follows:
 - a. Combine one part portland cement to 1.5 parts fine sand by volume, and mix with water to consistency of thick paint. Blend standard portland cement and white portland cement, in proportions determined by trial patches, so that final color of dry grout will closely match adjacent concrete surfaces.
 - b. Thoroughly wet concrete surface and apply grout uniformly by brushing or spraying immediately to wetted surfaces. Scrub surface with cork float or stone to coat surface and fill surface holes. Remove excess grout by scraping, followed by rubbing with clean burlap to remove visible grout

film. Keep grout damp during setting period by using fog spray on surface for at least 36 hours after final rubbing. Complete each area the same day the area is started, with limits of each area being natural breaks in the finished surface.

2. Use grout cleaned finish for the following:
 - a. Interior exposed walls and other vertical surfaces.
 - b. Exterior exposed walls and other vertical surfaces down to one foot below grade.
 - c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
 - d. Interior exposed vertical surfaces of liquid-containing structures down to one foot below normal operating liquid level.
 - e. Other areas shown.

3.9 GROUT PLACING

- A. Place grout as shown and indicated, and in accordance with grout manufacturer's instructions and recommendations. If grout manufacturer's instructions conflict with the Contract Documents, notify ENGINEER and do not proceed until obtaining ENGINEER's clarification.
- B. Dry-packing is not allowed, unless otherwise indicated.
- C. Manufacturers of proprietary grout materials shall make available upon 72 hours notice the services of qualified, full-time, factory-trained employee to aid in ensuring proper use of grout materials at the Site.
- D. Placing grout shall comply with temperature and weather limitations described in Article 3.4 of this Section.

3.10 FIELD QUALITY CONTROL

- A. Site Testing Services:
 1. OWNER will employ testing laboratory to perform field quality control testing for concrete. ENGINEER will direct the testing requirements.
 2. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including: scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.
- B. Quality Control Testing During Construction:
 1. Perform sampling and testing for field quality control during concrete placing, as follows:
 - a. Sampling Fresh Concrete: ASTM C172.
 - b. Slump: ASTM C143/C143M; one test for each concrete load at point of discharge.

- c. Concrete Temperature: ASTM C1064/C1064M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed. Test each load when time from batching to placement exceeds 75 minutes.
- d. Air Content: ASTM C231; one for every two concrete load at point of discharge, and when a change in the concrete is observed.
- e. Unit Weight: ASTM C138/C138M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed.
- f. Compression Test Specimens:
 - 1) In accordance with ASTM C31/C31M, make one set of compression cylinders for each 50 cubic yards of concrete, or fraction thereof, of each mix design placed each day. Each set shall be four standard cylinders, unless otherwise directed by ENGINEER.
 - 2) Cast, store, and cure specimens in accordance with ASTM C31/C31M.
- g. Compressive Strength Tests:
 - 1) In accordance with ASTM C39/C39M; one specimen tested at seven days, and three specimens tested at 28 days.
 - 2) Concrete that does not comply with strength requirements will be considered as defective Work.
- h. Within 24 hours of completion of test, testing laboratory will transmit certified copy of test results to CONTRACTOR and ENGINEER.
- i. When there is evidence that strength of in-place concrete does not comply with the Contract Documents, CONTRACTOR shall employ the services of concrete testing laboratory to obtain cores from hardened concrete for compressive strength determination. Cores and tests shall comply with ASTM C42/C42M and the following:
 - 1) Testing of Adhesive Dowels: Owner will employ testing agency to perform field quality control testing of drilled dowel installations. After adhesive system manufacturer's recommended curing period and prior to placing connecting reinforcing, proof-test for pullout ten percent of adhesive dowels installed. Adhesive dowels shall be tensioned to 60 percent of specified yield strength. Where dowels are located less than six bar diameters from edge of concrete, ENGINEER will determine tensile load required for test. If one or more dowels fail, retest all dowels installed for the Work. Dowels that fail shall be reinstalled and retested at CONTRACTOR's expense.

++ END OF SECTION ++

SECTION 03 01 30

REPAIR AND REHABILITATION OF CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to repair or rehabilitate, as required, all existing concrete shown or indicated in the Contract Documents as being repaired or rehabilitated.
2. CONTRACTOR shall repair all damage to new concrete construction as specified in this Section except for repair Work specified in Section 03 00 05, Concrete.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the Work that must be installed with or before repair and rehabilitation of concrete.

C. Related Sections:

1. Section 03 00 05, Concrete.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
2. ASTM C882/C882M, Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
3. ASTM D1042, Test Method for Linear Dimensional Changes of Plastics Under Accelerated Service Conditions.
4. ASTM D3574, Test Methods for Flexible Cellular Materials – Slab, Bonded, and Molded Urethane Foams.
5. ASTM G109, Test Method for Determining the Effects of Chemical Admixtures on the Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments.
6. NSF/ANSI 61, Drinking Water System Components – Health Effects.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data: Information on all products proposed for use, including manufacturer's brochures, technical data, specifications, and other applicable data.
- B. Informational Submittals: Submit the following:
1. Certificates: Certificates documenting that repair materials that will be in contact with potable water or water that will be treated to become potable are listed in NSF/ANSI 61.
 2. Manufacturer's Instructions: Manufacturer's recommended procedures for installing materials proposed for use.
 3. Special Procedure Submittals: When requested by ENGINEER, submit information on methods for supporting, during demolition and repair Work, existing structures, pipes, and other existing facilities affected by the Work.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling of Materials:
1. Conform to Section 01 65 00, Product Delivery Requirements, and this Section.
 2. Clearly mark on containers manufacturer's name and label, name or title of material, manufacturer's stock number, and date of manufacture.
 3. Handle materials carefully to prevent inclusion of foreign matter.
 4. Do not open containers or mix components until necessary preparatory Work has been completed and application Work is to start immediately.
- B. Storage of Materials:
1. Conform to Section 01 66 00, Product Storage and Handling Requirements, and this Section.
 2. Store only approved materials at the Site.

PART 2 – PRODUCTS

2.1 SYSTEM REQUIREMENTS

- A. All repair and rehabilitation materials that can or will come into contact with potable water or that will be treated to become potable shall be listed in ANSI/NSF 61.

2.2 REPAIR MORTAR

- A. Product Description: Repair mortar shall be prepackaged, cement-based product specifically formulated for repairing concrete surface defects.
- B. Products and Manufacturers: Provide one of the following:
1. SikaTop 122 Plus or SikaTop 123 Plus, by Sika Corporation.
 2. DuralTop Gel, DuralTop Flowable Mortar by Euclid Chemical Company.
 3. Or equal.

C. Materials:

1. Provide a two-component, polymer-modified, Portland cement, fast-setting, trowel-grade mortar. Repair mortar shall be enhanced with penetrating corrosion inhibitor, and shall have the following properties:

Physical Property	Value	ASTM Standard
Minimum Compressive Strength at One Day	2,000 psi	C109
Minimum Compressive Strength at 28 Days	6,000 psi	C109
Minimum Bond Strength at 28 Days	1,800 psi	C882*
* Modified for use with repair mortars.		

2. Where the least dimension of the placement in width or thickness exceeds four inches, extend repair mortar by adding aggregate as recommended by repair mortar manufacturer.
3. Product shall be listed in NSF/ANSI 61.

2.3 EXPANSION JOINT REPAIR SYSTEM

A. System Description: Joint repair system shall consist of two components: an epoxy resin adhesive and hypalon sheeting.

B. Products and Manufacturers: Provide one of the following:

1. Sikadur Combiflex, by Sika Corporation.
2. Or equal.

C. Materials:

1. Epoxy Resin Adhesive: Provide two-component epoxy resin as follows:
 - a. Component "A" shall be modified epoxy resin of epichlorohydrin bisphenol-A type containing suitable viscosity control agents and pigments. Resin shall not contain butyl glycidyl ether.
 - b. Component "B" shall be primarily a reaction product of selected amine blend with epoxy resin of epichlorohydrin bisphenol-A type containing suitable viscosity control agents, pigments, and accelerators.
2. Hypalon Sheeting:
 - a. Provide sheeting of hypalon rubber, perforated along bonding edge to provide mechanical key. Sheeting shall have ability to be vulcanized with hydrocarbon solvent for adhesion to an epoxy resin adhesive.
 - b. Provide sheeting in 12-inch width with thickness of 40 mils.
 - c. Sheeting shall be able to be lapped or seamed by heat or by anaromatic hydrosolvent strip.
 - d. Provide sheeting with removable center expansion strip.
3. Products shall be listed in NSF/ANSI 61.

2.4 CRACK INJECTION REPAIR SYSTEM

- A. Non-structural Crack Repair System:
1. Hydrophobic Polyurethane Chemical Grout:
 - a. Provide hydrophobic polyurethane that forms a flexible gasket.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) SikaFix HH LV, by Sika Chemical Company.
 - 2) Hydro Active Flex SLV, by De Neef Construction Chemicals, Inc.
 - 3) Or equal.
 - c. Shrinkage limit shall not exceed 4.0 percent in accordance with ASTM D1042.
 - d. Minimum elongation of 250 percent in accordance with ASTM D3574.
 - e. Minimum tensile strength of 150 psi in accordance with ASTM D3574.
 - f. Product shall be listed in NSF/ANSI 61.
 2. Hydrophilic Acrylate-Ester Resin:
 - a. Hydrophilic crack repair system shall be acrylate-ester resin that forms a flexible gasket and increase in volume by at least 50 percent when in contact with water.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Duroseal Multigel 850, manufactured by BBZ USA, Inc.
 - 2) Or equal.
 - c. Product shall be listed in NSF/ANSI 61.

2.5 POLYURETHANE COATING SYSTEM

- A. Provide a two-component elastomeric polyurethane coating waterproofing system consisting of a high solids, fast curing base coat and aliphatic, polyurethane top coat.
1. Polyurethane Base Coat:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikalastic 720 Base
 - 2) Or equal
 - b. Minimum tensile strength of 2500 psi in accordance with ASTM D-412.
 - c. Minimum elongation of 800% in accordance with ASTM D-412.
 - d. Minimum hardness of 80 Shore A in accordance with ASTM D-2240.
 2. Polyurethane Top Coat:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikalastic 745 AL
 - 2) Or equal
 - b. Minimum tensile strength of 3200 psi in accordance with ASTM D-412.
 - c. Minimum elongation of 450% in accordance with ASTM D-412.
 - d. Minimum hardness of 85 Shore A in accordance with ASTM D-2240.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which the repair Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation:
 1. Initial Surface Preparation: Remove by chipping, abrasive blasting, or hydro blasting all laitance, foreign material, and unsound concrete from entire area to be repaired. Further roughen surface as specified in this Section. Where non-shrink grout or repair mortar is used, perform additional surface preparation, if any, recommended by product manufacturer.
 2. Wetting Procedure: Where repair concrete, shotcrete, or cement grout is used, and bonding agent is not required, or where repair mortar or non-shrink grout manufacturer recommends wet or saturated surface, perform the following:
 - a. Continuously apply water for at least four hours to surface being repaired. Where large surface areas are to be repaired, use fog-spray nozzles, mounted on stands, in sufficient number so that entire surface to be repaired is contacted by fog spray cloud.
 - b. Prevent concrete from drying until after repair is completed. Re-wet surfaces not yet repaired using water sprays at least daily; should more than four days elapse without re-wetting surfaces not yet repaired, repeat the original saturating procedure.
 - c. Remove standing water in areas to be repaired before placing repair material. Provide means to remove excess water from structure.
 3. Preparation for Epoxy Bonding Agent: Where repair material manufacturer recommends use of epoxy-bonding agent, conform to recommendations of both repair material manufacturer and bonding agent manufacturer.

3.3 INSTALLATION, GENERAL

- A. Construction Tolerances: Shall be as specified in Section 03 00 05, Concrete, except as specified in this Section and elsewhere in the Contract Documents.
- B. Care shall be taken to fully consolidate repair material, completely filling all portions of space to be filled.
- C. Bring surface being repaired into alignment with adjacent surfaces, providing uniform, even surface. Surface repaired shall match adjacent existing surfaces in texture and shall receive coatings or surface treatments, if any, provided for the existing surface adjacent to repaired surface.

D. Curing:

1. Curing of repair mortar and non-shrink grout shall be in accordance with manufacturer's recommendations, except that minimum cure period shall be three days.
2. Curing of other materials shall be in accordance with requirements of Section 03 00 05, Concrete.

3.4 REPAIR OF SURFACE DEFECTS

A. Surface defects are depressions in a concrete surface that do not extend all the way through the concrete. Surface defects can result from removal of an embedded item, removal of an intersecting concrete member, physical damage, or unrepaired rock pockets created during original placement.

B. Preparation: Perform the following in addition to requirements of Article 3.2 of this Section:

1. Remove by chipping all loose, damaged concrete to sound material.
2. Where existing reinforcing is exposed, remove concrete to minimum of one-inch around exposed bars. If existing bars are cut through, cracked, or cross sectional area is reduced by more than 25 percent from original, immediately notify ENGINEER.
3. Score-cut perimeter of area to be repaired to minimum depth of 1/2-inch and maximum depth that will not cut existing reinforcing steel. Chip out existing concrete to the score line so that minimum thickness of repair mortar will be 1/2-inch.

C. Repair Material:

1. Completely fill the surface defect with specified repair material, in accordance with material manufacturer's instructions and the Contract Documents.
2. Perform, with repair mortar, repairs of surface defects in concrete normally in contact with water or soil, and interior surfaces of structures that contain water.
3. Repair of other surface defects may be by applying repair mortar, repair concrete, shotcrete, or cement grout, as appropriate.

3.5 REPAIR OF DETERIORATED CONCRETE

A. This Article pertains to deteriorated concrete which has been damaged due to corrosion of reinforcing steel, physical damage due to abrasion, or damage due to chemical attack. Use repair mortar, as specified in this Article, for repairing deteriorated concrete. Where repaired surface will be subsequently covered with plastic liner material, coordinate finishing with requirements for installing plastic liner material.

B. Surface Preparation: In addition to requirements of Article 3.2 of this Section, perform the following surface preparation:

1. Remove loose, broken, softened, and acid-contaminated concrete by abrasive blasting and chipping to sound, uncontaminated concrete.
2. Upon completion of removal of deteriorated concrete, notify ENGINEER in writing. Allow two weeks for ENGINEER to evaluate the surface, perform testing for acid contamination if required, determine if additional concrete shall be removed, and to develop special repair details (if any) required. Should ENGINEER determine that additional concrete be removed to reach sound, uncontaminated concrete, allow another two-week period for further evaluation and testing following the additional removal.
3. Surface preparation shall conform to recommendations of repair mortar manufacturer.
4. Repair and rehabilitate isolated areas of exposed reinforcing bars in accordance with Article 3.4 of this Section. If extensive areas of reinforcing steel are uncovered after removal of deteriorated concrete, ENGINEER will determine the repair methods required.

C. Repair Mortar Placing:

1. Conform to manufacturer's recommended procedures for mixing and placing repair mortar.
2. After initial mixing of repair mortar, addition of water is not allowed.
3. Minimum Thickness:
 - a. Install repair mortar to not less than minimum thickness recommended by manufacturer, and not less than 1/2-inch.
 - b. Where removal of deteriorated concrete results in repair thickness of less than minimum required thickness to return to original concrete surface in isolated areas totaling less than ten percent of total repair surface area, remove additional concrete to obtain at least the required minimum thickness.
 - c. Where surface area with repair thickness less than minimum required thickness exceeds ten percent of total repair area, notify ENGINEER.
 - d. Provide repair mortar so that minimum cover over existing reinforcing steel is two inches. Do not place repair mortar creating locally raised areas.
 - e. Where transitioning to or from wall surfaces not requiring repair, do not feather-out repair mortar at transition. Instead, form the transition by saw cutting a score line to not less than minimum required repair mortar depth and chip out concrete to the saw cut line. Do not cut or otherwise damage reinforcing steel.
4. Place repair mortar to an even, uniform plane to restore concrete member to its original surface. Out-of-plane tolerance shall be such that the gap between 12-inch long straight edge and repair mortar surface does not exceed 1/8-inch, and gap between a four-foot long straight edge and repair mortar surface shall not exceed 1/4-inch. Tolerances specified in this paragraph apply to straight edges placed in any orientation at any location.

D. Finishing:

1. Provide smooth, steel trowel finish to repair mortar.

2. When completed, there shall be no sharp edges. Provide exterior corners, such as at penetrations, one-inch radius. Interior corners shall be square, except corners to receive plastic lining which shall be made with two-inch fillet in repair mortar.

3.6 REPAIR OF EXPANSION JOINTS

- A. Surface Preparation: Remove the following from surfaces to be repaired: laitance, foreign material, and unsound concrete. Remove by chipping, abrasive blasting, or hydro blasting. Additional surface preparation, if required, shall be as recommended by expansion joint repair system manufacturer.
- B. Installation: Installation shall be as recommended by expansion joint repair system manufacturer.

3.7 CRACK INJECTION

- A. Examine areas under which injection Work will be installed and locate cracks that require injection. Identify and inject cracks greater than 0.010-inch wide in structures that retain or contain water, wastewater, or similar liquid.
- B. Install injection material in accordance with crack injection manufacturer's requirements.
- C. After injecting and curing, verify that injected material penetrated the crack adequately and that there is no visible leakage through the crack. After injecting, if crack continues to leak, re-inject crack at no additional cost to OWNER until structure is watertight.
- D. If proper penetration of crack cannot be achieved, submit to ENGINEER a proposed alternate approach for modifying the specified injection procedure to properly seal the crack. In new concrete and in concrete cracked as a result of CONTRACTOR's operations, perform modifications to crack injection procedure and fully repair the crack without additional cost to OWNER or extension of the Contract Times.

3.8 POLYURETHANE COATING SYSTEM

- A. Surface Preparation: Remove the following from surfaces to be repaired: laitance, foreign material, curing compounds, delaminated coating systems and any other contaminants. Additional surface preparation, if required, shall be as recommended by polyurethane coating system manufacturer.
- B. Installation: Installation shall be as recommended by polyurethane coating system manufacturer.

3.9 SITE QUALITY CONTROL

- A. Owner will employ and pay for services of testing laboratory for Site quality control testing. ENGINEER will direct the number of tests and specimens required, including providing necessary materials for making and facility for storing test specimens. Testing laboratory shall make standard compression test specimens as specified in this Section under the observation of ENGINEER. CONTRACTOR shall provide:
1. Necessary assistance required by ENGINEER and Testing Laboratory.
 2. All labor, material, and equipment required, including rods, molds, thermometer, curing in heated storage box, and all other incidentals required, subject to approval by ENGINEER.
 3. All necessary storage, curing, and transportation required for testing.
 4. CONTRACTOR will be charged for cost of additional testing and investigation, if any, for Work performed that is not in accordance with the Contract Documents or is otherwise defective.
- B. Site Tests of Cement-based Grouts and Repair Mortar:
1. Obtain compression test specimens during construction from first placement of each type of mortar or grout, and at intervals thereafter as selected by ENGINEER, to verify compliance with the Contract Documents. Specimens will be made by ENGINEER or ENGINEER's representative.
 2. Compression tests and fabrication of specimens for repair mortar and non-shrink grout will be performed in accordance with ASTM C109. Set of three specimens will be made for each test. Tests will be made at seven days, 28 days, and additional time periods as deemed appropriate by ENGINEER.
 3. Material, already placed, failing to conform to the Contract Documents, is defective.
- C. Repair Concrete: Repair concrete shall be tested as required in Section 03 00 05, Concrete.

++ END OF SECTION ++

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SECTION 05 05 33

ANCHOR SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install anchor systems.
2. This Section includes all anchor systems required for the Work, but not specified under other Sections.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before anchor systems Work.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ACI 318, Building Code Requirements for Structural Concrete.
2. ACI 350, Code Requirements for Environmental Engineering Concrete Structures.
3. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
4. ANSI B212.15, Cutting Tools - Carbide-tipped Masonry Drills And Blanks For Carbide-tipped Masonry Drills.
5. ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
6. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
7. ASTM A276, Specification for Stainless Steel Bars and Shapes.
8. ASTM A493, Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging.
9. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
10. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
11. ASTM B633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
12. ASTM C881/C881M, Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
13. ASTM D695, Test Method for Compressive Properties of Rigid Plastics.

14. ASTM E329, Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
15. ASTM E488, Test Methods for Strength of Anchors in Concrete and Masonry Elements.
16. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
17. ASTM F594, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
18. ASTM F1554, Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
19. FS A-A-1922A, Shield, Expansion (Caulking Anchors, Single Lead).
20. FS A-A-1923A, Concrete Expansion Anchors.
21. FS A-A-55614, Shield, Expansion (non-drilling expansion anchors).
22. ICC-ES AC01, Acceptance Criteria for Expansion Anchors in Masonry Elements.
23. ICC-ES AC 58, Acceptance Criteria for Adhesive Anchors in Masonry Elements.
24. ICC-ES AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
25. ICC-ES AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
26. NSF/ANSI 61, Drinking Water System Components – Health Effects.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Testing Laboratory: Shall comply with ASTM E329 and shall be experienced in tension testing of post-installed anchoring systems.
2. Post-installed Anchor Installer: Shall be experienced and trained by post-installed anchor system manufacturer in proper installation of manufacturer's products. Product installation training by distributors or manufacturer's representatives is unacceptable unless the person furnishing the training is qualified as a trainer by the anchor manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Listing of all anchor systems products intended for use in the Work including product type, intended location in the Project, and embedded lengths.
2. Product Data:
 - a. Manufacturer's specifications, load tables, dimension diagrams, acceptable base material conditions, acceptable drilling methods, and acceptable bored hole conditions.

- b. When required by ENGINEER, copies of valid ICC ES reports that presents load-carrying capacities and installation requirements for anchor systems.

B. Informational Submittals: Submit the following:

1. Certificates:
 - a. For each type of anchor bolt or threaded rod, submit copies of laboratory test reports and other data required to demonstrate compliance with the Contract Documents.
 - b. Post-installed anchor system manufacturer's certification that installer received training in the proper installation of manufacturer's products required for the Work.
2. Manufacturer's Instructions:
 - a. Installation instructions for each anchor system product proposed for use, including bore hole cleaning procedures and adhesive injection, cure and gel time tables, and temperature ranges (storage, installation and in-service).

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage and Protection:

1. Keep materials dry during delivery and storage.
2. Store adhesive materials within manufacturer's recommended storage temperature range.
3. Protect anchor systems from damage at the Site. Protect products from corrosion and deterioration.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. General:

1. At locations where conditions dictate that Work specified in other Sections is to be of corrosion resistant materials, provide associated anchor systems of stainless steel materials, unless other corrosion-resistant anchor system material is specified. Provide anchor systems of stainless steel materials where stainless steel materials are required in the Contract Documents.
2. Stainless Steel Nuts:
 - a. For anchor bolts and adhesive anchors, provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts for stainless steel anchors used for anchoring equipment, gates, and weirs, and other locations, if any, where the attachment will require future removal for operation or maintenance. Provide lock washer or double nuts on each anchorage device provided for equipment, as required by equipment manufacturer.

- b. For other locations, provide for each anchorage device a nut as specified or as required by anchor manufacturer. When ASTM A194/A194M, Grade 8S (Nitronic 60) nuts are not required for anchor bolts and adhesive anchors as specified in this Section, provide anti-seizing compound where stainless steel rods are used with stainless steel nuts of the same type.
3. Materials that can contact potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.

B. Design Criteria

1. Size, Length, and Load-carrying Capacity: Comply with the Contract Documents. When size, length or load-carrying capacity of anchor system is not otherwise shown or indicated, provide the following:
 - a. Anchor Bolts: Provide size, length, and capacity required to carry design load based on values and requirements of Paragraph 3.2.A of this Section. For conditions outside limits of critical edge distance and spacing in Paragraph 3.2.A of this Section, minimum anchor bolt embedment as shown or indicated in Paragraph 3.2.A of this Section apply and capacity shall be based on requirements of Laws and Regulations, including applicable building codes.
 - b. Adhesive Anchors, Expansion Anchors, or Concrete Inserts: Provide size, length, type, and capacity required to carry design load. Anchor capacity shall be based on the procedures required by the building code in effect at the Site. Where Evaluation Service Reports issued by the ICC Evaluation Service are required in this Section, anchor capacities shall be based on design procedure required in the applicable ICC Evaluation Service Report.
 - 1) General: Determine capacity considering reductions due to installation and inspection procedures, embedment length, strength of base fastening materials, spacing, and edge distance, as indicated in the manufacturer's design guidelines. For capacity determination, concrete shall be assumed to be in the cracked condition, unless calculations demonstrate that the anchor system will be installed in an area that is not expected to crack under any and all conditions of design loading.
 - 2) Concrete Adhesive Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum embedment depth of the greater of the following: required to develop tensile strength of anchor, or a minimum embedment of 10 anchor diameters; and minimum anchor spacing and edge distance of 12 anchor diameters.
 - 3) Concrete Masonry Adhesive Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum anchor spacing and edge distance as indicated in anchor manufacturer's instructions.

- 4) Concrete Expansion Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum embedment depth of six anchor diameters, and minimum anchor spacing and edge distance of seven anchor diameters.
 - 5) Concrete Masonry Expansion Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum anchor spacing and edge distance as indicated in anchor manufacturer's instructions.
2. Design Loads. Comply with the Contract Documents. When design load of supported material, equipment, or system is not otherwise shown or indicated, provide the following:
 - a. Equipment Anchors: Use design load recommended by equipment manufacturer. When equipment can be filled with fluid, use loads that incorporate equipment load and load imposed by fluid.
 - b. Pipe Hangers and Supports: Use full weight of pipe, and fluid contained in pipe that are tributary to the support plus the full weight of valves and accessories located between the hanger or support being anchored and the next hanger or support.
 - c. Hangers and Supports for Electrical Systems, and HVAC, Plumbing, and Fire Suppression Systems and Piping: Use the full weight of supported system that is tributary to the support plus the full weight of accessories located between the hanger or support being anchored and the next hanger or support. When piping or equipment is to be filled with fluid, anchor systems shall be sized to support such loads in addition to the weight of the equipment, piping, or system, as applicable.
 - d. Delegated Design: When anchor systems are used for supporting materials, equipment, or systems delegated to a design professional retained by CONTRACTOR, Subcontractor, or Supplier, provide anchor system suitable for loads indicated in delegated design documents and consistent with the design intent expressed in the Contract Documents.

C. Application:

1. Anchor Bolts:
 - a. Where anchor bolt is shown or indicated, use cast-in-place anchor bolt unless another anchor type is approved by ENGINEER.
 - b. Provide anchor bolts as shown or indicated, or as required to secure structural element to appropriate anchor surface.
2. Concrete Adhesive Anchors:
 - a. Use where adhesive anchors are shown or indicated for installation in concrete.
 - b. Suitable for use where subject to vibration.
 - c. Suitable for use in exterior locations or locations subject to freezing.
 - d. Suitable for use in submerged, intermittently submerged, or buried locations.

- e. Do not use in overhead applications, unless otherwise shown or approved by ENGINEER.
 - f. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.
3. Concrete Masonry Adhesive Anchors:
- a. Use where adhesive anchors are shown or indicated for installation in grout filled or hollow masonry units.
 - b. Suitable for use where subject to vibration.
 - c. Suitable for use in exterior locations or locations subject to freezing.
 - d. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.
4. Concrete Wedge Expansion Anchors:
- a. Use where expansion anchors are shown or indicated for installation in concrete.
 - b. Do not use where subject to vibration.
 - c. Do not use in exterior locations or locations subject to freezing.
 - d. Do not use in submerged, intermittently submerged, or buried locations.
 - e. Suitable for use in overhead applications.
5. Grout-filled Concrete Masonry Wedge Expansion Anchors:
- a. Use where expansion anchors are shown or indicated for installation on the interior face of grout-filled unit masonry.
 - b. Do not use where subject to vibration.
 - c. Do not use in exterior locations or locations subject to freezing.
6. Hollow Concrete Masonry Sleeve Expansion Anchors:
- a. Use where expansion anchors are shown or indicated for installation in hollow concrete unit masonry or solid brick.
 - b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
 - c. Do not use where subject to vibration.
 - d. Do not use in exterior locations or locations subject to freezing.
7. Drop-in Expansion Anchors:
- a. Use drop-in expansion anchors installed in concrete where light-duty anchors are required to support piping or conduit two-inch diameter or smaller.
 - b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
 - c. Do not use where subject to vibration.
 - d. Do not use at submerged, intermittently submerged, or buried locations.
 - e. Do not use in exterior locations or locations subject to freezing.
 - f. Suitable for use in overhead applications.
8. Concrete Inserts:
- a. Use only where shown or indicated in the Contract Documents.

- b. Allowed for use to support pipe hangers and pipe supports for pipe size and loading recommended by the concrete insert manufacturer.
- 9. Drive-In Expansion Anchors:
 - a. Use drive-in expansion anchors installed in concrete, precast concrete, grouted masonry units, or brick, where light-duty anchors are required to support piping or conduit one-inch diameter and smaller.
 - b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
- 10. For Use in Precast Concrete Planks:
 - a. To support piping or conduit six-inch diameter and smaller, use low-profile drop-in anchors, hollow concrete masonry adhesive anchors, or through-bolts.
 - b. For piping greater than six-inch diameter, or to support safety-related systems, use through-bolts. Each through-bolt shall consist of threaded rod, nuts, washers, and bearing plate.

2.2 MATERIALS

A. Anchor Bolts:

- 1. Provide stainless steel straight threaded rods complying with ASTM F593, AISI Type 316, Condition A, with ASTM F594, AISI Type 316, stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required. Other AISI types may be used when approved by ENGINEER. Hooked bolts are unacceptable.
- 2. Equipment: Provide anchor bolts complying with material requirements of this Section and equipment manufacturer's requirements relative to size, embedment length, and anchor bolt projection. Anchor bolts shall be straight threaded rods with washers and nuts as specified in this Section. Hooked bolts are unacceptable.
- 3. Anchoring of Structural Elements: Provide anchor bolts of size, material, and strength shown or indicated in the Contract Documents.

B. Concrete Adhesive Anchors:

- 1. General:
 - a. Adhesive anchors shall consist of threaded rods anchored into hardened concrete using an adhesive system.
- 2. Products and Manufacturers: Provide one of the following:
 - a. HIT-RE 500-SD Injection Epoxy Adhesive Anchoring System, by Hilti Fastening Systems, Inc.
 - b. SET-XP Epoxy-Tie Adhesive, by Simpson Strong-Tie Company, Inc.
 - c. Or equal.
- 3. Adhesive:
 - a. Adhesive system shall use two-component adhesive mix.

- b. Epoxy adhesives shall comply with physical requirements of ASTM C881/C881M, Type IV, Grade 2 and 3, Class A, B, and C, except gel times.
- c. Adhesives shall have a current evaluation report by ICC Evaluation Service for use in both cracked and uncracked concrete with seismic recognition for SDC A through F as tested and assessed in accordance with ICC-ES AC308.
- d. Adhesives shall have minimum bond strength and minimum design bond strength (bond strength multiplied by strength reduction factor) in accordance with Table 05 05 33-A:

**TABLE 05 05 33-A:
ADHESIVE BOND STRENGTH ^{1,2}**

Anchor Rod Diameter / Dowel Size	Uncracked Concrete		Cracked Concrete	
	Bond Strength (psi)	Design Bond Strength (psi)	Bond Strength (psi)	Design Bond Strength (psi)
3/8-inch / #3	2040	1300	1090	700
1/2-inch / #4	1920	1200	920	560
5/8-inch / #5	1830	1150	710	390
3/4-inch / #6	1760	1050	710	460
7/8-inch / #7	1670	900	610	340
1-inch / #8	1650	1050	850	460
- / #9	1900	1000	800	400
1.25-inch / #10	1580	1000	730	400

Table Notes:

- 1. Bond strengths listed for hammer-drilled, dry hole.
- 2. Bond strengths listed for maximum short term concrete temperature of 110 degrees F and maximum long term concrete temperature of 75 degrees F.

4. Anchor:

- a. Provide continuously-threaded, AISI Type 316 stainless steel adhesive anchor rod. Threaded rods shall comply with the concrete adhesive anchor manufacturer's specifications as included in the ICC Service Evaluation Report for the anchor submitted. Nuts shall have specified proof load stresses equal to or greater than the minimum tensile strength of the stainless steel threaded rod used. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required.

C. Concrete Masonry Adhesive Anchors:

1. General:

- a. Grout-filled Concrete Masonry Adhesive anchors shall consist of threaded rods anchored into grout-filled concrete block masonry using an adhesive system.

- b. Hollow Concrete Masonry Adhesive Anchors shall consist of threaded rods with a cylindrical mesh steel or plastic screen tube anchored into hollow concrete block masonry using an adhesive system.
- 2. Products and Manufacturers: Provide one of the following:
 - a. HIT-HY 70 Hybrid Adhesive Anchor System, by Hilti Fastening Systems, Inc.
 - b. Acrylic-Tie Adhesive, by Simpson Strong-Tie Company, Inc.
 - c. Or equal.
- 3. Adhesive:
 - a. Adhesive system shall use two-component adhesive mix.
 - b. Hybrid adhesives shall comply with the following:
 - 1) ASTM D695 compressive yield strength greater than 7,200 psi on a 7 day cure.
 - c. Adhesives shall have current ICC Evaluation Service Report for use in grout-filled concrete masonry, tested and assessed in accordance with ICC-ES AC 58.
- 4. Anchor:
 - a. Provide stainless steel adhesive anchor rod complying with ASTM F593, AISI Type 316, Condition CW, with ASTM F594, AISI Type 316 stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required.
- 5. Mesh Screen Tube (for hollow masonry applications):
 - a. Provide with mesh size, material, length, and diameter as required by adhesive anchor manufacturer.

D. Concrete Wedge Expansion Anchors:

- 1. General:
 - a. Concrete wedge expansion anchors shall consist of stud, wedge, nut, and washer.
- 2. Products and Manufacturers: Provide one of the following:
 - a. Kwik Bolt TZ Wedge Anchor, by Hilti Fastening Systems, Inc.
 - b. Strong Bolt 2 Wedge Anchor, by Simpson Strong-Tie Company, Inc.
 - c. Or equal.
- 3. Anchors shall comply with physical requirements of FS A-A-1923A, Type 4. Provide concrete wedge expansion anchors suitable for use in cracked and uncracked concrete in accordance with ACI 318 and ACI 350, Appendix D. Demonstrate suitability of cracked concrete wedge anchors in accordance with ACI 355.2 prequalification tests.
- 4. Interior Dry Non-corrosive Locations: Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633.
- 5. Other Locations: Provide expansion anchors complete with nuts and washers, AISI Type 304 stainless steel anchor body, in accordance with ASTM A276 or ASTM A493.
- 6. Concrete wedge expansion anchors shall have a current ICC Evaluation Service Report for use in both cracked and uncracked concrete with seismic

recognition in seismic design Categories A through F when tested and assessed in accordance with ICC-ES AC193.

E. Grout-filled Masonry Wedge Expansion Anchors:

1. General:
 - a. Grout-filled masonry wedge expansion anchors shall each consist of stud, wedge, nut, and washer.
2. Product and Manufacturers: Provide one of the following:
 - a. Kwik-Bolt 3 Expansion Anchors, by Hilti Fastening Systems, Inc.
 - b. Wedge-All Wedge Anchors, by Simpson Strong-Tie Company, Inc.
 - c. Or equal.
3. Anchors shall comply with physical requirements of FS A-A-1923A, Type 4.
4. Anchors shall be non-bottom bearing type with single-piece steel expansion clip providing 360-degree contact with base material and shall not require oversized holes for installation.
4. Interior Dry Non-corrosive Locations: Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633.
5. Other Locations: Provide AISI Type 316 stainless steel anchor, complete with nut and washer, in accordance with ASTM A276 or ASTM A493.
6. Grout-filled masonry wedge expansion anchors shall have a current ICC Evaluation Service report for use in fully-grouted concrete masonry construction when tested and assessed in accordance with ICC-ES AC01.

F. Hollow Concrete Masonry Sleeve Expansion Anchors:

1. General:
 - a. Sleeve expansion anchors shall each consist of an externally threaded stud with full length expanding sleeve.
2. Products and Manufacturers: Provide one of the following:
 - a. HLC Sleeve Anchors, by Hilti Fastening Systems, Inc.
 - b. Dynabolt Sleeve Anchors, by ITW Red Head.
 - c. Or equal.
3. Anchors shall comply with physical requirements of FS A-A-1922A. Anchors shall be non-bottom bearing type with single-piece steel expansion sleeve providing 360-degree contact with base material, and shall not require oversized holes for installation.
4. Interior Dry Non-corrosive Locations: Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633.
5. Other Locations: Provide expansion anchors complete with nuts and washers, Type 304 stainless steel, in accordance with ASTM A276 or ASTM A493.

G. Drop-in Expansion Anchors:

1. General:

- a. Drop-in expansion anchors shall each consist of an internally threaded, deformation-controlled expansion anchor with pre-assembled expander plug.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. HDI Drop-In Anchors, by Hilti Fastening Systems, Inc.
 - b. Drop-In Anchor, by Simpson Strong-Tie Company, Inc.
 - c. Or equal.
 - 3. Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633, complying with physical requirements of FS A-A-55614, Type I. Anchors shall be flush or shell type. Provide low-profile anchors for use in precast concrete planks.
- . H. Drive-In Expansion Anchors:
 - 1. General:
 - a. Drive-In expansion anchors shall each consist of stainless steel drive pin and expanding alloy body.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Metal HIT Anchor, by Hilti Fastening Systems, Inc.
 - b. Zinc Nylon Anchor, by Simpson Strong-Tie Company, Inc.
 - c. Or equal.
 - 3. Provide Type 304 stainless steel drive pin with zinc alloy body. Anchor shall comply with physical requirements of FS A-A-1925A, Type 1.
- I. Unless approved by ENGINEER, do not use power-actuated fasteners or other types of bolts and fasteners not specified in this Section.
- J. Anti-Seizing Compound:
 - 1. Products and Manufacturers: Provide one of the following:
 - a. Pure Nickel Never-Seez, by Bostik.
 - b. Nickel-Graf, by Anti-Seize Technology.
 - c. Or equal.
 - 2. Provide pure nickel anti-seizing compound.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine conditions under which materials will be installed and advise ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Anchor Bolts:

1. Provide anchor bolts as shown or indicated in the Contract Documents, or as required to secure structural element to the appropriate anchor surface.
2. Locate and accurately set anchor bolts using templates or other devices as required, prior to placing concrete. Wet setting of anchor bolts is unacceptable.
3. Protect threads and shank from damage during installation and subsequent construction operations.
4. Unless otherwise shown or approved by ENGINEER anchor bolts shall comply with Table 05 05 33-B:

**TABLE 05 05 33-B:
SINGLE ANCHOR ALLOWABLE LOADS ON ANCHOR BOLTS ¹**

Bolt Diameter (inch)	F1554 Grade 36				F1554			
	F593 Type 316, Condition A				Grade 55			
	Minimum Embedment (inch)	Minimum Edge Distance and Spacing ² (inch)	Shear ^{3,4} (lb)	Tension ³ (lb)	Minimum Embedment (inch)	Minimum Edge Distance and Spacing ² (inch)	Shear ³ (lb)	Tension ³ (lb)
1/2	6	9	1,262	2,420	8.5	12.75	1,660	3,190
5/8	7.5	11.25	2,010	3,860	10.5	15.75	2,640	5,080
3/4	9	13.5	2,974	5,720	13	19.5	3,910	7,520
7/8	10.5	15.75	4,106	7,890	15	22.5	5,400	10,390
1	12	18	5,386	10,360	17	25.5	7,090	13,450
1 1/8	13.5	20.25	6,787	13,052	19	28.5	8,930	16,580
1 1/4	15	22.5	8,617	16,572	21	31.5	11,340	20,040

Table Notes:

1. Table is based on ACI 318 and ACI 350, Appendix D, $f'_c = 4000$ psi. Table 05 05 33-B is not applicable to anchor bolts embedded in grouted masonry.
2. Critical edge distance and spacing are indicated in the table. Capacity of anchor bolts for other combination of edge distances and spacing shall be evaluated in accordance with ACI 318 and ACI 350, Appendix D.

3. Values for shear and tension listed are not considered to act concurrently. Interaction of tension and shear will be evaluated by ENGINEER in accordance with ACI 318 and ACI 350, Appendix D.

B. Adhesive Anchors and Expansion Anchors – General:

1. Prior to drilling, locate existing reinforcing steel in vicinity of proposed holes. If reinforcing conflicts with proposed hole location, obtain ENGINEER's approval of alternate hole locations to avoid drilling through or damaging existing reinforcing bars.

C. Adhesive Anchors:

1. Comply with manufacturer's written installation instructions and the following.
2. Drill holes to adhesive system manufacturer's recommended drill bit diameter to the specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits that comply with the tolerances of ANSI B212.15. Core-drilled holes are unacceptable.
3. Before setting adhesive anchor, hole shall be made free of dust and debris by method recommended by adhesive anchor system manufacturer. Hole shall be brushed with adhesive system manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
4. Before injecting adhesive, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
5. Prior to injecting adhesive into the drilled hole, dispense, to a location appropriate for such waste, an initial amount of adhesive from the mixing nozzle, until adhesive is uniform color.
6. Inject adhesive into hole through injection system-mixing nozzle and necessary extension tubes, placed to bottom of hole. Discharge end shall be withdrawn as adhesive is placed but kept immersed to prevent formation of air pockets. Fill hole to depth that ensures that excess material is expelled from hole during anchor placement.
7. Twist anchors during insertion into partially-filled hole to guarantee full wetting of rod surface with adhesive. Insert rod slowly to avoid developing air pockets.
8. Provide adequate curing in accordance to adhesive system manufacturer's requirements prior to continuing with adjoining Work that could place load on installed adhesive anchors. Do not begin adjoining Work until adhesive anchors are successfully tested or when allowed by ENGINEER.
9. Limitations:
 - a. Installation Temperature: Comply with manufacturer's instructions for installation temperature requirements. Provide temporary protection and other measures, such as heated enclosures, necessary to ensure that base material temperature complies with anchor systems

manufacturer's requirements during installation and curing of adhesive anchor system.

- b. Oversized Holes: Advise ENGINEER immediately if size of drilled hole is larger than recommended by anchor system manufacturer. Cost of corrective measures, including but not limited to redesign of anchors due to decreased anchor capacities, shall be paid by CONTRACTOR.
- c. Embedment depths shall be based on installation in normal-weight concrete with compressive strength of 2,500 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.

D. Expansion Anchors:

- 1. Comply with expansion anchor manufacturer's written installation instructions and the following:
- 2. Drill holes using anchor system manufacturer's recommended drill bit diameter and to the specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits complying with tolerances of ANSI B212.15. Core drilled holes are unacceptable.
- 3. Before installing anchor, hole shall be made free of dust and debris by method recommended by anchor system manufacturer. Hole shall be brushed with anchor system manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles.
- 4. Before installing anchor, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
- 5. Protect threads from damage during anchor installation. Drive anchors not less than four threads below surface of the attachment. Set anchors to anchor manufacturer's recommended torque using a torque wrench.

E. Concrete Inserts:

- 1. Comply with concrete insert manufacturer's installation instructions.
- 2. Inserts shall be flush with slab bottom surface.
- 3. Protect embedded items from damage during concrete placing. Ensure that embedded items are securely fastened to prevent movement during concrete placing, and ensure that embedded items do fill with concrete during concrete placing.
- 4. Inserts intended for piping greater than four-inch diameter shall be provided with hooked rods attached to concrete reinforcing.

F. Anti-Seizing Compound:

- 1. Provide anti-seizing compound in accordance with anti-seizing compound manufacturer's installation instructions, at locations indicated in Paragraph 2.1.B of this Section.
- 2. Do not use anti-seizing compound at locations where anchor bolt or adhesive anchor will contact potable water or water that will be treated to become potable.

3.3 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

3.4 FIELD QUALITY CONTROL

A. Site Tests:

1. Owner will employ services of testing agency to perform field quality tensile testing of production adhesive anchors at the Site, unless otherwise specified.
 - a. Testing shall comply with ASTM E488.
 - b. Test at least ten percent of all types of adhesive anchors. If one or more adhesive anchors fail the test, CONTRACTOR shall pay cost of testing, or at ENGINEER's option CONTRACTOR may arrange for testing paid by CONTRACTOR, for all adhesive anchors of same diameter and type installed on the same day as the failed anchor. If anchors installed on the same day as the failed anchor also fail the test, ENGINEER may require retesting of all anchors of the same diameter and type installed in the Work. CONTRACTOR shall be responsible for retesting costs.
 - c. ENGINEER will direct which adhesive anchors are to be tested and indicate test load to be used
 - d. Apply test loads with hydraulic ram.
 - e. Displacement of post-installed anchors shall not exceed $D/10$, where D is nominal diameter of anchor being tested.
2. Correct defective Work by removing and replacing or correcting, as directed by ENGINEER.
3. CONTRACTOR shall pay for all corrections and subsequent testing required to confirm competence in the installation of post-installed mechanical anchors.
4. Testing agency shall submit test results to CONTRACTOR and ENGINEER within 24 hours of completion of test.

B. Manufacturer's Services:

1. Provide at the Site services of qualified adhesive manufacturer's representative during initial installation of adhesive anchor systems to train CONTRACTOR's personnel in proper installation procedures. Manufacturer's representative shall observe to confirm that installer demonstrates proper installation procedures for adhesive anchors and adhesive material.

++ END OF SECTION ++

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SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish miscellaneous metal fabrications including surface preparation and shop priming.
2. The Work also includes:
 - a. Providing openings in miscellaneous metal fabrications to accommodate the Work under this and other Sections, and attaching to miscellaneous metal fabrications all items such as sleeves, bands, studs, fasteners, and all items required for which provision is not specifically included under other Sections.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the Work to be installed with, or attached to miscellaneous metal fabrications Work.
2. Hot-dip Galvanizing: Coordinate with steel fabricator detailing for and fabrication of assemblies to be hot-dip galvanized, to minimize distortion during galvanizing process.

C. Related Sections:

1. Section 05 05 33, Anchor Systems.
2. Section 09 91 00, Painting,

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ASTM A36/A36M, Specification for Carbon Structural Steel.
2. ASTM A53/A53M, Specification for Pipe Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A153/A153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

5. ASTM A240/A240M, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
6. ASTM A384/A384M, Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
7. ASTM A500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
8. ASTM A572/A572M, Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
9. ASTM A992/A992M, Specification for Structural Steel Shapes.
10. ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
11. ASTM B211, Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
12. ASTM B221, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
13. ASTM B308/B308M, Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
14. ASTM B429, Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
15. ASTM B632/B632M, Specification for Aluminum-Alloy Rolled Tread Plate.
16. AWS D1.1/D1.1M, Structural Welding Code – Steel.
17. AWS D1.2/D1.2M, Structural Welding Code – Aluminum.
18. AWS D1.6, Structural Welding Code – Stainless Steel.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Welding:
 - a. Qualify welding processes and welding operators in accordance with AWS D1.1/D1.1M, D1.2/D1.2M, or D1.6, as applicable.
 - b. When requested by ENGINEER, provide certification that each welder employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within previous 12 months. Ensure that all certifications are current.

B. Regulatory Requirements: Conform to the following:

1. 29 CFR 1910, Occupational Health and Safety Standards.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Fabrication and erection details for assemblies of miscellaneous metal Work. Include plans, elevations, and details of sections and connections.

Show anchorage and accessory items. Include setting drawings and templates for locating and installing miscellaneous metal items and anchorage devices.

2. Product Data:
 - a. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal Work.
- B. Informational Submittals: Submit the following:
1. Test and Evaluation Reports:
 - a. Mill test report that indicate chemical and physical properties of each type of material, when requested by ENGINEER.
 2. Qualifications Statements:
 - a. Copies of welder's certifications, when requested by ENGINEER.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in other construction in ample time to prevent delaying the Work.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Steel:
1. W-Shapes and WT-Shapes: ASTM A992/A992M.
 2. S-Shapes and Channels: ASTM A572/A572M, Grade 50.
 3. Hollow Structural Sections: ASTM A500, Grade B.
 4. Angles, Plates, Bars: ASTM A36/A36M.
 5. Steel Pipe: ASTM A53/A53M, Grade B.
- B. Aluminum:
1. Aluminum Shapes: ASTM B308/B308M, Alloy 6061-T6, ASTM B 221, Alloy 6061-T6.
 2. Aluminum Tubes and Pipes: ASTM B429, Alloy 6061-T6.
 3. Aluminum Bars and Rod: ASTM B211, Alloy 6061-T6.
 4. Aluminum Plates: ASTM B209, Alloy 6061-T6.
- C. Stainless Steel:
1. Plates and Sheets: ASTM A240/A240M, Type 304L or Type 316 stainless steel.
 2. Submerged or Intermittently Submerged: Type 316 stainless steel.

- 3. Non-submerged: Type 304L stainless steel.
- D. Stainless Steel Fasteners and Fittings: ASTM A 320/A 320M, Type 304L or Type 316 Stainless Steel.
- E. Zinc-coated Hardware: ASTM A153/A153M.
- F. Aluminum Grating frames: Aluminum alloy 6061-T6 or alloy 6063-T6, complying with ASTM B221 with Type 316 stainless steel welded stud anchors and other fasteners.

2.2 MISCELLANEOUS METAL ITEMS

- A. Shop Assembly:
 - 1. Pre-assemble items in the shop to the greatest extent possible to minimize field-splicing and field-assembly of units at the Site. Disassemble units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Steel Lintels:
 - 1. Provide loose structural steel lintels for openings and recesses in masonry walls and brick walls as specified or as shown.
 - 2. Weld adjoining members together to form a single unit, where shown or indicated.
 - 3. Provide not less than eight inches bearing at each side of openings, unless otherwise shown.
 - 4. Steel lintels to be installed in exterior walls shall be hot-dip galvanized and finish painted. Other steel lintels shall be painted.
 - 5. Surface preparation and painting shall conform to Section 09 91 00, Painting.
 - 6. Where lintels are not shown on the Drawings, provide lintels as specified in the following table. Provide other lintels where shown and of size indicated on the Drawings.

Clear Span (Max)	Exterior Angle	Interior Angles (typical 8-inch wall)
4.0 feet	3.5 inches by 3.5 inches by 5/16 inches	Two 3.5 inches by 3.5 inches by 5/16 inches
6.0 feet	Four inches by 3.5-inches by 5/16 inches	Two 4 inches by 3.5 inches by 5/16 inches
8.0 feet	Five inches by 3.5 inches by 5/16 inches	Two 5 inches by 3.5 inches by 5/16 inches

- C. Shelf Angles:

1. Provide structural steel shelf angles of sizes shown, for attachment to concrete or masonry construction. Provide slotted holes to receive 3/4-inch bolts, spaced not more than six inches from ends and not more than 2.0 feet on centers, unless otherwise shown.
 - a. Provide galvanized shelf angles on outdoor construction.
2. Provide wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

D. Steel Ladders:

1. Fabricate ladders for locations shown or indicated with dimensions, spacing, details, and anchorages as shown or specified. Comply with OSHA 29 CFR 1910 and ANSI A14.3, except as otherwise shown or specified.
 - a. Unless otherwise shown, provide 2.5-inch by 0.375 inch flat bars for stringers, spaced at least 1.5 feet apart.
 - b. Provide 0.75 inch diameter steel rod rungs, spaced maximum of 12 inches on centers, with non-slip surface on top of each rung. Adhesive strips for non-slip surfaces are not acceptable.
2. Fit rungs in centerline of side rails, plug weld, and grind smooth on outer rail faces.
3. Support each ladder at top and bottom and at intermediate points spaced not more than four feet on centers.
4. Use welded or bolted brackets, designed for adequate support and anchorage, and to hold ladder clear of wall surface with minimum of seven inches between wall and centerline of rungs.
5. Unless otherwise shown or approved by ENGINEER, extend rails 3.5 feet above top rung, and return rails to wall or structure, unless other secure handholds are provided. If adjacent structure does not extend above top rung, goose-neck extended rails back to structure to provide secure ladder access.

E. Davit Crane Flush Mounted Floor Sleeve:

1. Provide stainless steel floor mounted sleeve with welded steel studs for embedment into fresh concrete. Sleeve shall be 4" in diameter and include PVC liner and sleeve cover.
2. Products and Manufacturers: Provide products of one of the following:
 - a. Flush Floor Mount Sleeve, Model #8512828 by DBI-Sala.
 - b. Or equal.

F. Miscellaneous Framing and Supports:

1. Provide miscellaneous metal framing and supports that are not part of structural steel framework and are required to complete the Work.
2. Fabricate miscellaneous units to sizes, shapes, and profiles shown on the Drawings or, if not shown, of required dimensions to receive adjacent grating, plates, tanks, doors, and other work to be retained by the framing.

3. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all-welded construction using mitered corners, welded brackets, and splice plates and minimum number of joints for field connection.
4. Cut, drill, and tap units to receive hardware and similar items to be anchored to the Work.
5. Furnish units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units are to be installed after concrete is placed.
 - a. Except as otherwise shown, space anchors, 2.0 feet on centers, and provide units the equivalent of 1.25-inch by 1/4-inch by eight-inch strips.
 - b. Galvanize exterior miscellaneous frames and supports.
 - c. Where shown or indicated, galvanize miscellaneous frames and supports that are not to be installed outdoors.
6. Miscellaneous steel framing and supports shall be hot-dip galvanized and finish-painted, unless otherwise shown or indicated.
7. For railings, refer to Section 05 52 15, Aluminum Handrails and Railing.
8. For grating requirements refer to Section 05 53 16, Aluminum Grating.
9. Surface preparation and painting of galvanized surface shall conform to Section 09 91 00, Painting

G. Aluminum Raised-pattern Floor Plate:

1. Provide raised-pattern floor plate conforming to ASTM B632/B632M and manufacturer's standards. Provide plates of thicknesses shown.
2. Products and Manufacturers: Provide products of one of the following:
 - a. 4-Way Safety Aluminum Plate, by Ryerson Tull Company.
 - b. Raised Pattern Floor Aluminum Plate, by Central Steel and Wire Company.
 - c. Or equal.
3. Provide removable plates at locations and sizes shown. Provide perforated plates where shown.
4. Provide each plate section with four lifting handles as recommended by manufacturer. Lifting handles shall be recessed, drop handle type. Maximum weight of checkered plate or plank section shall be 150 pounds.
5. Finish: Anodized. Protect finish with factory-applied coating of manufacturer's standard lacquer coating, suitable for service on floor.

H. Provide existing aluminum gratings and checkered plate in concrete with aluminum angle frames with mitered corners and welded joints. Grind exposed joints smooth. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected for flush fit in accordance with the details shown on the Drawings.

I. Fasteners and Hardware: Provide Type 316 stainless steel fasteners for aluminum fabrications and zinc-coated hardware for galvanized fabrications, unless otherwise shown or specified.

- J. Anchors and Expansion Anchors: Refer to Section 05 05 33, Anchor Systems.

2.3 FINISHING

- A. Surface Preparation and Shop Priming: Perform surface preparation and apply primer coat to miscellaneous metal fabrications in the shop. Conform to surface preparation and shop priming requirements in Section 09 91 00, Painting.
- B. Galvanizing:
 - 1. Galvanizing of fabricated steel items shall comply with ASTM A123/A123M.
 - 2. Details of fabrication of steel items and assemblies to be hot-dip galvanized shall conform to recommendations of ASTM A384/A384M to minimize the potential for distortion.
- C. Aluminum Finish: Provide natural mill finish for aluminum Work unless otherwise shown or specified.

2.4 SOURCE QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures complying with the Contract Documents.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine conditions under which the Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install miscellaneous metal fabrications accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork where fabrications are to be built into concrete, masonry, or other construction.
- B. Anchor securely as shown and as required for the intended use, using concealed anchors where possible.

- C. Fit exposed connections accurately together to form tight, hairline joints. Field-weld steel connections that are not to be exposed joints and cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1/D1.1M, D1.2/D1.2M and D1.6, as applicable to the material being welded. Grind steel joints smooth and touch-up shop paint coat. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

- D. Protection of Aluminum from Dissimilar Materials:
 - 1. Coat surfaces of aluminum that will contact dissimilar materials such as concrete, masonry, and steel, in accordance with Section 09 91 00, Painting.

++ END OF SECTION ++

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, material, tools, equipment, and incidentals as shown, specified, and required to furnish and install all miscellaneous rough carpentry Work.
2. The Work also includes:
 - a. Providing openings in miscellaneous rough carpentry to accommodate the Work under this and other Sections and building into miscellaneous rough carpentry items such as sleeves, anchorages, inserts and other items to be embedded in or penetrating miscellaneous rough carpentry for which placement is not specifically provided under other Sections.
3. Types of materials required include:
 - a. Miscellaneous blocking, furring strips, and other miscellaneous wood framing.
 - b. Lumber for temporary protection.
 - c. Lumber for temporary support.
 - d. Miscellaneous accessories.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before miscellaneous rough carpentry Work.

C. Related Sections:

1. Section 05 05 33, Anchor Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ALSC PS 20, American Softwood Lumber Standard.
2. ASME B18.2.1 Square and Hex Bolts and Screws, Inch Series.
3. ASME B18.6.1 Wood Screws, Inch Series.
4. ASTM F1667, Specification for Driven Fasteners: Nails, Spikes, and Staples.
5. NIST PS-1, Construction and Industrial Plywood.
6. Southern Pine Inspection Bureau (SPIB), Standard Grading Rules for Southern Pine Lumber.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and the building code referred to in Section 01 42 00, References, for size, spacing and attachment of wood members, unless more stringent requirements are shown or specified in the Contract Documents.
- B. Certifications:
 - 1. Certificates of Grade: Where appearance of wood is important and grade marks will deface the Work, in lieu of grade markings on wood, submit certificates attesting that materials comply with grade requirements specified.

1.4 SUBMITTALS

- A. Action Submittals; Submit the following:
 - 1. Shop Drawings:
 - a. List of species and grade of lumber proposed for each use.
 - b. Fastener schedule with location, size, material and type of each fastener to be used in the Work.
- B. Informational Submittals: Submit the following:
 - 1. Certificates:
 - a. Lumber treater's certification of compliance, in accordance with Paragraph 1.3.B.1 of this Section.
 - b. Certificates of grade in accordance with Paragraph 1.3.B.2 of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
 - 1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in concrete or masonry in ample time to prevent delaying the Work.
 - 2. Comply with Section 01 65 00, Product Delivery Requirements.
- B. Storage and Protection:
 - 1. Keep materials dry during delivery and storage.
 - 2. Keep materials off ground using pallets, platforms, or other appropriate supports. Protect materials from corrosion and deterioration. Stack lumber, and provide air circulation within stacks.
 - 3. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Lumber, General:
 - 1. Factory-mark each piece of lumber with type, grade, mill and grading agency. Surfaces that will be exposed to view shall not have grade marks or other types of identifying marks.
 - 2. Nominal sizes are shown or indicated, unless otherwise shown or indicated in the Contract Documents. Provide actual sizes as required by ALSC PS 20 for moisture content specified for each use.
 - a. Provide dressed lumber, surfaced four sides (S4S), unless otherwise shown or specified.
 - b. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing.
 - 3. Provide the following grade and species:
 - a. Construction Grade, for material up to and including four-inch wide.
 - b. No. 2 or better for material greater than four-inch wide up to and including 12-inch wide.
 - c. Southern Pine, SPIB.
 - 4. Lumber for Protection and Temporary Support: Size and grades to conform to Laws and Regulations, including OSHA.

- B. Fasteners and Anchorages:
 - 1. Fasteners exposed to the weather as well as fasteners embedded in, or in contact with, preservative treated wood shall be hot-dip galvanized.
 - 2. Common wire nails shall conform to ASTM F1667.
 - 3. Wood screws shall conform to ASME B18.6.1.
 - 4. Lag screws and lag bolts shall conform to ASME B18.2.1.
 - 5. Anchorage devices shall conform to Section 05 05 33, Anchor Systems.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine substrates and supporting structure and conditions under which miscellaneous rough carpentry Work will be installed and notify ENGINEER in writing of conditions detrimental to proper completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Coordination: Fit miscellaneous rough carpentry Work to other Work and work under other contracts, as applicable, and scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other construction.

- B. General:

1. Discard units of material with defects that might impair quality of the Work, and units too small to fabricate the Work with minimum joints or optimum joint arrangement.
 2. Set miscellaneous rough carpentry Work accurately to required levels and lines, with members plumb and true, accurately cut and fitted.
 3. Securely attach miscellaneous rough carpentry Work to substrates by anchoring and fastening as shown and indicated in the Contract Documents. Countersink nail heads on exposed miscellaneous rough carpentry Work and fill holes. Make tight connections between members.
 4. Install fasteners without splitting of wood, pre-drill as required and for masonry anchors fastened to wood stud wall framing.
- C. Wood Grounds, Nailers, and Blocking:
1. Provide where shown or indicated, and where required for attachment of other construction. Form to shapes as shown or indicated and cut as required for true line and level of Work to be attached. Coordinate location with other work involved.
 2. Attach substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown or indicated.
 3. Provide permanent grounds of dressed, preservative-treated, key-bevelled lumber not less than 1.5-inch wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.
- D. Plywood, General:
1. Install in accordance with the Contract Documents and requirements of authorities having jurisdiction.
 2. Allow for installed clearances between individual plywood panels as specified by plywood manufacturer. Provide 1/4-inch space at panel edge joints and 1/8-inch space at panel end joints, unless otherwise recommended by manufacturer.
 3. Install plywood with long dimension across supports.
 4. Install roof sheathing using 8d helical or annular nails spaced six inches at panel edges and 12 inches at intermediate framing.
 5. Provide panel edge clips at unsupported edges of roof sheathing.

++ END OF SECTION ++

SECTION 07 16 00

CAPILLARY WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install capillary waterproofing.
 2. The extent of the capillary waterproofing Work is shown on Drawings.
- B. Coordination:
1. Review installation procedures under other Sections and coordinate the installation of items to be installed with or before the capillary waterproofing Work.
 2. Coordinate the placing of capillary waterproofing following manufacturer's recommendations for concrete treatment, finishes and curing, to produce maximum penetration and adhesion of capillary waterproofing.

1.2 REFERENCES

- A. Standards referenced in this Section are:
1. NSF/ANSI 61, Drinking Water System Components – Health Effects.

1.3 QUALITY ASSURANCE

- A. Qualifications:
1. Installer:
 - a. Retain a single installer with experience in the application of capillary waterproofing who is a licensee of the capillary waterproofing manufacturer, or who can submit evidence of being acceptable to the manufacturer of the capillary waterproofing.
 - b. Installer shall employ only tradesmen with specific skill and successful experience in the type of Work required.
 - c. When requested by ENGINEER, submit name and qualifications of installer with the following information for not less than three successful, completed projects
 - 1) Names and telephone numbers of owner and architect or engineer responsible for each project.
 - 2) Approximate contract cost of capillary waterproofing work for which installer was responsible.
 - 3) Quantity, in square feet, of capillary waterproofing installed.

- B. Component Supply and Compatibility:
 - 1. Obtain materials from only one manufacturer who will provide the services of a manufacturer's technical representative as specified.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Product Data:
 - a. Manufacturer's specifications, installation instructions, and general recommendations for each type of capillary waterproofing product required. Include manufacturer's data substantiating that the materials comply with the requirements specified herein.
- B. Informational Submittals: Submit the following:
 - 1. Certificates:
 - a. Capillary waterproofing manufacturer's certification that installer received training in the proper installation of manufacturer's products required for the Work.
 - 2. Qualifications Statements: Submit qualifications for the following:
 - a. Installer.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver materials in capillary waterproofing manufacturer's original unopened containers.
 - 2. Include the following information on the label:
 - a. Name of material and supplier.
 - b. Mixing instructions, shelf life and curing time when applicable.
 - 3. Deliver materials in sufficient quantity to allow continuity of the Work.
- B. Storage of Materials:
 - 1. Store material in original, undamaged containers with manufacturer's labels and seals intact.
 - 2. Store materials in dry, enclosed areas, off the ground.
 - 3. Prevent damage to materials during storage.
- C. Handling of Materials:
 - 1. Handle materials carefully to prevent inclusion of foreign materials.
 - 2. Do not open containers or mix components until necessary preparatory work has been completed.

1.6 JOB CONDITIONS

- A. Environmental Conditions:
 - 1. Proceed with capillary waterproofing Work only when temperature and moisture conditions comply with the capillary waterproofing manufacturer's written recommendations and as specified herein.
 - 2. Surface and surrounding air temperature shall not be less than 35 degrees F for a minimum period of 48 hours before, during, and after the capillary waterproofing Work.
 - 3. Protect Work from precipitation, frost and direct sun.
 - 4. During hot weather use wet mats or constant mist water spray to prevent premature drying.
 - 5. Provide air circulation to assure setting of the capillary waterproofing.

- B. Protection: Do not allow surfaces treated with capillary waterproofing to be exposed to aggressive water, chemicals or acids until capillary waterproofing has reached full strength.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide specially formulated, cementitious capillary waterproofing for "slurry coat" application technique, unless otherwise shown, consisting of a combination of chemicals, cement, and specially treated quartz, capable of extensive chemical penetration to produce crystalline growth which closes the natural concrete capillaries, providing dense, in-depth protection against moisture, chemical attack and liquid pressure.

- B. Cementitious capillary waterproofing shall contain no iron oxide, calcium chloride, or organics.

- C. Provide the manufacturer's complete system of waterproofing products as may be required for the conditions encountered, including construction joints.

- D. Material shall be listed in NSF/ANSI 61.

2.2 MANUFACTURERS

- A. Product and Manufacturer: Provide one of the following:
 - 1. Vandex Super by Vandex Sales & Services, Incorporated.
 - 2. Xypex by Xypex Chemical Corporation.
 - 3. Or equal.

2.3 MIXES

- A. Mix following manufacturer's written instructions.
- B. For construction joints and other conditions requiring special mixing, follow manufacturer's written instructions.
- C. Do not add additional water to improve workability.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the surfaces to receive the capillary waterproofing, and the conditions under which the capillary waterproofing Work is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the capillary waterproofing. Do not proceed with the capillary waterproofing Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 SUBSTRATE PREPARATION

- A. Follow manufacturer's instructions for extremely high hydrostatic heads.
- B. Provide rough wood float finish on concrete to expose capillaries.
- C. Remove all laitance oil, dirt and other surface contamination.
- D. Extremely smooth surfaces shall be acid etched.
- E. Install seal strips 3/4 inch by 1-1/4 inch at all construction joints using laminating layers of special capillary waterproofing mortar, to achieve a watertight condition, as recommended by the manufacturer.
- F. Fill all form tie holes, honeycombed areas, and cracks exceeding 0.1 inch, with combination of special capillary waterproofing mortars.
- G. Do not use curing agents or hardeners on concrete to receive capillary waterproofing.

3.3 INSTALLATION

- A. Do not apply capillary waterproofing until hydrostatic test results have been accepted by OWNER.
- B. Provide the services of an on-site manufacturer's technical representative during the installation.

- C. Using the "slurry coat" method of installation, apply capillary waterproofing at the rate of 1-1/2 pounds per square yard per coat following manufacturer's written instructions. Apply two coats for a total of three pounds per square yard.
- D. Saturate surface with water and allow to dry until damp, but not wet to the touch.
- E. Apply first coat by brush and while still damp fill in all cracks, joints and honeycombs with capillary waterproofing in layers not to exceed 1/2 inch.
- F. While first coat is still damp, apply second coat. Remoisten if first coat dries before application of second coat.
- G. Moisture cure all capillary waterproofing for a minimum period of two days, starting with a fine water fog spraying the day following completion of the application unless other recommendations are made by the manufacturer or because of weather conditions specified herein.
- H. Allow 14 days for curing.

3.4 ADJUSTMENT AND CLEANING

- A. Correct all leaks in the completed Work following written recommendations of capillary waterproofing manufacturer at no additional cost to the Owner.
- B. Do not allow construction traffic on concrete slabs for 48 hours after application.
- C. Protect from heavy construction traffic for seven days after installation.
- D. Protect capillary waterproofing Work from freezing for seven days after installation.
- E. Protect capillary waterproofing from damage until Final Acceptance by Owner.

3.5 INSPECTION AND ACCEPTANCE

- A. Certify that the completed capillary waterproofing Work is in accordance with the Specifications and is watertight at the time of Final Acceptance.

++ END OF SECTION ++

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SECTION 07 22 16

ROOF BOARD INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install all roof board insulation.
2. Extent of each type of roof board insulation is shown on Drawings.
3. Types of products required include the following:
 - a. Extruded, pentane isomer blown, polyisocyanurate rigid board-type insulation.
 - b. Miscellaneous materials and accessories.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the roof board insulation Work.
2. All framing for openings, edge angles, nailers, curbs and other items shall be in place before start of roof board insulation Work.
3. Field-verify location of all roof penetrations, drain locations, and deck deflections.

C. Related Sections:

1. Section 06 10 53, Miscellaneous Rough Carpentry.
2. Section 07 55 52, Modified Bituminous Protected Membrane Roofing.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American Society for Testing and Materials, (ASTM).
 - a. ASTM C 518, Test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.
 - b. ASTM C 1289, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - c. ASTM D 1621, Test Method for Compressive Properties of Rigid Cellular Plastics.
 - d. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
 - e. ASTM E 96, Test Methods for Water Vapor Transmission of Materials.
2. Factory Mutual, (FM).

- a. FM Publication, Loss Prevention Data for Roofing Contractors, 1-29, Above-Deck Roof Components.
- b. FM Publication, Approval Guide.
3. Underwriters Laboratories, (UL).
 - a. UL Building Materials Directory.

1.3 QUALITY ASSURANCE

- A. Installer's Qualifications:
 1. Roof board insulation Work shall be performed by the installer of the associated roofing for undivided responsibility.
- B. Source Quality Control:
 1. Obtain extruded polyisocyanurate rigid board-type insulation from manufacturers who manufacture specified insulation using a blowing agent containing no chlorine-based compounds.
 2. Engage a single manufacturer for each type of roofing insulation who shall provide the services of a technical representative to assist CONTRACTOR and ENGINEER by providing technical opinions on the adequacy of materials and methods of installation based on Shop Drawings approved by ENGINEER.
 3. Provide such services during the time of delivery, storage, handling and installation of all roofing insulation.
 4. The thicknesses shown are based on the thermal conductivity, k-value at 75°F specified for each material. Thicknesses of roof board insulation materials submitted by CONTRACTOR as "or equal" to specified materials shall have their thicknesses adjusted to provide the same thermal resistance as materials specified.
- C. Requirements of Regulatory Agencies: Comply with fire-resistance ratings as required by governing authorities and building codes, and complies with the following roof board insulation requirements:
 1. Underwriters Laboratories requirements for roof deck constructions which are rated "UL Class A".
 2. Factory Mutual requirements for "Class 1-90" rated construction, for wind resistance.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Samples:
 - a. Each fastener to be used in the Work.
 - b. 12-inch by 12-inch sample of insulation system.
 2. Shop Drawings:
 - a. Field verified locations of all roof penetrations, drain locations, and deck deflections.

- b. Complete layout of all roof board insulation showing sizes, placement, number of courses and methods of fastening. Include statement that fastening method, location and density of fasteners have been approved by roof membrane manufacturer and comply with wind uplift requirements specified.
 - c. Weights of all equipment to be used on roof.
 - d. All required roof board insulation details approved by the roof board insulation manufacturer and the manufacturer of the respective roofing systems.
3. Product Data:
- a. Manufacturer's specifications and installation instructions for each type of roof board insulation required. Include data substantiating that the materials comply with specified requirements.

B. Informational Submittals: Submit the following

- 1. Certificates:
 - a. Installer's qualifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

- 1. Do not deliver insulation materials to the Site before time of installation.
- 2. Deliver materials in manufacturer's original, undamaged packages or acceptable bulk containers.

B. Storage of Materials:

- 1. Do not allow insulation materials to become wet or soiled, or covered with ice or snow.
- 2. Protect plastic insulation from exposure to sunlight.
- 3. Protect plastic insulation against ignition.
- 4. Store packaged materials to protect them from the weather and physical damage.

C. Handling of Materials:

- 1. Comply with manufacturer's recommendations for handling, storage and protection.

1.6 JOB CONDITIONS

A. Pre-Roofing Conference: Provide both a representative of the composite roof board insulation system manufacturer and the foreman of the installer who will actually work on this Project at the Pre-Roofing Conference specified in Section 07 55 52, Modified Bituminous Protected Membrane Roofing.

B. Environmental Requirements:

- 1. Do not install roof board insulation when weather conditions are such that the deck is not completely dry, there is ice or snow on the deck, or where there is no

assurance that the roof board insulation can be completely protected from the weather by the end of the day's Work.

B. Protection:

1. Do not overload the building structure with the weight of stored materials or use of equipment.
2. Install temporary water cut-offs at the end of each day's Work to protect the roof board insulation. Remove the temporary water cut-offs upon resumption of the Work.

1.7 SEQUENCING

- A. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the roofing membrane over the roof board insulation are at the Site and are ready to follow with this Work immediately (same day) after the roof board insulation Work.
- B. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the roofing membrane over the insulation are at the Site; are installing the vapor barrier, and are ready to follow with this Work immediately (same day) behind the roof board insulation Work.
- C. Do not install any more rigid board-type roof board insulation each day than can be covered with complete roofing system by the end of that working day.

1.8 SUBSTITUTIONS

- A. Manufacturer of the primary roofing membrane systems shall be a manufacturer who finds the generic types of insulation specified herein as acceptable and bondable if installed according to the roofing manufacturer's standards for complete product and performance responsibility.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Extruded Polyisocyanurate Rigid Board Roof board insulation:
 1. Rigid, rectangular boards of extruded closed-cell polyisocyanurate complying with ASTM C 1289, Type II, with low water vapor permeability and laminated to heavy black (non-asphaltic) fiber-reinforced felt facers with one side of board containing perforated facers and the other side containing non-perforated facers.
 2. Provide a blowing agent with zero ozone depletion potential, such as pentane.
 3. Physical Properties: Provide the following:
 - a. Minimum Compressive Strength, (at 10 percent deformation), ASTM D 1621: 25 psi minimum.

- b. Flame Spread, ASTM E 108: Class A.
 - c. Smoke Development, ASTM E 84: 120 maximum.
 - d. Vapor Transmission, ASTM E 96: 0.8 perms/inch.
 - e. Thermal Resistance, ASTM C 518: 7/inch.
 - f. Maximum Water Absorption, ASTM C 209: 0.10 percent by volume.
4. Size: 48-inches by 96 inches by 2-inch thick.
 5. Number of Layers: As required by thickness of roof board insulation shown.
 6. Products and Manufacturers: Provide one of the following:
 - a. ACUltra (Pentane Blown) Hydrocarbon ACFoam - II by Atlas Roofing Corporation.
 - b. Or equal.

B. Miscellaneous Materials:

1. Adhesive for Bonding Insulation: The type recommended by the roof board insulation manufacturer, and complying with fire-resistance requirements.
2. Mechanical Anchors: The type recommended by the roof board insulation manufacturer for the type of deck used, and complying with fire and insurance rating requirements.
3. Mastic Sealer: Type recommended by roof board insulation manufacturer for bonding edge joints between units and filling voids.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and installer shall examine the substrate and the conditions under which the roof board insulation Work is to be performed, and notify ENGINEER, in writing, of any unsatisfactory conditions. Do not proceed with the roof board insulation Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Commencement of the Work shall be understood by ENGINEER to mean that all conditions are acceptable to the manufacturer's technical representative, CONTRACTOR and installer to provide acceptable Work under this Contract.

3.2 PREPARATION

- A. Verify that vapor barrier has been installed on decks, with all joints and penetrations in the vapor barrier sealed using techniques recommended by the vapor barrier manufacturer to retain full perm rating of the vapor barrier.

3.3 INSTALLATION

- A. General:

1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to Site conditions, consult manufacturer's technical representative for specific recommendations before proceeding. Incorporate recommendations into the Work only as approved by ENGINEER. Record all such discussions and the basis for discussions in Job Conditions Report.
 2. Coordinate heights of wood blocking to provide flush transition between roof board insulation and perimeter wood blocking.
 3. Extend roof board insulation full thickness as shown over entire surface to be insulated.
 4. Cut and fit tightly around obstructions, and fill voids with roof board insulation.
- B. Board-Type Roof board insulation Units: Install rigid board-type roof board insulation according to FM 1-29 Wind Storm Resistance Classification specified, and as follows:
1. Install wood nailers as required by roofing membrane manufacturer.
 2. Prime surface of concrete deck with asphalt primer at the rate of 3/4 gallons per 100 square feet, unless greater weight is required by roofing membrane system manufacturer, and allow primer to dry. Set each layer of roof board insulation in a solid mopping of hot roofing asphalt.
 3. Apply two courses of roof board insulation to make up the total required thickness under roofing.
 4. Install rigid board-type roof board insulation to form a continuous, uninterrupted plane between metal purlins installed perpendicularly to slope of metal deck, with all roof board insulation boards tightly butted together. Align top of roof board insulation boards flush with top surface of metal purlins or as shown for ventilated metal roof assemblies.
 5. Stagger the short-side edges of roof board insulation board in one direction with the two opposite sides of each roof board insulation board continuously supported on steel deck ribs, as close as possible to the center of the rib as practical, and with a minimum bearing width of 1-inch. Trim board edges if they veer off the rib center. Stagger joints in each succeeding layer from joints of previous layer a minimum of 6-inches in each direction.
 6. Coat edges of closed-cell (non-breathing) units with either adhesive or mastic sealer, and shove into place against installed units so that joints are filled and sealed.
 7. Extend roof board insulation full thickness as shown over entire surface of roofs.

3.4 PERFORMANCE

- A. Roof board insulation Work shall withstand the uplift forces of wind, as defined by the roofing guarantee.
- B. Failures of the roof board insulation Work in bond or anchorage to the substrate, or between courses of roof board insulation, or within the roof board insulation, will be considered failures of materials or workmanship under the Roofing Guarantee.

3.5 FIELD QUALITY CONTROL

- A. Test the substrate for moisture content, by suitable means, wherever there is a possibility that exposed substrate has acquired moisture in excess of the maximum content for optimum application of the insulation, as determined by the manufacturer.

3.6 PROTECTION

- A. Do not permit construction traffic over completed insulation Work, except as required for roofing.
- B. Protect roof board insulation Work from exposure to moisture, damage and deterioration, primarily by prompt installation of roofing Work to be placed over the roof board insulation.

3.7 INSPECTION AND ACCEPTANCE

- A. Roof board insulation which has become wet, damaged, or deteriorated, as determined by ENGINEER, shall be promptly removed from the Site, even if already installed.
- B. Correct all improperly sloped, chipped, cracked, improperly set, ridged or rough areas in the roof board insulation to provide substrate acceptable to roofing manufacturer and ENGINEER.
- C. Final acceptance will be contingent upon the receipt by ENGINEER of a Job Conditions Report certifying conformance of the Work with the requirements of this Section and which includes all information requested by these Specifications.

++ END OF SECTION ++

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SECTION 07 55 52

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals required to furnish and install modified bituminous membrane roofing with manufacturer's standard Thirty year warranty and CONTRACTOR'S two year roofing guarantee as shown and specified.
2. The extent of modified bituminous membrane roofing is shown and includes walkway protection course and other items, if any, embedded in the Work, as specified in this Section.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the modified bituminous protected membrane roofing Work.
2. Coordinate the installation of roof insulation and associated work so as to provide a complete system complying with the combined recommendations of manufacturers and installers involved in the Work.

C. Related Sections:

1. Section 06 10 53, Miscellaneous Rough Carpentry.
2. Section 07 22 16, Roof Board Insulation.
3. Section 07 62 00, Sheet Metal Flashing and Trim.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American Society for Testing and Materials, (ASTM).
 - a. ASTM D 41, Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.
 - b. ASTM D 312, Specification for Asphalt Used in Roofing.
 - c. ASTM D 6163, Specification for Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet Materials using a Glass Fiber Reinforcements.
 - d. ASTM E 96, Test Methods for Water Vapor Transmission of Materials.
2. American Wood Preservers Bureau, (AWBP).
 - a. AWPB Standard LP-2, Pressure Treated with Water-Borne Preservatives, Above Ground Use.
3. Factory Mutual, (FM).

- a. FM, Approval Guide.
4. National Roofing Contractors Association, (NRCA).
 - a. NRCA, Roofing and Water Proofing Manual.
 - b. NRCA, Roofing Materials Guide.
5. Underwriters Laboratories, Incorporated, (UL).
 - a. UL, Building Materials Directory.
6. Kentucky Building Code, (KBC).

1.3 QUALITY ASSURANCE

A. Installer's Qualifications:

1. Engage a single installer skilled, trained and with successful experience in the installation of modified bituminous membrane roofing systems, who is a recognized roofing installer with specific skill and successful experience in the type of roofing specified, and equipped to perform workmanship in accordance with the Contract Documents, manufacturer's written instructions for guaranteed construction and the approved Shop Drawings and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work. Submit names and qualifications to ENGINEER along with the following information on a minimum of three successful projects:
 - a. Names and telephone numbers of owners, architects or engineers responsible for projects.
 - b. Approximate contract cost of the modified bituminous membrane roofing system.
 - c. Amount of area installed.
2. The roofing installer shall be an approved roofing applicator who has qualified for appointment and has been trained by the manufacturer.
3. Submit proof of acceptability of installer by manufacturer to ENGINEER.

B. Manufacturer's Field Reports: Submit the following reports directly to the project construction manager, with copy to others as requested.

1. Inspector Requirements & Qualifications: Engage an experienced technical inspector, to perform daily job monitoring for this project. Inspector shall be specialized in inspecting roofing similar to that required for this Project; must have a minimum of five years experience providing roof construction monitoring and shall have no manufacturer sales responsibilities; must be full time employee of the roofing system manufacturer to daily inspect the manufacturer's project a minimum of four hours per work day and provide daily written reports to the Owner Representatives. The approved inspector must be certified as a Registered Roof Observer by the Roof Consultants Institute.
 - a. Preparatory inspection.
 - b. Initial inspection.
 - c. Daily inspections.
 - d. Final inspection.

C. Component Supply and Compatibility:

1. Obtain all roofing system components including but not limited to base sheet fasteners, insulation fasteners and adhesives, felts and adhesives, base flashing, adhesives, coatings, perimeter edge systems, and all miscellaneous adhesives from a single proposed roofing system manufacturer. All components shall be supplied and warranted by the proposed roof system manufacturer.
- D. Requirements of Regulatory Agencies:
1. Comply with applicable insurance rating bureau requirements as required by the Kentucky Building Code, unless more restrictive requirements are specified.
 2. Provide materials and roofing systems which have been tested, listed and labeled by Underwriter's Laboratories Incorporated for Class "A" rating, and bear the UL label on each package or are shipped to the project with a UL certificate of compliance.
 3. Provide materials and roofing systems which have been tested, listed and FM labeled for Class "I" rating.
- E. Pre-Roofing Meeting:
1. Prior to the installation of the roofing and associated Work, CONTRACTOR shall schedule and meet at the Site with the roofing installer, the installer of each component of associated Work, the installers of deck or substrate construction to receive roofing Work, the installers of other work in and around roofing which must follow the roofing Work, including mechanical work, if any, the ENGINEER and other representatives directly concerned with performance of the Work including where applicable, insurers, test agencies, product manufacturers, governing authorities having jurisdiction and the OWNER. Record the discussions of the Pre-Roofing Meeting and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending. Review foreseeable methods and procedures related to the roofing Work, including but not necessarily limited to the following:
 - a. Review project requirements, including Drawings, Specifications and other Contract Documents.
 - b. Review required submittal, both completed and yet to be completed.
 - c. Review status of substrate including drying, structural loading limitations and similar considerations.
 - d. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
 - e. Review required inspection, testing, certifying and accounting procedures.
 - f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - g. Review regulations concerning code compliance, environmental protection, health, safety, fire and similar considerations.
 - h. Review procedures needed for protection of roofing during the remainder of the construction period.

2. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Product Data:
 - a. Copies of specifications, installation instructions and general recommendations from the roofing material's manufacturer, for each type of roofing product required. Include manufacturer's data substantiating that the materials comply with the requirements.
- B. Informational Submittals: Submit the following:
 1. Source Quality Control Submittals:
 - a. Research or evaluation reports indicating that materials specified meet required ASTM standards and building code requirements in addition to required FM and UL approvals.
 2. Qualifications Statements:
 - a. Installer's qualifications.
 - b. Manufacturer qualifications:
 - a. Intent to warranty the system as specified and that proposed materials meet the specified standards.
 - b. All materials to be supplied by a single source roof system manufacturer as a complete system.
 - c. Construction observation: Submit letter from the manufacturer indicating who the technical inspector will be, experience qualifications, assurance of non-sales related functions and Registered Roof Observer certification along with copies of prior reports.
 3. Certificates:
 - a. Copies of letter of final inspection, as specified.
 4. Site Quality Control:
- C. Closeout Submittals: Submit the following:
 1. Warranty:
 - a. Membrane manufacturer's representative shall inspect the installation of the modified bituminous membrane roofing system and upon approval provide a no-dollar-limit thirty year warranty. The warranty shall cover full roofing replacement, including materials and labor.
 1. Guarantee:
 - a. Provide two year roofing guarantee covering the modified bituminous protected membrane roofing system Work indicated, signed by CONTRACTOR and installer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:

1. Deliver materials in manufacturer's original, unopened containers and rolls with labels intact and legible.
 2. Materials requiring fire resistance classification shall be delivered to the Site with labels attached and packaged as required by labeling service.
 3. Deliver materials in sufficient quantity to allow continuity of the Work.
- B. Storage of Materials:
1. Store roofing materials in a dry, well ventilated, weather tight place, and in a manner which will ensure that there is no possibility of significant moisture pick-up. Remove wet material from Site.
 2. Store in a manner which complies with fire and safety regulations.
 3. Store materials on clean raised platforms with weather protective covering when stored outdoors.
- C. Handling of Materials:
1. Select and operate material handling equipment so as not to damage existing construction or applied roofing.

1.6 JOB CONDITIONS

- A. Environmental Conditions:
1. Proceed with roofing and associated Work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with these Specification requirements and with the recommendations of the roofing materials manufacturers.
 - a. Proceed only when CONTRACTOR and their installer are willing to guarantee the Work as required and without additional reservations and restrictions.
 - b. Record decisions, conditions and agreements to proceed with the Work when weather conditions might be unfavorable. State the reasons for proceeding, with the names of the persons involved along with the changes, if any, or revisions, requirements or terms of the Contract.
- B. Protection:
1. Provide continuous protection of materials against wetting and moisture absorption.
 2. Protect materials against damage by construction traffic.

1.7 SCHEDULING

- A. Proceed with the roofing and associated Work only after curbs, blocking, nailer strips, vents, drains and other projection through the substrate have been installed, and when the substrate construction and framing of openings are completed.
- B. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the vapor barrier, roof insulation, cover boards and modified bituminous membrane roofing system are at the Site and are

ready to follow with the Work immediately (same day) for a complete modified bituminous protected membrane roofing system.

- C. Phasing is not acceptable. Install all roofing and associated Work in a manner that will ensure a complete modified bituminous protected membrane roofing system at the end of each days' work. Do not advance the installation of any one material beyond that which is necessary for proper sequencing of the Work.

1.8 GUARANTEES

- A. Provide a roofing guarantee in the form and content specified, covering the roofing and associated Work specified therein, signed by CONTRACTOR and their installer. Provide a two year roofing guarantee period, starting on the date of the OWNER'S Final Acceptance of the completed Work, stating that for the duration of the guarantee CONTRACTOR and installer shall be responsible to fix leaks, replace roofing system and roof insulation components damaged by moisture penetration and other defects caused by improper workmanship or the improper arrangement of the various system components.
- B. Warranty:
 - 1. Modified bituminous membrane roofing system manufacturer's representative shall inspect the installation of the roofing assembly and upon approval provide a no-dollar-limit thirty year warranty. The warranty shall cover full roofing replacement, including materials and labor.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement and exposure to weather without failure.
 - 1. Provide modified bituminous membrane roofing, base flashings and component materials that meet the requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's Approval Guide for Class 1 or non-combustible construction, as applicable. Identify materials with FM markings.
 - 2. Provide materials and roofing systems which have been tested, listed and labeled by Underwriters Laboratories for Class A rating, and bear the UL label on each package of materials or are shipped to the Site with a UL Certificate of Compliance.
 - 3. Provide modified bituminous membrane roofing system with Fire/Windstorm classification of Class 1A-90 in compliance with FM standards.
 - 4. Provide a two-ply modified bitumen mineral surfaced roofing system, acceptable for use over manufacturer approved substrates, and on slopes-to-

drain up to 3-inches per foot. Approximate installed weight of modified bituminous protected membrane roofing is 255 lbs per square.

2.2 MATERIALS

A. Membrane:

1. First Ply:
 - a. POWERply HT Base by Tremco Incorporated.
 - b. FlexBase E by The Garland Company.
2. Finish Ply:
 - a. POWERply Premium FR by Tremco Incorporated.
 - b. StressPly E FR Mineral by The Garland Company.
3. Products and Manufacturers: Provide one of the following:
 - a. Two-ply SBS modified bitumen mineral surfaced roofing system by Tremco Incorporated.
 - b. Two-ply SBS modified bitumen mineral surfaced roofing system by The Garland Company.
 - c. Or equal.

B. Related Materials:

1. Asphalt for Vapor retarder, Insulation, base sheet, and flashing:
 - a. Asphalt shall be certified for full compliance with the requirements for Type III asphalt listed in Table 1, ASTM D 312.
 - 1) Tremco Premium III Asphalt
 - 2) Garland HPR All Temp Asphalt
 - b. Each container shall indicate the equiviscous temperature (EVT), the finished blowing temperature (FBT), and the flash point.
2. Cold Applied Modified Bitumen Cap Sheet Adhesive:
 - a. Powerply Standard Cold Adhesive by Tremco.
 - b. Weatherking Cold Adhesive by The Garland Company.
3. Asphalt primer shall conform to ASTM D 41.
4. Flashing Materials:
 - a. Modified bitumen flashing sheet incorporating a fiberglass scrim/polyester mat composite reinforcement.
 - b. Products and Manufacturers: Provide Two-ply flashing system:
 - 1) POWERply HT Base POWERply Plus HT FR_by Tremco Incorporated.
 - 2) Flexbase E Base and StressPly FR Mineral_by The Garland Company.
 - 3) Or equal.
5. Mechanical Attachment:
 - a. Corrosion-resistant fasteners in length and quantity as recommended and provided by the roof system manufacturer.

C. Walkway Pads:

1. Mineral surfaced modified bitumen cap sheet or mineral asphalt plank, ASTM D 517, minimum 1/2 -inch thick as recommended and provided by the roof system manufacturer.
- D. Calking:
1. Calking type and grade to provide a high performance, long-weathering seal for the surface mount counterflashing as recommended and provided by the roof system manufacturer.
- E. Vapor Barrier for Structural Concrete Decks:
1. Burmastic Composite Ply Base by Tremco.
 2. Tri Base by The Garland Company.
- F. Mechanically Fastened Base Sheet for Gypsum Decks:
1. Burmastic Composite Ply by Tremco.
 2. Tri Base by the Garland Company.
- G. Base Sheet Fastener for Mechanically fastened base:
1. Light deck fasteners as recommended and provided by the roof system manufacturer.
- H. Insulation:
1. Insulation shall be compatible with the membrane, as recommended by the membrane manufacturer's printed instructions, and as specified in Section 07 22 16, Roof Board Insulation.
- I. Cover Board: Provide a premium homogeneous, perlite based, 3/4-inch thick, or wood fiber base, 1/2-inch thick, roof insulation board in addition to roof insulation specified in Section 07720, Roof Insulation, for no-dollar-limit guaranteed construction, as required and provided by modified bituminous roof system manufacturer.
- J. Wood Members, Units: Comply with requirements of Section 06 10 53, Miscellaneous Rough Carpentry, for nailers, cant strips and other wood members indicated as roofing system Work. Provide wood pressure treated with waterborne preservatives for above-ground use (American Wood Preservers Bureau Standard LP-2).

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and installer must examine the substrate and the surface conditions to receive roofing and associated Work, and ascertain the conditions under which the Work will be performed, and notify the ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with roofing and associated Work

until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.2 PREPARATION

- A. General: Comply with membrane manufacturer's instructions for preparation of substrate to receive roofing assembly.
- B. Substrate must be smooth and free of ridges and depressions. Roofing Work shall not proceed until any unacceptable decking has been replaced.
- C. Prime the substrate if recommended by the membrane manufacturer in accordance with the manufacturer's recommendations.
- D. Install flashings, cant strips, nailers, vapor barrier, insulation, cover boards and similar items as recommended by the manufacturer of the roofing assembly.
- E. Heat roofing asphalt and apply within plus or minus 25°F of equiviscous temperature, unless otherwise recommended by membrane manufacturer. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25°F of flash point. Discard roofing asphalt maintained at a temperature exceeding 500°F for more than four hours. Keep kettle lid closed, unless adding roofing asphalt.
- F. Prevent compounds from entering and clogging drains, conductors, and gutters, and from spilling or migrating onto surfaces of other work.

3.3 INSTALLATION

- A. Vapor Barrier Installation:
 - 1. Beginning at the low point of the roof solid mop one ply of specified vapor barrier ply to the primed concrete deck surface, lapping sides a minimum of 3-inches and ends a minimum of 4-inches.
- B. Mechanically Fastened Base Sheet Installation:
 - 1. Beginning at the low point of the roof and mechanically fasten one ply of specified mechanically attached base sheet to surface of gypsum decking, lapping sides a minimum of 3-inches and ends a minimum of 4-inche
- C. Membrane Installation:
 - 1. Start installation only in the presence of manufacturer's technical representative.
 - 2. Beginning at the low point of the roof solid mop one ply of of specified base sheet in hot asphalt to the insulation surface, lapping sides a minimum of 3-inches and ends a minimum of 4-inches.
 - 3. Beginning at the low point fully adhere one ply of specified cap sheet in specified cold adhesive to the base ply, lapping sides and ends a minimum of 4-inches. Stagger laps between plies.

4. All layers of roofing shall be laid free of wrinkles, creases or fishmouths and shall be laid parallel to the slope of the deck.
5. Temporary seal all loose edges to prevent water from infiltrating under the new roof at the end of each days Work.

D. Flashing and Stripping Installation:

1. Perimeter, curb, vents, expansion joints, drains and other details shall be flashed in accordance with the manufacturer's standard published details.
2. Exercise extreme care to minimize possibility of damage to membrane.
 - a. Base Flashing: Provide sufficiently wide to extend 4-inches out on the roof over the roofing (measured from the top edge of the cant strip). Prime masonry, concrete and plaster surfaces to receive the flashing with asphalt primer in accordance with manufacturer's recommendations and allow to dry before application. Mop concrete, masonry and plaster surfaces to receive flashing sheet with hot Type III asphalt. Embed the modified bitumen flashing sheet into the asphalt. End laps of base flashing shall not be less than 4-inches. Strip in all vertical flashing laps and flashing toe with cold applied asphalt mastic and reinforcing mesh in three-course detail. Apply in accordance with the manufacturer's recommendations.
 - b. Strip-In Flashing: Cover sheet metal flanges of pitch pockets, scuppers and flashings for vents and drains with one ply of specified base sheet and one ply of specified modified bitumen flashing sheet, laid in hot asphalt or cold applied asphalt mastic extending 4-inches beyond the edges of the underlying metal.
 - c. Roof Drains: Set 30-inch by 30-inch metal flashing in bed of asphalt roofing cement on modified bitumen membrane roofing. Cover metal flashing with modified bitumen stripping extending a minimum of 4-inches beyond edge of metal flashing onto field of roof membrane. Clamp roof membrane, metal flashing and stripping into roof-drain

E. Walkway Pads:

1. Traffic pads shall be installed in accordance with the manufacturer's recommendations and in areas as shown and at the following minimum locations.
 - a. At perimeters of roof hatches.
 - b. At perimeters of roof mounted mechanical and electrical equipment.
 - c. At landings of roof access ladders.

F. Protect roofing and associated Work from damage until Final Completion by OWNER.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Construction Observation: Provide daily inspections and reporting in accordance with paragraph 1.7 C

- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Owner's representative.
 - 1. Notify Owner's representative 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed if needed, to determine compliance of replaced or additional work with specified requirements.

3.5 INSPECTION AND ACCEPTANCE

- A. At the end of the construction period, or at a time when the remaining construction work will in no way affect or endanger the roofing and associated Work, make a final inspection of the Work and prepare a written report to the OWNER and the ENGINEER of deterioration, damage or deficiencies found in the Work.
- B. Only the installer shall repair or replace deteriorated or defective Work.
- C. Certify that the completed Work is in accordance with these Specifications and without damage or deterioration (except for normal weathering) at time of acceptance.

++ END OF SECTION ++

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SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

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. Formed Products:
 - a. Formed roof drainage sheet metal fabrications.
 - b. Formed low-slope roof sheet metal fabrications.
- B. Related Sections:
 - 1. Division 6 Section 06 10 53, Miscellaneous Rough Carpentry for wood nailers, curbs, and blocking.
 - 2. Division 7 Section 07 51 23, Glass-fiber Reinforced Asphalt Emulsion Roofing for custom-formed sheet metal flashing and trim integral with sheet metal roofing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows 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.

1.4 ACTION SUBMITTALS

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

- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.
 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 7. Details of special conditions.
 8. Details of connections to adjoining work.
 9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches (1:5).
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim

including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.

2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: (20) twenty years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
 1. Exposed Coil-Coated Finishes:

- a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal[or manufactured item] unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal[or manufactured item].
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Gutter Straps: Same material as gutter; with fasteners matching internal gutter width.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [polysulfide] [silicone] polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

- E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

- G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual"[and by FMG Loss Prevention Data Sheet 1-49] for application, but not less than thickness of metal being secured.

- H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

- I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.[Rivet joints where necessary for strength.]

- J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.[Rivet joints where necessary for strength.]
- K. Do not use graphite pencils to mark metal surfaces.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing / Drip Edge: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.
 - 1. Joint Style: Lap, 4 inches (100 mm) wide.
 - 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch (0.71 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.
- B. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
- C. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

- D. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back side of [uncoated aluminum] [and] [stainless-steel] sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of [10 feet (3 m)] <Insert dimension> with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate [wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood

screws] [metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance] <Insert size requirement>.

- E. Seal joints as shown and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section 07 92 00, Joint Sealants.
- F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 - 3. Anchor and loosely lock back edge of gutter to continuous [cleat] [eave or apron flashing].
 - 4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
 - 5. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.
- D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints.
 - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
 - 2. Provide elbows at base of downspout to direct water away from building.
 - 3. Connect downspouts to underground drainage system indicated.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.
- B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

++ END OF SECTION ++

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SECTION 07 72 00
ROOF ACCESSORIES

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. Roof Curbs.
 - 2. Equipment Support.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened.
- C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

2.3 ROOF CURBS

- A. Roof Pipe Curbs: Internally reinforced roof-pipe-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AES Industries, Inc.
 - b. Curbs Plus, Inc.
 - c. Custom Solution Roof and Metal Products.
 - d. Greenheck Fan Corporation.
 - e. LM Curbs.
 - f. Metallic Products Corp.
 - g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - h. Pate Company (The).
 - i. Roof Products, Inc.
 - j. Safe Air of Illinois.
 - k. Thybar Corporation.
 - l. Vent Products Co., Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.

- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

++ END OF SECTION ++

SECTION 07 92 00

JOINT SEALANTS

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. Urethane joint sealants.
- B. Related Sections:
 - 1. Division 4 Section 04 05 05, Masonry Construction, for masonry control and expansion joint fillers and gaskets.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight (8) pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:

- a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- F. Field-Adhesion Test Reports: For each sealant application tested.
- G. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- E. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - 2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. **Special Installer's Warranty:** Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: (2) Two years from date of Substantial Completion.
- B. **Special Manufacturer's Warranty:** Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: (5) Five years from date of Substantial Completion.
- C. **Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:**
 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. **Compatibility:** Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. **VOC Content of Interior Sealants:** Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.

- C. Provide colors selected by ENGINEER from calking and sealant manufacturer's standard and custom color charts. "Or equal" manufacturers shall provide same generic products and colors as available from manufacturers specified.

2.2 MATERIALS

- A. Exterior and Interior Horizontal and Vertical Joints; Submerged and Intermittently Submerged in Potable Water or Water That Will be Treated to Become Potable:
 - 1. One-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex-1a by Sika Corporation.
 - 2) Or equal.
 - b. One-component, moisture cured, gun grade, polyurethane sealant, complying with:
 - 1) FS TT-S-00230C, Type II, Class A; ASTM C920, Type S, Grade NS, Class 25.
 - 2) Adhesion-in-Peel, FS TT-S-00230C, ASTM C794 (minimum five pounds.): Glass, minimum 20 pounds per linear inch; Aluminum, minimum 20 pounds per linear inch; Concrete, minimum 20 pounds per linear inch.
 - 3) Hardness (Standard Conditions), ASTM D2240: 20 to 25 (Shore A).
 - 4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
 - 6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
 - 7) VOC Content: 100 g/L, maximum.
 - 8) Listed in NSF/ANSI 61
 - 2. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c NS by Sika Corporation.
 - 2) Or equal.
 - b. Two-component, moisture cured, gun grade, polyurethane sealant, complying with:
 - 1) FS TT-S-00227E, Type II, Class A; ASTM C920, Type M, Grade NS, Class 25.
 - 2) Adhesion-in-Peel, FS TT-S-00227E, ASTM C794 (Minimum five pounds per linear inch with no adhesion failure): 18 pounds.
 - 3) Hardness (Standard Conditions), ASTM C661: 25 (Shore A).
 - 4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.

- 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
- 6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
- 7) VOC Content: 220 g/L, maximum.
- 8) Listed in NSF/ANSI 61

B. Exterior and Interior Vertical Joints; Non-submerged:

1. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c NS by Sika Corporation.
 - 2) Dymeric 240 FC by Tremco Sealant/Waterproofing Division of RPM International, Inc.
 - 3) Or equal.
 - b. Polyurethane based, two-component elastomeric sealant complying with:
 - 1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.
 - 2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 10 pounds.
 - 3) Hardness (Standard Conditions), ASTM C661: 25 to 35 (Shore A).
 - 4) Stain and color change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
 - 6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
 - 7) VOC Content: 100 g/L, maximum.

C. Exterior and Interior Horizontal Joints; Non-submerged:

1. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c SL by Sika Corporation.
 - 2) THC/900 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
 - 3) Or equal.
 - b. Polyurethane based, two-component elastomeric, self-leveling sealant complying with the following:
 - 1) FS TT-S-00227E, Type I (self-leveling) Class A. and ASTM C920, Type M, Grade P, Class 25
 - 2) Water Immersion Bond, FS TT-S-00227E: Elongation of 50 percent with no adhesive failure.
 - 3) Hardness (Standard Conditions), ASTM C661: 35 to 45.
 - 4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.

- 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
- 6) VOC Content: 165 g/L, maximum.

2.3 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
- D. Low-temperature Catalyst: As recommended by calking and sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

- A. **Surface Cleaning of Joints:** Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. **Joint Priming:** Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. **Masking Tape:** Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
 - 1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- I. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform (10) ten tests for the first for each kind of sealant and joint substrate.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

++ END OF SECTION ++

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SECTION 08 11 00

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Galvanized interior and exterior standard hollow metal doors and frames.
- B. Related Sections:
 - 1. Division 8 Section 08 71 00, Door Hardware, for door hardware for hollow metal doors.
 - 2. Division 9 Section 09 91 00, Painting, for field painting hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 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.

9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Other Action Submittals:
1. 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 door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Regulatory Requirements:
1. Fire Resistance-Rated Assemblies: Wherever a fire resistance classification is shown or scheduled for hollow metal doors and frames (3-hour, 1 1/2-hour, and similar designations), provide fire resistance-rated hollow metal doors and frames tested as a fire door assembly, complete with type of fire door hardware to be used.
 2. Identify each fire-resistance-rated door and frame with recognized testing laboratory labels, indicating applicable fire-resistance-rating of both door and frame. Provide fire-resistance-rated doors and frames with metal labels permanently fastened to door and frame. Labels shall display all UL required information.
 3. Temperature Rise Rating: Wherever a temperature rise rating is required by the building code, provide doors for fire-resistance-ratings shown and in accordance with UL 10B.
 - a. For a UL 3 hour (A) classification, provide doors with a temperature rise rating of not more than 250°F maximum to 30 minutes of exposure.
 - b. For a UL 1 1/2-hour (B) classification, provide doors with a temperature rise rating of not more than 450°F or 650°F maximum to 30 minutes of exposure.
 4. Door and frame assemblies shall comply with NFPA 80, and as specified. Modify specified hollow metal door and frame system components to comply

with requirements of governing jurisdictions for fire-resistance-rated construction.

5. **Oversize Assemblies:** Wherever hollow metal assemblies are larger than size limitations established by ANSI/NFPA 252 and UL10B provide manufacturer's certification that assembly has been constructed with materials and methods equivalent to labeled construction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to finish of 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 under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

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

1.9 COORDINATION

- A. Coordinate installation of anchorages 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Amweld Building Products, LLC.
 2. Benchmark; a division of Therma-Tru Corporation.

3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Deansteel Manufacturing Company, Inc.
6. Firedoor Corporation.
7. Fleming Door Products Ltd.; an Assa Abloy Group company.
8. Habersham Metal Products Company.
9. Karpen Steel Custom Doors & Frames.
10. Kewanee Corporation (The).
11. Mesker Door Inc.
12. Pioneer Industries, Inc.
13. Security Metal Products Corp.
14. Steelcraft; an Ingersoll-Rand company.
15. Windsor Republic Doors.
16. Equivalent by other manufacturer.

2.2 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; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (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. Powder-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.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-

development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

- I. Glazing: Comply with requirements in Division 8 Section "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W) when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors
 - 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
 - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
 - 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
 - 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-(1.0-mm-) thick, end closures or channels of same material as face sheets.
 - 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated]. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty) galvanized Model 1 (Full Flush)
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

- D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded, galvanized.
 - 3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 - 4. Frames for Borrowed Lights: Same as adjacent door frame.
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 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 (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.9 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 thickness of metal. 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. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
 - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
- D. 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Compression Type: Not less than two anchors in each jamb.
 - c. 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.
 7. Door Silencers: Except on weather-stripped doors, 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.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section 08 71 00, Door Hardware.
1. Locate hardware as indicated, or if not indicated, according to ANSI/NAAMM-HMMA 861.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 3. Provide loose stops and moldings on inside of hollow metal work.
 4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory-Applied Paint Finish: Manufacturer's standard, complying with ANSI/SDI A250.3 for performance and acceptance criteria.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

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. For the record, 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. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. 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.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. 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.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. 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 of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 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. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. 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.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are 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 powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 4. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. 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 Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Division 8 and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

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 Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

++ END OF SECTION ++

SECTION 08 62 00

UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all unit skylight Work.
2. Extent of unit skylight Work is shown.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before unit skylight Work.

C. Related Sections:

1. Section 07 92 00, Joint Sealants.
2. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. Architectural Aluminum Manufacturers Association, (AAMA), AAMA 1603.1, Voluntary Standard Test Method for Thermal Transmittance of Skylights.
2. ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
3. ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C920, Specification for Elastomeric Joint Sealants.
5. ASTM D1003, Test Method for Haze and Luminous Transmittance of Transparent Plastics.
6. ASTM D1044, Test Methods for Resistance of Transparent Plastics to Surface Abrasion.
7. ASTM D2822, Specification for Asphalt Roof Cement.
8. AWPB LP2, Pressure Treated with Water-borne Preservatives, Above Ground Use.
9. FS TT-C-494, Coating Compound, Bituminous, Solvent Type, Acid Resistant.
10. SSPC Paint 12, Cold Applied Asphalt Mastic (Extra Thick Film).
11. UL 790, Standard Test Methods for Fire Tests of Roof Coverings.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:

- a. Shall have a minimum of five years experience producing substantially similar products to those specified and shall be able to document of at least five installations in satisfactory operation for at least five years.
- b. Engage one manufacturer, with undivided responsibility for furnishing products and services for unit skylight Work.

2. Installer:

- a. Engage installer regularly engaged in unit skylight installation and with five years experience in installing types of materials required; and who employs only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications of installer.
- b. Engage one installer for all unit skylight Work with undivided responsibility for performance and other requirements.

B. Component Supply and Compatibility:

1. Obtain all products included in this Section regardless of component manufacturer from a single unit skylight manufacturer.
2. Skylight manufacturer shall review and approve or to prepare all Shop Drawings and other submittals for components provided under this Section.
3. Components shall be specifically constructed for specified service conditions and be integrated into overall assembly by unit skylight manufacturer.

C. Regulatory Requirements:

1. Building code specified in Section 01 42 00, References.

1.4 SUBMITTALS

A. Action Submittals: Provide the following:

1. Shop Drawings:

- a. Assembly of entire unit skylight system, showing all dimensions, gages, finishes, location of joints, wood blocking, connections, fasteners, and locations and types of glazing gaskets, and other related items, as required. Provide detail sections of curb and skylight units.

2. Product Data:

- a. Manufacturer's product literature and specifications.

B. Informational Submittals: Provide the following:

1. Supplier's installation instructions:

- a. CONTRACTOR'S procedures for protecting unit skylights following installation and prior to final inspection.

2. Qualifications Statements:

- a. Manufacturer.
- b. Installer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage products to be embedded in concrete in ample time to prevent delaying the Work.
 2. Inspect all boxes, crates, and packages upon delivery to Site and notify ENGINEER in writing of loss or damage to products. Promptly remedy loss and damage to new condition per manufacturer's instructions.
 3. Conform to Section 01 65 00, Product Delivery Requirements.
- B. Storage and Protection:
1. Keep all products off ground using pallets, platforms, or other supports. Protect steel and packaged materials from corrosion and deterioration.
 2. Conform to Section 01 66 00, Product Storage and Handling Requirements.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. System Description:
1. Provide manufacturer's standard units modified as necessary to comply with the Contract Documents. Shop-fabricate each unit to greatest extent possible.
- B. Design Criteria:
1. Standards: Comply with the following applicable standards, except when more stringent requirements are specified in the Contract Documents.
 - a. AAMA 1603.1.
 - b. Glazing shall pass Class "B" burning brand test for flame spread and smoke contribution as specified in UL 790.
 2. Thermal Efficiency: Total thermal loss of entire unit skylight due to conductivity and air infiltration shall not exceed 5.1 BTU per hour per degree F.
 3. Air infiltration shall be less than 0.1 cfm per foot at 7.5 mph wind velocity.

2.2 MANUFACTURERS

- A. Manufacturers: Provide products of one of the following:
1. Wasco Products, Inc.
 2. Or equal.

2.3 MATERIALS

- A. Stainless Steel: AISI Type 302/304, ASTM A167, 2D annealed finish, except as otherwise indicated, temper as required for forming and performance.

- B. Aluminum Sheet: ASTM B209, Alloy 3003, temper as required for forming and performance; AA-C22-A42 dark bronze anodized finish, except mill finish prepared for painting where indicated.
- C. Extruded Aluminum: Manufacturer's standard extrusions of sizes and general profiles shown, Alloy 6063-T52; 0.078-inch minimum thicknesses for primary framing and curb member legs, 0.062-inch for secondary legs; AA-C22-A42 dark bronze anodized finish on exposed members, except as otherwise indicated.
- D. Insulation: Manufacturer's standard rigid or semi-rigid board of glass fiber of thicknesses indicated.
- E. Wood Blocking and Nailers: Softwood lumber, pressure treated with water-borne preservatives for above-ground use, complying with AWPB LP2, not less than two inches thick.
- F. Fasteners: Same material as metals being fastened, or non-magnetic stainless steel or other non-corrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
- G. Gaskets: Tubular or fingered design of neoprene or polyvinyl chloride, or block design of sponge neoprene.
- H. Bituminous Coating: FS TT-C-494 or SSPC Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- I. Elastomeric Sealant: Generic type recommended by skylight manufacturer, compatible with joint surfaces. Comply with ASTM C920.
- J. Roofing Cement: Comply with ASTM D2822, asphaltic.

2.4 FABRICATION

- A. Plastic Unit skylights:
 1. Sheet Thicknesses: Provide minimum thickness of 1/4-inch, except where additional thickness is required for light transmittances. Provide glazing plastic sheet thickness required for 40 pounds per square foot external loading and 35 pounds per square foot internal loading pressures; comply with thickness recommendations of AAMA 1603.1. Plastic shall conform to ASTM D1044.
 2. Profile: Pyramidal double-sheet insulating units with average one-inch minimum air space between sheets, manufacturer's standard hermetic edge seal.
 3. Color, Exterior Sheet: Bronze tinted sheet, 25 to 30 percent light transmittance conforming to ASTM D1003.
 4. Color, Interior Sheet: Colorless transparent sheet.

5. Glazing Frame, Dome Retainer, Trim: Extruded aluminum.
6. Curb Frame: Provide nine-inch high prefabricated curbs consisting of inner and outer aluminum skins thermally separated by a vinyl curb at the top, one-inch unfaced fiberglass insulation in body and vinyl extrusion at bottom. Provide fused corners, condensation gutter, and four-inch wide continuous aluminum nailing mounting flange at base integral with outer aluminum skin.
7. Glazing System: Neoprene, closed-cell sponge neoprene, or PVC gasketing, or of partially vulcanized butyl tape or liquid-applied elastomeric sealant. Provide bronze tinted outer dome with clear inner dome.
8. Condensation Control: Fabricate units with integral internal gutters and non-clogging weeps for permanent control of condensation on inside of domes.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions under which unit skylights are to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation Requirements:
 1. Install unit skylights and related components in accordance with manufacturer's written instructions, approved submittals, and the Contract Documents.
 2. Anchor enclosures permanently to substrate by methods in accordance with approved Shop Drawings. Anchorages shall be adequate for sizes and locations of units and adequate to withstand lateral and thermal stresses and inward and outward loading pressures.
 3. Protection of Aluminum from Dissimilar Materials: Coat all aluminum surfaces in contact with dissimilar materials, such as concrete, masonry, steel and other metals, as specified in Section 09 91 00, Painting.
 4. Seal all joints to provide a permanently watertight closure in accordance with Section 07 92 00, Joint Sealants.
 5. Clean exposed metal and plastic surfaces of unit skylight in accordance with manufacturer's instructions as required for preventing deterioration and uneven weathering.
 6. Advise ENGINEER in writing of protection and surveillance requirements that CONTRACTOR shall provide, at no additional cost to OWNER, to ensure that unit skylights will be without deterioration or damage at the time of final inspection.
 7. Clean and polish inside and outside of plastic unit skylight within five days prior to date of Substantial Completion.

3.3 FIELD QUALITY CONTROL

A. Field Testing:

1. After nominal cure of exterior joint sealants exposed to weather, test all exposed unit skylight joints for water leakage.
2. Flood exposed joint with water from garden hose without nozzle held perpendicular to wall face, 2.0 feet from joint. Hose shall discharge water at 30 pounds per square inch minimum pressure. Move stream of water along joint at approximate rate of 20 feet per minute.
3. Conduct test in presence of ENGINEER.
4. Criteria for Acceptance: No evidence of leakage is allowed.
5. Repair joints that fail test and re-test until satisfactory results are achieved.

++ END OF SECTION ++

SECTION 08 71 00

DOOR HARDWARE

PART 1 – GENERAL

1.1 SUMMARY

A. Scope

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install door hardware. Furnish door hardware for all doors in compliance with these Specifications herein.
2. Extent of door hardware is specified. Door hardware is defined to include all items known commercially as door hardware, except special types of unique and non matching hardware specified in the same Section as the door and door frame.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, the door hardware.
2. Notify other contractors in advance of the installation of the door hardware to provide them with sufficient time for the installation of items included in their contracts that must be installed with, or before, the door hardware.
3. Coordinate the Work of other Sections to provide clearances and accurate positioning of recessed or cast-in-place items.

C. Related Sections:

1. Section 08 11 13, Hollow Metal Doors and Frames.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American National Standards Institute, (ANSI).
 - a. ANSI A117.1, Accessible and Usable Buildings and Facilities.
2. American National Standards Institute, (ANSI), in association with Builders Hardware Manufacturers' Association, (ANSI/BHMA).
 - a. ANSI/BHMA A156.1, Butts and Hinges.
 - b. ANSI/BHMA A156.3, Exit Devices.
 - c. ANSI/BHMA A156.4, Door Controls - Closers.
 - d. ANSI/BHMA A156.6, Architectural Door Trim.
 - e. ANSI/BHMA A156.7, Template Hinge Dimensions.
 - f. ANSI/BHMA A156.8, Door Controls - Overhead Stops and Holders.
 - g. ANSI/BHMA A156.13, Mortise Locks and Latches, Series 1000.

- h. ANSI/BHMA A156.16, American National Standard for Auxiliary Hardware.
- i. ANSI/BHMA A156.18, Hardware - Materials and Finishes.
- j. ANSI/BHMA A156.21, Thresholds.
- k. ANSI/BHMA A156.22, Door Gasketing and Edge Seal Systems.
- 3. ANSI, in association with Door and Hardware Institute, (ANSI/DHI).
 - a. ANSI/DHI A115.1, Preparation of Mortise Locks in 1-3/8-inch and 1-3/4-inch Standard Steel Doors and Frames.
- 4. ANSI, in association with National Fire Protection Association, (ANSI/NFPA).
 - a. ANSI/NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- 5. ANSI, in association with Underwriters' Laboratories, Inc., (UL).
 - a. UL 10B, Fire Tests of Door Assemblies.
- 6. The Americans with Disabilities Act of 1990 (Public Law 101-336), Appendix A to Title 28 Code of Federal Regulations Part 36 (Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities - ADAAG).
- 7. Door and Hardware Institute, (DHI).
 - a. DHI, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
 - b. DHI, Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.
 - c. DHI, Sequencing and Format for the Hardware Schedule.
- 8. Hollow Metal Manufacturers Association, Division of National Association of Architectural Metal Manufacturers, (HMMA).
 - a. HMMA 830, Hardware Preparation and Locations for Hollow Metal Doors and Frames.
- 9. National Fire Protection Association, (NFPA).
 - a. NFPA 80, Fire Doors and Fire Windows.
- 10. Steel Door Institute, (SDI).
 - a. SDI 109, Hardware for Standard Steel Doors and Frames.
 - b. SDI 118, Basic Fire Door Requirements.
- 11. Underwriters' Laboratories, Inc., (UL).
 - a. UL 305, Panic Hardware.
 - b. UL, Building Materials Directory.

1.3 SUBMITTALS

A. Schedules:

- 1. The finish hardware supplier shall, upon award of the contract, furnish six (6) copies of a completely detailed schedule of finish hardware in "Vertical Format" in the Door and Hardware Institute's Sequence and Format for approval within 30 days. Hardware schedule to be complete with Title page, Door Index/Keying Schedule and Manufactures legend. After "Approval" provide six (6) copies, unless otherwise requested, of the corrected, revised and approved schedule for field use, distribution and files.

Provide one (1) copy complete with Catalog Cuts, marked "Installers Copy" and deliver it to the job site. Horizontal format schedules will be rejected.

B. Product Data:

1. Provide a catalog cut, clearly marked and identified, illustrating and describing each product included in the hardware schedule. Formulate these catalog cuts into sets and include a set with each copy of the hardware schedule submitted.

C. Samples:

1. If so requested by the Architect, provide a sample of any product or item requested, properly marked and tagged, for the opening for which it is intended. After examination and approval by the Architect, the sample shall be turned over to the General Contractor, for incorporation into the project.

D. Templates:

1. Upon "Approved" copies of the hardware schedule, provide a complete "Template List". Further and upon request, provide copies to manufacturers or trades, whose work includes preparation of their products, to receive hardware. Provide copies of all such transmittals to the contractor, for their files. If physical samples are required, the manufacturer may request it from the general contractor and assume all responsibility of shipping it complete to the project.

E. Keying:

1. The hardware supplier shall meet with owner and/or architect to establish keying requirements. Provide a keying schedule, listing the levels of keying, (GMKD, MKD, Keyed alike, etc.) as well as an explanation of the key's function, the symbols used and the numbers of the doors controlled. This shall be provided in reference to the Door and Hardware Institute's manual "Keying Systems and Nomenclature". Also in conjunction the Door Index/Keying Schedule (which lists the door number, schedule heading, lock type and individual key symbol and remarks or special instructions) mentioned in paragraph "B", Schedules.

F. Wiring Diagrams:

1. Unless otherwise specifically stated, for any electrified hardware furnished on this project, provide complete point to point wiring diagrams along with riser drawings and elevations, showing locations where such material is to be installed. Also check with the system installer as to the scope of their work.

G. Operations and Maintenance Data:

1. At the completion of the project, provide an Owner's Operation and Maintenance Manual. The manual shall consist of a hard three ring binder. Include a copy of the latest revised and updated schedule of finish hardware, complete with catalog cuts and keying schedule. In addition, furnish one

copy of maintenance and parts manual, for those items, for which they are readily available and normally provided.

1.4 QUALITY ASSURANCE

A. Substitutions:

1. The manufacturers and catalog numbers listed are intended to establish a standard of quality. Items specified as “owner’s standard” shall be provided as listed they have been requested by the Owner/Architect to match existing for continuity and/or future performance, maintenance standards or there is no equal product. Certain products have been selected for their unique characteristics and particular project suitability. Requests for substitutions will require architects approval and must be made in accordance with Division 01. Provide sample if requested. Substitution item will be reviewed and if approved it will be listed in an addendum prior to bid date.

B. Supplier Qualification:

1. The hardware supplier must be engaged currently in the furnishing, delivery and servicing of contract builders hardware. The firm shall have been furnishing hardware on similar projects in the vicinity for not less than five (5) years. The supplier must employ a certified Architectural Hardware Consultant (AHC) qualification and be available at reasonable times during the course of this project for consultation with the owner, architect and general contractor.

C. Single source responsibility: Obtain each type of hardware (latches and locks, hinges, exit devices, door closers, etc) from a single manufacturer.

D. Fire-Rated Openings:

1. Provide door hardware for fire-rated openings that complies with NFPA and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Warnock Hersey, Factory Mutual, or other testing and inspecting organization for given type/size and degree of label. Provide proper latching hardware, door closers, approved bearing hinges and seals whether listed in the hardware schedule or not. All hardware shall comply with standards UBC702 (1997) and UL10C. These must be acceptable to the authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and frame labels.
 - a. Where emergency exit devices are required on fire rated doors, (with supplementary marking on door’ UL labels indicating “Fire Doors to be equipped with Fire Exit Hardware”) provide UL label on exit devices indicating, “Fire Exit Hardware”.

E. Electronic Security Hardware:

1. When electrified hardware is included in the hardware specification, the hardware supplier must employ an individual knowledgeable in electrified

components and systems, who is capable of producing wiring diagrams and consulting as needed. Coordinate installation and technical data of the electronic security hardware with Architect, electrical engineers and other related contractors. Upon completion of the electronic security hardware installation, verify that components are working properly, and state in the required guarantee that this inspection has been performed. Provide electrical door hardware from the same source manufacturer as the mechanical door hardware.

1.5 DELIVERY, STORAGE AND HANDLING

A. Marking and packaging:

1. All items of hardware shall be delivered to the job site, in the manufacturer's original packages, they shall be marked to correspond with approved hardware schedule, item number, heading number, door number and key sets symbols. Include installation instructions with each piece of hardware.

B. Delivery:

1. The hardware supplier shall coordinate delivery with general contractor, in order to compile a mutually beneficial delivery schedule, which imposes no hardship on either party. Some items of the hardware may be delivered to fabricators for factory installation in such case, the general contractor shall be advised of such shipments, along with copies of shipping tickets and any other documentation, thus transferring responsibility to the manufacturer or fabricator, for care of said hardware. Any delivery fees will be in the quoted price of the material.

C. Storage:

1. Hardware is to be delivered to the job site and stored in a clean dry, secure area, with adequate strong shelving. If requested by the contractor, the hardware supplier shall send a representative to the job site to "assist" the check in and laying-out of the hardware on the shelves. A representative of the contractor **MUST** be present. At this time any installation tips or special instructions will be reviewed.

D. No direct shipments will be allowed unless prior approval by the contractor.

1.6 WARRANTY

A. Starting date for all warranty periods will be from the date of substantial completion.

B. All material must carry a limited warranty against defects in workmanship and materials from the date of acceptance of the project as follows.

1. Door Closers: at least ten (10) year warranty, except electronic closers, two (2) years

2. Exit Devices: at least three (3) year warranty, except electrified devices, one (1) year.
 3. Locksets: at least seven (7) year warranty, except electrified devices, one (1) year.
 4. Hinges: life of the building.
 5. Balance of the hardware: one (1) year.
- C. Products judged to be defective during the warranty period will be replaced or repaired in accordance with the manufacturer's warranty at no additional cost to the owner. However, NO warranty against defects due to improper installation or failure to exercise normal maintenance.

1.7 MAINTENANCE

- A. Maintenance service:
1. If there are any products listed hereinafter that normally require a maintenance or service contract, provide the owner with details and costs of said contract.
- B. Maintenance Tools and Instructions:
1. Furnish a complete set of specialized tools and maintenance instructions as needed for the owners continued adjustment, maintenance, and removal and the replacement of door hardware.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

- A. The following manufacturers listed in 2.2 Materials have been selected for this project, whose products numbers have been used in the preparation for this specification.
- B. Note that even though an acceptable substitute manufacturer may be listed, the product must provide all the functions and features of the specified product or it will not be approved.
- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where the exact types of hardware specified are not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having as nearly as possible the same operation and quality as the type specified, subject to Architect's approval.

2.2 MATERIALS

A. Screws and Fasteners:

1. Provide all screws and fasteners of the proper size and type to properly anchor or attach the item of hardware they are intended for. Provide all fasteners with Phillips head, do not use through-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely.

B. Hinges:

1. The following is a guide for hinge type required for this specification:
 - a. 1-3/4" thick doors up to and including 3'0" wide:
 - 1) Exterior: standard (.134) or heavy weight (.180) ball bearing, bronze/stainless steel 4-1/2" high.
 - 2) Interior: standard (.134) or heavy weight (.180) plain or ball bearing, steel 4-1/2" high.
 - b. 1-3/4" doors over 3'0" wide:
 - 1) Exterior: standard (.134) or heavy weight (.180) ball bearing, bronze/stainless steel 5" high.
 - 2) Interior: standard (.134) or heavy weight (.180) plain or ball bearing, steel 5" high.
 - c. Furnish one pair of hinges for all doors up to 60" high. Furnish one additional hinge for every additional 30" or fraction thereof. The width of hinges shall be sufficient to clear all trim.
 - d. Hinges specified Ives (IVE), approved acceptable substitute Hager, Stanley, McKinney

C. Continuous Hinges:

1. Hinges shall be manufactured of three interlocking components and two hinge leafs. The door leaf and jamb leaf shall be pinned together for the entire length of the hinge. The assembly of three interlocking shall be applied to the full height of the door and frame without mortising.
 - a. Continuous Hinges specified Ives (IVE), approved acceptable substitute Hager Roton, McKinney, Select

D. Automatic and Manual Flush Bolts:

1. Shall have forged bronze faceplate with extruded brass lever and with wrought brass guide and strike. Flush bolts for hollow metal doors shall be extension rod type door up to 7'6" in height shall have 12" steel or brass rods, manual flush bolts for doors over 7'6" in height shall be increased by 6" for each additional 6" of door height. Wood doors shall have corner-wrap type. Provide dust proof strikes for all bottom bolts.
 - a. Flush Bolts specified Ives (IVE), approved acceptable substitute DCI, Rockwood

E. Coordinators:

1. Where pairs of doors are equipped with automatic flush bolts, provide bar type coordinating device, surface applied to the underside of the stop at the frame head. Provide a filler bar of the correct length to span the entire width of the opening, and any appropriate brackets for parallel arm door closers, surface vertical rod strikes, and or any other hardware. Finish of the coordinator, filler bar and mounting brackets to be US28 unless otherwise noted.
 - a. Coordinators specified Ives (IVE), approved acceptable substitute DCI, Rockwood

F. Mortise Locks:

1. Locks shall be ANSI A156.13, Grade 1 Operational, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Lock case shall be multi-function and field reversible for handing without opening the case. Cylinders: Refer to 2.04 KEYING.
2. Locks to have a standard 2-3/4" backset with a full 3/4" throw stainless steel mechanical anti-friction latch bolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Provide electrical options as scheduled. Provide electrified locksets with micro switch (RX) option that monitors the retractor crank, and is actuated when rotation of the inside or outside lever rotates the retractor hub. Provide normally closed contacts or normally open contacts as required by security system. All electrification and or additional switches shall be added to the mortise lock by the manufacturer of the mortise lock. Electric and Non-Electric additions to the mortise lock by a second manufacturer that void the warranty of the mortise lock manufacturer will not be acceptable.
5. Lever trim shall be cast or forged in the design specified, with 2-1/8" diameter roses with wrought roses and external lever spring cages. Levers shall be thru-bolted to assure proper alignment, and shall have a 2-piece spindle. Levers to be thru-bolted to assure proper alignment. Trim shall be applied by threaded bushing "no exposed screws".
6. Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
7. Locks meeting this specification: Schlage (SCH) L9000 x 17L approved acceptable substitute Sargent 8200 series , Stanley Best 45H series

G. Exit Devices:

1. Exit devices shall be touch pad type, fabricated of brass, bronze, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.
2. Exit devices shall be tested to ANSI/BHMA A156.3 test requirements by a BHMA certified laboratory. A written certification showing successful completion of a minimum 1,000,000 cycles must be provided.

3. All exit devices shall incorporate a fluid damper or other device, which eliminates noise associated with the standard operation.
4. Touch pad shall extend a minimum of one half of the door width. Maximum unlatching force shall not exceed 15 pounds. End-cap will have three-point attachment to the door. Touch pad shall match exit device finish, and shall be stainless steel for US26, US26D, US28, US32, and US32D finishes.
5. Only compression springs will be used in devices, latches, and outside trim and/or controls.
6. All lever design shall match mortise lock lever designs.
7. All devices to incorporate a security dead-latching feature.
8. Provide roller strikes for all rim and surface mounted vertical rod devices, ASA strikes for mortise devices, and manufacturer's standard strikes for concealed vertical rod devices.
9. Device mechanism case and bar shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or the moulding projects off the face of the door, provide glass bead kits.
10. Exit devices shall be UL listed panic exit hardware. All exit devices for fire rated openings shall be UL labeled fire exit hardware.
11. Provide electrical options as scheduled.
12. Exit devices meeting this specification: Von Duprin (VON) 98 series approved acceptable substitute None Owners Standard

H. Door Closers:

1. All closers will utilize a stable fluid withstanding temperature range of 120 degrees f to -30 degrees f without seasonal adjustment of closer speed to properly close the door. Closers on fire rated doors will be provided with temperature stabilizing fluid that complies with standard UL 10C for "Positive Pressure Fire Tests of Door Assemblies" and UBC 7-2 (1997).
2. Door closers shall hydraulic, full rack and pinion action with a high strength cast iron cylinder. Cylinder body shall be 1 1/2" in diameter, and double heat-treated pinion shall be 11/16" in diameter. A written certificate showing successful completion of a minimum of 10,000,000 cycles for exterior door closers must be provided.
3. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and back check.
4. All closer shall have forged steel main arms and forged forearms for parallel arm closers.
5. Closer cylinders and arms (and metal covers when specified) shall have a powder coating finish which has been certified to exceed 100 hours of salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification. For metal components that can't be powder coated, a special rust inhibiting finish (SRI) must be used.

6. All closers will not be seen on the public side or hallway side of the door. The appropriate drop plate or mounting plates will be used as conditions dictate.
 7. Door closers meeting this specification: LCN (LCN) 4011, 4111 approved acceptable substitute None Owners Standard
- I. Door Stops and Holders:
1. It shall be the responsibility of the hardware supplier to provide doorstops for all doors in accordance with following requirements:
 - a. Wall stops may be used wherever possible.
 - b. Where wall stops cannot be used, provide dome type floor stops of the proper height.
 - c. At any opening where a wall or floor stop cannot be used, a heavy-duty overhead stop will be required.
 - d. At no time will a hinge pin stop be acceptable.
 - e. Stops specified Ives (IVE), approved acceptable substitute Hager, Rockwood
- J. Overhead Stops/ Holders:
1. Overhead door stops and holders; surface or concealed at the top of the door shall have shock absorber in extruded stainless steel case. Hold open and shock absorber feature that automatically engages and releases the door. Sliding member in the channel shall have accessible adjustment screw to regulate hold open tension.
 2. Overhead stops/holders specified Glynn-Johnson (GLY), approved acceptable substitute Sargent, Rixson
- K. Thresholds and Gasketing:
1. Furnish as specified and per details. Match finish of other items as closely as possible. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available. Threshold, sweep and weather-stripping will be supplied to weather proof the exterior doors. The thresholds will be supplied to fit the particular sill conditions and not conflict with the American Disabilities Act (ADA). Exterior pairs of doors will have split astragal to prevent air infiltration. Interior doors may require gasketing, thresholds and sweeps to act as a sound barrier per the owner's request.
 - a. Thresholds specified National Guard Products (NGP), approved acceptable substitute Reese, Zero
- L. Silencers:
1. Furnish Ives SR64 for the "push in type: for metal frames, Ives SR65 for wood frames, or Ives SR66 adhesive type. Supply 3 each for single doors, 2 each for pair of doors. Omit silencers where gasketing is scheduled.
 - a. Silencers specified Ives (IVE), approved acceptable substitute Hager, Rockwood

M. Miscellaneous Items:

1. Transom Spring Bolts specified Richard Wilcox (RIC), approved acceptable substitute architect approved.

2.3 FINISHES

- A. All hardware is to be furnished in one of the following finishes, depending upon the item and its base metal. All satin chrome or satin stainless steel or as noted.

Item	BHMA #	US #
Hinges exterior	630	(US32D)
Hinges interior	630	(US32D)
Continuous Hinges	630	(US32D)
Flush Bolts	630	(US32D)
Coordinators	628	(US28)
Mounting Brackets	689	(alum painted)
Locks	630	(US32D)
Exit Devices	630	(US32D)
Door Closers	689	(alum painted)
Door wall stops	630	(US32D)
Overhead Holders	630	(US32D)

Other items to be 630 if available. If not, 626 over brass or bronze.

2.4 KEYING

- A. All locksets shall be furnished with two (2) cut keys and with key code number stamped on the bow of the key. All cylinders shall be factory masterkeyed and grand masterkeyed as required. Furnish three (3) grand masterkeys and six (6) masterkeys for each masterkeyed group. The grand masterkeys and masterkeys shall be sent direct to the owner's representative by registered mail, return receipt requested.
- B. Consult with OWNER and secure written approval of the complete keying layout prior to placing lock order with factory.
1. Cylinders and Keying specified Schlage (SCH), approved acceptable substitute Sargent, Stanley Best

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine condition of opening size, shall be verified as to door frames being plumb and of correct tolerance, walls or any

related items that would prevent proper installation of doors and hardware. Correct any and all defects prior to proceeding with installation.

3.2 INSTALLATION

- A. Prior to hardware installation the general contractor will set up a preinstall job site meeting with the hardware supplier, hardware installer and any other trades people deemed necessary (i.e. electrical contractor, security contractor, etc.) for communication to assure trouble free installation. This meeting would be best coordinated with the delivery requirements detained in section 1.05.
- B. Review with the architect the mounting locations of various items of hardware in accordance with the Door and Hardware Institute's (DHI), "Recommended Locations for Architectural Hardware" for standard and custom steel doors and frames, and DHI's WDHS-3 for flush wood doors. Special attention to be given to all special and unusual conditions. All hardware shall be installed by carpenter mechanics skilled in the application of said hardware.
- C. Install each hardware item in compliance with the manufacturer's instructions and recommendations, using only the fasteners provided by the manufacturer.
- D. Set thresholds for exterior doors in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 "Joint-Sealers".

3.3 FIELD QUALITY CONTROL

- A. After all hardware has been installed, provide the services of a qualified hardware consultant to check for proper installation of hardware, according to the "Approved" hardware and keying schedule's. Also, check the operation and adjustment of all hardware items in accordance with the manufacturer's recommendations.

3.4 ADJUSTING AND CLEANING

- A. At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to all door closers and other items of hardware. Where hardware is found defective, repair or replace or otherwise correct as directed. After building is occupied, arrange an appointment with owner's representative to instruct in the proper use, servicing, adjusting and maintenance of the hardware.
- B. Hardware items specified to receive antimicrobial coating may be cleaned with a mild detergent, air-dry or dried with soft cloth.
- C. Avoid harsh abrasive cleaners and abrasive cleaning pads.

3.5 PROTECTION

- A. Provide protection for all items of hardware during construction, to prevent damage, field painting or marring. Damaged or disfigured hardware shall be replaced or corrected by the responsible party.

3.6 HARDWARE SCHEDULE

- A. Provide hardware for each door to comply with requirements of this section “Finish Hardware” hardware set numbers indicated in the door schedule, and in the following schedule of hardware sets.
- B. It is intended that the following schedule includes all items of the finish hardware necessary to complete the work. If a discrepancy is found in the schedule, such as a missing item, improper hardware for a frame, door or fire codes, it shall be the responsibly of the hardware supplier to supply the proper materials.
- C. Hardware Sets:

1. Set 1: 301-1

<u>Qty</u>	<u>Description</u>
6	Hinges
1	Closer
1	Panic Hardware
6	Silencers
2	Stops
1	Coordinator
1	Astragal
1	Flush Bolt

2. Set 2: 301-2

<u>Qty</u>	<u>Description</u>
3	Hinges
1	Closer
1	Panic Hardware
3	Silencers
1	Stops

++ END OF SECTION ++

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SECTION 09 66 00

TERRAZZO FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install all terrazzo flooring.
2. Extent of terrazzo flooring Work is shown.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the terrazzo flooring Work.
2. Coordinate and schedule shot blasting, grinding and installation of cementitious underlayments, to provide substrates within tolerances and surface profile specified.
3. Coordinate required thickness of cementitious underlayments with doors, thresholds and adjacent materials to provide smoothly aligned transitions in compliance with the requirements of governing authorities having jurisdiction at the Site.
4. Remove all chemicals, compounds and other materials from substrates that could preclude bonding of terrazzo flooring, even if chemicals, compounds and other materials are specified as acceptable for use in the Work under other Sections.
5. Do not use liquid curing compounds on cast-in-place concrete floors shown to receive terrazzo flooring.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American Concrete Institute, (ACI).
 - a. ACI 302.1R, Guide for Concrete Floor and Slab Construction.
 - b. ACI 403, Bulletin Title No. 59-43.
2. American Society for Testing and Materials, (ASTM).
 - a. ASTM C 33, Specification for Concrete Aggregates.
 - b. ASTM C 150, Specification for Portland Cement.
 - c. ASTM C 157/C 157M, Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 - d. ASTM C 170, Test Method for Compressive Strength of Natural Building Stone.

- e. ASTM C 241, Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
 - f. ASTM C 267, Test Methods for Chemical Resistance of Mortars, Grouts and Monolithic Surfacing and Polymer Concretes.
 - g. ASTM C 293, Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).
 - h. ASTM C 348, Test Method for Flexural Strength of Hydraulic Cement Mortars.
 - i. ASTM C 579, Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts Monolithic Surfacing and Polymer Concretes.
 - j. ASTM D 570, Test Method for Water Absorption of Plastics.
 - k. ASTM D 635, Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 - l. ASTM D 695, Test Method for Compressive Properties of Rigid Plastics.
 - m. ASTM D 696, Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 Degrees C and 30 Degrees C with a Vitreous Silica Dilatometer.
 - n. ASTM D 1308, Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 - o. ASTM D 2240, Test Method for Rubber Property - Durometer Hardness.
 - p. ASTM G 23, Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
3. National Terrazzo and Mosaic Association, Incorporated (NTMA), Guide Specifications.

1.3 QUALITY ASSURANCE

- A. Source Quality Control:
- 1. In addition to specified requirements, comply with resin manufacturer's approved instructions and recommendations, including storing, mixing and applying materials, finishing, and curing of terrazzo flooring Work.
 - 2. Materials shall comply with NTMA requirements. Submit these requirements along with verification of compliance.
- B. Installer's Qualifications:
- 1. Installer shall be a member of NTMA in good standing and be certified to perform all the Work in accordance with NTMA Standards.
 - 2. Engage a single installer regularly engaged in performing terrazzo flooring Work and with successful experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work.
 - 3. Submit name and qualifications to ENGINEER along with the following information on a minimum of three successful projects of the same magnitude and complexity:
 - a. Names and telephone numbers of owners, architects or engineers responsible for projects.

- b. Approximate contract cost of the terrazzo flooring.
 - c. Amount of area installed.
- C. Pre-Installation Conference:
1. Prior to the installation of terrazzo flooring, CONTRACTOR shall schedule a Pre-Installation Conference at the Site.
 2. Notify ENGINEER and others, as specified, and submit proposed meeting agenda at least five days before scheduled date of conference. The agenda shall include a review of foreseeable methods and procedures related to the terrazzo flooring Work including, but not necessarily limited to, the following:
 - a. Project requirements, including Contract Documents.
 - b. Underbed preparation and installation.
 - c. Method of sequence of terrazzo flooring installation.
 - d. Special terrazzo flooring designs and patterns.
 - e. Required submittals, both completed and yet to be completed.
 - f. Standard of workmanship.
 - g. Quality control requirements.
 - h. Work organization and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
 - i. Terrazzo flooring control and expansion joint locations and materials.
 - j. Modular planning requirements and special installation considerations.
 - k. Procedures for coping with unfavorable conditions and dust control procedures.
 - l. Required inspection, testing and certifying procedures.
 3. Attendance is mandatory for the following:
 - a. CONTRACTOR'S superintendent.
 - b. Terrazzo flooring subcontractor's foreman.
 - c. ENGINEER'S authorized representative.
 4. Reconvene the Pre-Installation Conference at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.
 5. Record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
1. Shop Drawings: Submit the following:
 - a. Copies of manufacturer's technical information and installation instructions for all materials required. Include requirements for environmental conditions and other conditions required for an acceptable installation.
 - b. Complete and coordinated plans drawn at 1/4-inch scale showing locations of all divider, control and expansion joint strips. Base positions of strips on dimensions obtained from measurements taken at the Site of the Work. Indicate the location of each NTMA color plate number based on terrazzo flooring patterns shown. Include location of all penetrations

through terrazzo flooring and all equipment and other items that interrupt terrazzo flooring patterns.

- c. Completely dimensioned details drawn at 1-1/2-inch scale showing all jointing and edge conditions at accessory strips, cove bases, stair nosings, abrasive strips, control and expansion joints, termination in the Work and similar details. Include details of anchorage and other special features required.

2. Samples: Submit the following:

- a. Each pattern and color of terrazzo flooring required with all types of divider and similar type strips included on a thin-set sample panel not less than 12-inches square. Provide original, full color print copies of all NTMA color plate numbers shown or specified, for acceptance by ENGINEER.
- b. Six-inch lengths of all accessories.
- c. Samples will be reviewed for color, pattern, texture and workmanship only. Compliance with all other requirements is the responsibility of CONTRACTOR.
- d. Installer's Qualifications: Submit qualifications in accordance with Article 1.3, above.

B. Informational Submittals: Submit the following:

1. Certificates: Submit copies of manufacturer's written certification that terrazzo flooring materials meet or exceed specified NTMA properties requirements.

C. Closeout Submittals: Submit the following:

1. Maintenance Instructions: Upon completion of the Work, submit five copies of NTMA written instructions for recommended periodic maintenance of terrazzo flooring Work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded, in ample time to prevent delay of that Work.
2. Only materials approved at the time of Shop Drawing submission shall be delivered to the Site.
3. Do not open containers or bags until all preparatory Work is complete and installation will start immediately.
4. Handle materials to prevent the inclusion of foreign materials and contaminants.

B. Storage and Protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. Do not allow materials to become wet or covered with ice or snow.

C. Acceptance at Site:

1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

1.6 PROJECT CONDITIONS

A. Scheduling and Sequencing:

1. Complete terrazzo flooring installation before the installation of other items, which might be damaged by the spillage of water, resin or other materials required by the Work.
2. Sequence the Work so that other installers do not interfere with, or need to cross, the terrazzo flooring installation areas until such time as the terrazzo flooring Work can be adequately protected from potential damage that may be caused by the Work, or access requirements of, other installers.

B. Environmental Requirements:

1. Supplemental Heat:
 - a. Provide supplemental heat and protection as required to maintain terrazzo flooring at minimum of 50°F during and after installation.
 - b. Supplemental heat and power sources, as may be required should ambient temperature fall below 50°F, are not available at the Site. The provision of all supplemental heat, including fuel, equipment, operating and maintenance personnel and power sources, is the responsibility of CONTRACTOR.
2. Distribute heat uniformly and provide deflection or protective screens as required to prevent concentration of heat on terrazzo flooring Work near heat source.
3. Warm Weather Requirements: Protect terrazzo flooring Work against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure terrazzo flooring as required by climatic and Site conditions to prevent dry-out during cure period. Provide suitable coverings, moist-curing, barriers to deflect sunlight and wind, or combinations of these, as required.
4. Ventilation Requirements: Provide natural or mechanical means of ventilation to remove water in excess of that required for hydrating cement after application. Begin ventilation immediately after terrazzo flooring is applied and continue until it sets.
 - a. If glass is not in place and areas to receive terrazzo flooring are subjected to hot dry winds or will be subjected to temperature differentials of 20°F or more, cover openings with polyethylene film arranged to allow proper ventilation without excessive, non-uniform curing or temperature variations.
 - b. Avoid conditions that result in terrazzo flooring Work drying too rapidly. Provide moisture-cure and maintain relative humidity levels appropriate

for prevailing ambient temperatures that will produce normal curing conditions.

C. Site-Measurements:

1. Verify actual dimensions in areas of installation by measurements taken at the Site before installation. Indicate dimensions on Shop Drawings.
2. Where measurements cannot be made without delaying the Work, establish dimensions and proceed with Shop Drawing preparation without Site verified dimensions. Coordinate supports, adjacent construction, and equipment locations to ensure actual dimensions shown on Shop Drawings correspond to dimensions established for terrazzo flooring Work.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design Criteria:

1. Terrazzo Flooring Selections:
 - a. Match existing color, stone density, blend and size of existing aggregate. Provide same matrix color and material as existing, unless otherwise specified. Provide same strip width, material and divider strip pattern required to match, and be continuous with, existing patterns. Align face of new Work with existing.
2. Thickness: Provide finished terrazzo flooring thickness of 3/8-inch.
3. Minimum Allowance for Thickness of Terrazzo Flooring at Localized High Points in Substrate: 1/4-inch.

B. Performance Standards:

1. Comply with applicable guide specifications and recommendations of NTMA.

C. Materials:

1. Polyacrylate Modified Portland Cement Terrazzo Flooring: Provide the following physical properties in the finished terrazzo flooring system:
 - a. Matrix Odor: Free from objectionable odors under ordinary service conditions.
 - b. Bond Strength, ACI 403 Bulletin Title No. 59-43: 300 psi, minimum.
 - c. Tensile Strength, ASTM C 170: 1,000 psi, minimum after aging 28 days. Tensile strength shall not change more than 20 percent between -10 and +180°F.
 - d. Flexural Strength, ASTM C 348: 2,000 psi, minimum.
 - e. Thermal Coefficient of Expansion, ASTM D 696: Matrix material shall develop a coefficient of thermal expansion no greater than 10×10^{-6} .
 - f. Linear Shrinkage, ASTM C 157/C 157M: 0.05 percent maximum in 365 days.
 - g. Toxicity: Materials shall be non-toxic and non-allergenic and shall emit no toxic or noxious fumes or odors during mixing and placing procedures.

2. Polyester Terrazzo Flooring: Provide the following physical properties in the finished terrazzo flooring system:
 - a. Compressive Strength, ASTM C 579: 8,000 psi, minimum.
 - b. Bond Strength, ACI 403 Bulletin Title No. 59-43: 100 percent concrete failure, and 200 psi minimum tensile strength.
 - c. Chemical Resistance, ASTM C 267: No evidence of change in color, blistering, cracking, peeling or loss of adhesion after 48 hours.
 - d. Hardness, ASTM D 2240: 80, minimum.
 - e. Water Absorption After 24 Hours, ASTM D 570: 0.10 percent, maximum.
 - f. Porosity After 24 Hours, ASTM D 570: Eight percent maximum weight gain with no evidence of cracking, peeling, blistering or loss of adhesion.
 - g. Flammability, ASTM D 635: Self-extinguishing.
3. Epoxy Terrazzo Flooring: Provide the following physical properties in the finished terrazzo flooring system:
 - a. Compressive Strength, ASTM C 695: 10,000 psi, minimum.
 - b. Bond Strength, ACI 403 Bulletin Title No. 59-43: 100 percent concrete failure, and 200 psi minimum tensile strength.
 - c. Chemical Resistance - Seven-Day Immersion at Room Temperature, ASTM C 1308: No deleterious effect from the following:
 - 1) Isopropanol.
 - 2) Thirty percent sulfuric acid.
 - 3) Ten percent hydrochloric acid.
 - d. Hardness, ASTM D 2240: 60 to 85.
 - e. Porosity After 24 Hours, ASTM D 570: Eight percent maximum weight gain with no evidence of cracking, peeling, blistering or loss of adhesion.
 - f. Flammability, ASTM D 635: Self-extinguishing.
 - g. Thermal Coefficient of Linear Expansion, ASTM D 696: 25×10^{-6} in/in/°F maximum, over temperature range -12 to 140°F.

2.2 MANUFACTURERS

- A. Polyacrylate Modified Portland Cement Matrix:
 1. Products and Manufacturers: Provide one of the following:
 - a. Deco-Rez Thinset Polyacrylate No. 801 Terrazzo, as manufactured by General Polymers Corporation.
 - b. Or equal.
- B. Polyester Resin Matrix:
 1. Products and Manufacturers: Provide one of the following:
 - a. Deco-Rez Thinset Polyester Terrazzo No. 1200, as manufactured by General Polymer Corporation.
 - b. Or equal.
- C. Epoxy Resin Matrix:
 1. Products and Manufacturers: Provide one of the following:

- a. Deco-Rez Thinset Epoxy Terrazzo No. 1100, as manufactured by General Polymers Corporation.
 - b. Or equal.
- D. Terrazzo Flooring Divider Strips and Similar Accessories:
- 1. Provide a complete selection of terrazzo flooring divider strips and other accessories.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Dividing Strips, as manufactured by Manhattan American Terrazzo Strip Company.
 - b. Or equal.

2.3 MATERIALS

- A. Acrylic Modified Portland Cement Matrix: Composite thin-set, complying with NTMA “Guide Specifications for Polyacrylate Terrazzo” and as required to match NTMA specified plate numbers specified.
- B. Polyester Resin Matrix: Two-component polyester resin and hardener, mineral filler and color pigment, complying with NTMA “Guide Specifications for Polyester Terrazzo” and as required, to match NTMA plate number specified.
- C. Epoxy Resin Matrix: Thermosetting, amine-cured epoxy resin and hardener, mineral filler and color pigment, complying with NTMA “Guide Specifications for Epoxy Terrazzo” and as required to match NTMA plate number specified.
- D. White Portland Cement:
 - 1. ASTM C 150, Type I.
 - 2. Provide non-staining white portland cement, which will attain a compressive strength of not less than 2,800 pounds per square inch at three days and 4,000 pounds per square inch at seven days.
 - 3. Products and Manufacturers: Provide one of the following:
 - a. Lehigh White Portland Cement by Lehigh Portland Cement Company.
 - b. Or equal.
- E. Aggregates: Natural, sound, No. 2 and No. 1 crushed marble chips with a dust content of less than one percent by weight, colors selected and graded to match specified NTMA plate number and selected to avoid off-color or contaminated material, crushed by a process that will largely eliminate flat or slivery chips and accurately sized to yield marble chips for terrazzo, but with maximum size within limits of workability for the terrazzo thickness specified. Abrasion resistance of marble chips shall be Ha-10 minimum, in compliance with ASTM C 241, and shall have a 24-hour water absorption rate of less than 0.75 percent.
- F. Matrix Pigments: Pure mineral pigments, alkali-resistant, color stable and compatible with matrix binder.
- G. Sand: ASTM C 33; white.

- H. Substrate Primer: Two-component resin or other compound recommended by matrix manufacturer, to penetrate and seal substrate and provide maximum bond of terrazzo to underbed.
- I. Underbed to Cast-In-Place Concrete Slab Bonding Agent: Neat portland cement.
- J. Finishing Grout: Cementitious or resin grout with filler and pigments, as recommended by matrix manufacturer.
- K. Underlayment and Leveling Compound: Polyacrylate as recommended by terrazzo flooring manufacturer.
- L. Terrazzo Cleaner: Provide a non-ionic, neutral detergent solution, free from crystallizing salts and water-soluble alkaline salts and which is biodegradable and phosphate free.
- M. Penetrating Solvent Sealer: Polysiloxane penetrant sealer as recommended by the bonded cementitious terrazzo installer and as accepted by ENGINEER.
- N. Finish Sealer: A modified acrylic compound recommended by matrix manufacturer, which is self-polishing and slip-resistant.
- O. Acid Neutralizer: Dilute hydrochloric or phosphoric acid as acceptable to matrix manufacturer.
- P. Curing Material: Water, wet sand or polyethylene sheeting.
- Q. Water: Clean, free of oil, soluble salts and potable.

2.4 TERRAZZO ACCESSORIES

- A. Divider Strips: Provide two-piece, zinc-coated steel "T-strips" with a 14-gauge vertical leg and heavy top strip of solid White Alloy Zinc. Provide an exposed face in the floor of 1/4-inch; depth of strips sized for depth of finished terrazzo flooring and type of terrazzo flooring system specified.
- B. Accessory Strips: Match width, materials and color of floor divider strips, unless otherwise indicated. Provide the following types of accessory strips as required for a complete installation.
 - 1. One-piece base bead and 1-inch radii cove base dividers, to align with floor dividers, unless otherwise shown.
 - 2. Channels to receive abrasive inserts at stair treads and other locations shown.
 - 3. Stair nosings for treads, landings and similar exposed edges of flooring.
- C. Angle-Type Strip: Solid white alloy zinc with 1/4-inch exposed thickness; depth of strips sized for depth of finished terrazzo flooring and type of terrazzo flooring system specified.

- D. Abrasive Inserts: Composition strips, consisting of fused aluminum oxide or silicon carbide, with an amine-cured epoxy binder.
- E. Control Strips Double or Split Units: Back-to-back 16-gauge angles, of same material and color as divider strip top.
- F. Expansion Strips: T-type polyurethane filled expansion strips with white alloy zinc vertical legs; polyurethane exposed width of 1/4-inch with polyurethane full depth of strip; depth of strips sized for depth of finished terrazzo flooring and type of terrazzo flooring system specified.
- G. Strip Adhesive: Two-component resin adhesive with mineral filler as recommended by the matrix manufacturer.

2.5 MIXES

- A. Terrazzo Flooring Topping: In accordance with matrix resin manufacturer's written recommendations, as accepted by ENGINEER.

2.6 MIXING

- A. Terrazzo Flooring Topping: Charge and mix marble chips, filler and matrix resin in accordance with manufacturer's written and approved instructions.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR shall examine the substrates and conditions under which terrazzo flooring Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Fill and shot blast concrete substrate as may be required to achieve a uniformly textured level finished appearance on finished Work in compliance with allowable tolerances specified.
- B. Shot Blasting and Acid Neutralization: All areas to receive the Work of this Section shall be given a shot blast finish, to ensure maximum terrazzo flooring adhesion. After shot blasting the substrate shall be neutralized using an acid solution and water cleanup acceptable to the matrix resin manufacturer.
- C. Prior to start of applying terrazzo flooring, broom clean or vacuum surfaces to be covered and inspect the subfloor. Start of application operations will indicate

acceptance of subfloor conditions as adequate to produce acceptable terrazzo flooring system in compliance with the requirements of this Section.

- D. Apply substrate bonding agent in accordance with matrix manufacturer's written and approved instructions.

3.3 INSTALLATION

- A. Comply with NTMA guide specifications for proportioning mixes, installation of strips, and for placing, curing, grinding, grouting and finishing, except as otherwise specified herein.
- B. Provide terrazzo flooring shown or scheduled, without interruption or seams, except where divider, control joint stripes, or expansion joint strips are shown, or required.
- C. Place and finish terrazzo flooring around permanently fixed-in-place obstructions and beneath all moveable furniture and equipment such as office files, laboratory furniture, lockers and similar equipment and furniture, to achieve continuous color, pattern and finish.
- D. Install divider and accessory strips in a 3 foot-0 inches square maximum grid pattern with a 12-inch wide border along the base of all walls and as shown. Install in an adhesive setting bed, in accordance with manufacturer's instructions and without voids below strips. Provide mechanical anchorage for additional attachment of strips to substrate.
- E. Provide control joints, where shown or required, by installing angle-type divider strips back-to-back.
- F. Provide for expansion joints, where shown or required, by installing L-type divider strips back-to-back, with polyurethane filler of the width shown, but not less than 1/4-inch wide between strips.
- G. Install abrasive inserts where shown and in accordance with insert manufacturer's approved instructions.
- H. Mix, place and cure matrix and aggregates in accordance with matrix manufacturer's and NTMA approved standards. Comply with time limitations and instructions for rolling, troweling, sprinkling additional aggregates and curing installed Work.
- I. Rough grind with 24 or finer grit stones. Follow initial grind with 80 or finer grit stones. Clean terrazzo flooring with clean water and rinse.
- J. Remove excess rinse water and hand-apply grout using identical portland cement and color pigments as used in topping. Fill all voids and cure grout in compliance with matrix manufacturer's and NTMA approved instructions.

- K. Grind with not less than 120-fine grit polishing stones, until all grout is removed from surface. Clean, rinse and apply penetrant sealer. Final grind with 800-fine grit size polishing stones. Clean floor thoroughly again, before applying final sealer coats. Exercise extreme care to ensure that fluids from grinding operation do not react with divider or control strips to produce a stain on aggregate.

3.4 FIELD QUALITY CONTROL

- A. Allowable Tolerances:
 - 1. Prepared substrates shall be level with maximum variation not to exceed 1/8-inch in ten feet and shall have a finely textured surface achieved by shot blasting.
 - 2. Finished Floor Flatness: 1/8-inch in ten feet.
 - 3. Minimum Marble Chip Density: 70 percent minimum exposure upon completion of Work.

3.5 PROTECTION

- A. Protect terrazzo flooring from damage until construction operations are completed and acceptable to ENGINEER.
- B. Only the installer of terrazzo flooring shall be allowed in the installation area during the Work. No other installers or contractors shall be permitted to cross the Work area at any time during the installation of terrazzo flooring. Maintain appropriate barriers and signs alerting other trades during the times of restricted access.
- C. Terrazzo flooring shall be protected from all damage and abuse from all other contractors and installers involved in the Project until final acceptance by OWNER. All floor surfaces shall be protected from abrasion or the adherence of any foreign material by maintaining rigid covers when necessary. The wheeling of materials or placement of concentrated loads shall not be allowed on finished floors.

3.6 ADJUSTMENT AND CLEANING

- A. Thoroughly wash all surfaces with a neutral cleaner after fine grinding.
- B. Rinse with clean water and allow surface to dry thoroughly.
- C. Seal surface of terrazzo flooring with finish sealer in accordance with matrix manufacturer's and sealer manufacturer's approved instructions, after thoroughly curing and cleaning finished surface. Provide a two-coat final acrylic sealer application in strict compliance with sealer manufacturer's approved written requirements for a high gloss finish.

- D. Remove damaged material and replaced with new. Remove all material between divider strips and other natural breaks in the Work and replace with new matching material in compliance with this Section.
- E. Additional Final Cleaning: Clean terrazzo flooring and machine buff as required when building is ready for occupancy.

++ END OF SECTION ++

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SECTION 09 91 00

PAINTING

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-1 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.

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.
- 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. NOTE: PA-2 is only for large flat surfaces.
- 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. Owner will 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 893 SG	4.0 – 6.0
3rd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS	2.0 – 3.0	Carbothane 134 HG	2.0 – 3.0

2. Interior, Non-Immersion

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils	Carboline	Dry Mils
Surface Prep	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning	
1st Coat	91H20	2.5 – 3.5	Corothane I Galvapac NSF	2.5 – 3.5	Carbozinc 859	2.0 – 3.0
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 893 SG	4.0 – 6.0
3rd Coat	N69 High-Build Epoxoline	2.0 – 3.0	Macropoxy 646	2.0 – 3.0	Carboguard 893 SG	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 893 SG	
1st Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 893 SG	4.0 – 6.0
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 893 SG	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 893 SG	
1st Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 893 SG	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 893 SG	
1st Coat	N 69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0	Carboguard 893 SG	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 Tnemec-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 893 SG	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.)

		Dry		Dry		Dry
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	Tnemec	Mils	Sherwin Williams	Mils	Carboline	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 893 SG	4.0 – 6.0
2nd Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0	Carboguard 893 SG	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 (Where noted on the drawings or specified)

	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	N 66 Epoxoline	3.0 – 5.0	Macropoxy 646	3.0 – 5.0	Carboguard 60	4.0 – 6.0
2nd Coat	N 66 Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 60	4.0 – 6.0
3rd Coat	N 66 Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0	Carboguard 60	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. a. 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

5. b. 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 Tneme-Glaze	8.0 – 12.0	CorCote HCR	15.0 – 20.0	Semstone 145 SL	15.0 – 25.0

E. Wood - 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	Carboacrylic 120	1.0 – 2.0
2nd Coat	1029 Tuferyl	2.0–3.0 - 3.5	DTM Acrylic Coating	2.0 – 3.0	Carboacrylic 3359 DTM	2.0 – 3.0
3rd Coat	1029 Tuferyl	2.0 – 3.0	DTM Acrylic Coating	2.0 – 3.0	Carboacrylic 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	Carboacrylic 120	1.0 – 2.0
2nd Coat	1029 Tneme-Cryl	2.0 – 3.0	DTM Primer/Finish, B66W1	2.0 – 3.0	Carboacrylic 3359 DTM	2.0 – 3.0

G. PVC Piping – See color coding below.

I. Aluminum Windows, Doors, Handrails & Grating – Do Not Paint

J. Fiberglass Reinforced Plastic Doors & Windows, Handrails & Grating – Do Not Paint

K. FRP panels, stainless steel panels, and instruments shall not be painted.

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 (PACl)	Orange w/ green band
Ammonia	White
Carbon Slurry	Black
Caustic	Yellow w/ green band
Chlorine	Yellow
Copper Sulfate	Black w/ blue band
Corrosion Inhibitor (K-5)	Light green w/ red band
Lime Slurry	Light Green
Ferric Sulfate	Orange w/ black band
Fluoride	Light Blue w/ red band

Polymers or Coagulant Aid	Orange
Potassium Permanganate	Violet
Soda Ash	Light Green w/ orange band
Sodium Hypochlorite	Yellow w/ red band
Sulfur Dioxide	Light Green w/ yellow band
Other Chemical Lines	Yellow (stenciled as directed by CCA)
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
Electrical Conduits & Junction Boxes	Orange (stenciled as directed by CCA)

- B. All banding to be 2-inches wide and four feet on center.
- C. Sample, drain, vent, metering, blowoff, decant, hot lines and all other pumps and equipment shall be painted the same color combination as the piping system from which the line originates unless specified otherwise above. The additional pertinent text shall be applied to the pipe.
- D. Insulated pipe, jacketed with canvas, shall be painted with the color combination specified above.
- E. Insulated pipe, jacketed with aluminum and/or stainless steel shall have the jacket unpainted. When valves and fittings for such lines are not insulated, the valves and fittings shall be color coded.
- F. Building service lines such as plumbing lines, HVAC lines, and electrical conduit, shall not be color coded but shall be painted the same color as the background construction as directed CCA.

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 CCA of legends will be required. Names shall be "plainly visible" in all capital letters of approved size and type. Arrows showing direction of flow shall also be stenciled on pipes. The legends shall be applied on piping on every run and

located not more than 8 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.

- B. Text shall be applied on piping in the middle of pipe runs for runs under 50 feet or in one room, whichever is the least distance. On runs greater than 50 feet, text shall be applied at third points in the run and no more than 35 feet apart.

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.	Tunnel	
	a. Cast-in-Place Concrete.....	D
2.	Filter Building Electrical Room	
	a. Drywall Walls	G.2
	b. Doors and Frames, Interior	B.2
	c. Cast-In-Place Concrete	D
	d. Equipment & Piping	A
3.	Exhaust Fan Support Frame	
	a. Miscellaneous Steel	A.2
4.	Sedimentation Basins	
	a. Rake Arm Structures (Alternative No. 4).....	A.3

++ END OF SECTION ++

SECTION 10 14 00

SIGNAGE

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. This Section includes the following:
 - 1. Panel signs.

1.3 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
 - 1. Aluminum.
 - 2. Acrylic sheet.
 - 3. Polycarbonate sheet.
 - 4. Fiberglass sheet.
 - 5. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. One full size sign complete.

E. Sign Schedule: Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products, an employer of workers trained and approved by manufacturer.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
- C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
- D. Brass Castings: ASTM B 584, Alloy UNS No. C85200 (high-copper yellow brass).
- E. Brass, Yellow, Sheet: ASTM B 36/B 36M, Alloy UNS No. C26000.
- F. Bronze Castings: ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).
- G. Bronze Plate: ASTM B 36/B 36M.
- H. Copper Sheet: ASTM B 152/B 152M.
- I. Steel:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial or forming steel.
 - 2. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, Type B, exposed or electrolytic zinc-coated, ASTM A 591/A 591M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.

3. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, 316, stretcher-leveled standard of flatness.
 4. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi (290-MPa) minimum yield strength.
 5. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.
- J. Fiberglass Sheet: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with a minimum tensile strength of 15,000 psi (103 MPa) when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi (207 MPa) when tested according to ASTM D 790.
- K. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- L. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
1. Impact Resistance: 16 ft-lbf/in. (854 J/m) per ASTM D 256, Method A.
 2. Tensile Strength: 9000 lbf/sq. in. (62 MPa) per ASTM D 638.
 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. (2345 MPa) per ASTM D 790.
 4. Heat Deflection: 265 deg F (129 deg C) at 264 lbf/sq. in. (1.82 MPa) per ASTM D 648.
 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- M. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.

2.2 PANEL SIGNS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ACE Sign Systems, Inc.
 2. Advance Corporation; Braille-Tac Division.
 3. Allen Industries Architectural Signage
 4. Allenite Signs; Allen Marking Products, Inc.
 5. APCO Graphics, Inc.
 6. ASI-Modulex, Inc.
 7. Best Sign Systems Inc.

8. Bunting Graphics, Inc.
9. Fossil Industries, Inc.
10. Gemini Incorporated.
11. Grimco, Inc.
12. Innerface Sign Systems, Inc.
13. InPro Corporation
14. Matthews International Corporation; Bronze Division.
15. Mills Manufacturing Company.
16. Mohawk Sign Systems.
17. Nelson-Harkins Industries.
18. Seton Identification Products.
19. Signature Signs, Incorporated.
20. Supersine Company (The)
21. Equivalent by other manufacturer.

C. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:

1. Size: Minimum 8" x 8".
2. Laminated, Etched Photopolymer: Raised graphics with Braille 1/32 inch (0.8 mm) above surface with contrasting colors as selected by Architect from manufacturer's full range and laminated to acrylic back.
3. Edge Condition: Beveled.
4. Corner Condition: Square.
5. Mounting: Framed. Extruded aluminum mitred with concealed anchors and welded.
 - a. Wall mounted with concealed anchors.
 - b. Manufacturer's standard anchors for substrates encountered.
6. Color: As selected by Architect from manufacturer's full range.
7. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

D. Panel Sign Frames:

1. Extruded-Aluminum Frames: Mitered with concealed anchors and welded.
 - a. Color: As selected by Architect from manufacturer's full range.
 - b. Depth: 1/2".
 - c. Profile: Square.
 - d. Corner Condition: Square.
 - e. Mounting:
 - 1) Wall mounted with concealed anchors.
 - 2) Manufacturer's standard noncorroding anchors for substrates encountered.

E. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with

ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Photopolymer.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

F. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.

G. Panel Sign Schedule:

1. Provide signage for each room.
 - a. Sign Size: 8" x 8".
 - b. Message Panel Material: As specified.
 - c. Message Panel Finish/Color: as selected by Owner.
 - d. Background Finish/Color: As selected by Owner.
 - e. Character Size: As required by ADA.
 - f. Character Finish/Color: As selected by Owner.
 - g. Panel Sign Frame Finish/Color: As selected by Owner.
 - h. Text/Message: Room name and number.
 - i. Location: At the latch side of each door at height required by the ADA.
 - j. Provide International pictogram at restroom signs in addition to other requirements.

2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.

4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

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 work.
- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3

inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

- B. **Wall-Mounted Signs:** Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. **Two-Face Tape:** Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
 - 2. **Hook-and-Loop Tapes:** Mount signs to smooth, nonporous surfaces.
 - 3. **Magnetic Tape:** Mount signs to smooth, nonporous surfaces.
 - 4. **Silicone-Adhesive Mounting:** Attach signs to irregular, porous, or vinyl-covered surfaces.
 - 5. **Shim Plate Mounting:** Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
 - 6. **Mechanical Fasteners:** Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
 - 7. **Signs Mounted on Glass:** Provide matching opaque plate on opposite side of glass to conceal mounting materials.
- C. **Bracket-Mounted Signs:** Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.
- D. **Dimensional Characters:** Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
 - 1. **Flush Mounting:** Mount characters with backs in contact with wall surface.
 - 2. **Projected Mounting:** Mount characters at projection distance from wall surface indicated.
- E. **Cast-Metal Plaques:** Mount plaques using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.
 - 1. **Concealed Mounting:** Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.
 - 2. **Face Mounting:** Mount plaques using exposed fasteners with rosettes attached through face of plaque into wall surface.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

++ END OF SECTION ++

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SECTION 23 00 00

COMMON WORK RESULTS FOR HVAC

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. This Section includes the following:
 - 1. Dielectric fittings.
 - 2. Sleeves.
 - 3. Equipment installation requirements common to equipment sections.
 - 4. Painting and finishing.
 - 5. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- H. Product Data: For the following:
 1. Dielectric fittings.
- I. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 40 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 40 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epcos Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.

2.5 SLEEVES

- A. PVC Pipe: ASTM D 1785, Schedule 40.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 40 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. 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.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Sleeves are not required for core-drilled holes.
- K. Permanent sleeves are not required for holes formed by removable PE sleeves.
- L. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- M. Verify final equipment locations for roughing-in.
- N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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 unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.4 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

++ END OF SECTION ++

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 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 requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
 1. Comply with NEMA MG 1 unless otherwise indicated.
 2. 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. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class F.
- H. 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.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 SINGLE-PHASE MOTORS

- A. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- B. Motors 1/20 HP and Smaller: Shaded-pole type.
- C. 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 USED)

++ END OF SECTION ++

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 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. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

- B. 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 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.

2.3 EQUIPMENT SUPPORTS

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

2.4 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

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. 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.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers and other accessories.

- D. Install lateral bracing with pipe hangers and supports to prevent swaying.
- E. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 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.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- B. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- C. Use padded hangers for piping that is subject to scratching.
- D. 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).
- E. 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.
- F. 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.
- G. 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.
- H. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

+ + END OF SECTION + +

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.

- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC and NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

- B. TAB Conference: Meet with Architect on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.

- C. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

- D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect/Engineer.

- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine system pumps to ensure absence of entrained air in the suction piping.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
1. Permanent electrical-power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment and duct access doors are securely closed.
 5. Balance, smoke, and fire dampers are open.
 6. Isolating and balancing valves are open and control valves are operational.
 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23.
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.

- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 15 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.

- C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.
 - 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 - 5. Calculated kilowatt at full load.
 - 6. Fuse or circuit-breaker rating for overload protection.

- B. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - 5. Refrigerant suction pressure and temperature.

3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.

- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet.

3.10 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
 - 2. Air Outlets and Inlets: Plus or minus 5 percent.

3.11 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.

- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Filter static-pressure differential in inches wg (Pa).
 - f. Preheat-coil static-pressure differential in inches wg (Pa).
 - g. Cooling-coil static-pressure differential in inches wg (Pa).
 - h. Heating-coil static-pressure differential in inches wg (Pa).
 - i. Outdoor airflow in cfm (L/s).
 - j. Return airflow in cfm (L/s).
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch (mm) o.c.
 - f. Make and model number.
 - g. Face area in sq. ft. (sq. m).
 - h. Tube size in NPS (DN).
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm (L/s).
 - b. Average face velocity in fpm (m/s).
 - c. Air pressure drop in inches wg (Pa).
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
 - e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
 - f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
 - h. Water flow rate in gpm (L/s).
 - i. Water pressure differential in feet of head or psig (kPa).
 - j. Entering-water temperature in deg F (deg C).
 - k. Leaving-water temperature in deg F (deg C).
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig (kPa).
 - n. Refrigerant suction temperature in deg F (deg C).
 - o. Inlet steam pressure in psig (kPa).
- G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
- a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btu/h (kW).
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Air flow rate in cfm (L/s).
 - i. Face area in sq. ft. (sq. m).
 - j. Minimum face velocity in fpm (m/s).
2. Test Data (Indicated and Actual Values):
- a. Heat output in Btu/h (kW).
 - b. Air flow rate in cfm (L/s).
 - c. Air velocity in fpm (m/s).
 - d. Entering-air temperature in deg F (deg C).
 - e. Leaving-air temperature in deg F (deg C).
 - f. Voltage at each connection.

- g. Amperage for each phase.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches (mm), and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - g. Number, make, and size of belts.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Suction static pressure in inches wg (Pa).
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. (sq. m).
 - g. Indicated air flow rate in cfm (L/s).
 - h. Indicated velocity in fpm (m/s).
 - i. Actual air flow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
 - k. Barometric pressure in psig (Pa).
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:

- a. System and air-handling-unit identification.
- b. Location and zone.
- c. Room or riser served.
- d. Coil make and size.
- e. Flowmeter type.
- 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm (L/s).
 - b. Entering-water temperature in deg F (deg C).
 - c. Leaving-water temperature in deg F (deg C).
 - d. Water pressure drop in feet of head or psig (kPa).
 - e. Entering-air temperature in deg F (deg C).
 - f. Leaving-air temperature in deg F (deg C).

K. Instrument Calibration Reports:

- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.13 INSPECTIONS

A. Initial Inspection:

- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
- 2. Check the following for each system:
 - a. Measure airflow of at least 5 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

- 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
- 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
- 3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

++ END OF SECTION ++

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SECTION 23 07 19

HVAC 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 HVAC piping and duct systems:
 - 1. Condensate drain piping, indoors.
 - 2. Refrigerant suction indoors and outdoors.
 - 3. Hot water heating piping, indoors.

1.3 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 and inspecting 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.

1.4 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.

1.5 COORDINATION

- B. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- C. 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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- D. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 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 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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Super-Stik.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 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, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies 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," including 2004 Addenda.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 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, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies 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," including 2004 Addenda.
- D. ASJ Adhesive, and FSK and PVDC 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, available products that may be incorporated into the Work include, but are not limited to, 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; 85-50.
- d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

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.
 3. 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. Mix insulating cements with clean potable 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 with longitudinal seams at top and bottom of horizontal runs.
- C. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- D. Keep insulation materials dry during application and finishing.
- E. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- F. Install insulation with least number of joints practical.

- G. Apply adhesives at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- H. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
- I. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- J. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- K. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 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.

3.5 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 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.

3.2 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. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

B. 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.

C. 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.

3.6 FINISHES

A. Insulation with ASJ: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

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

3.7 INDOOR PIPING INSULATION SCHEDULE

A. Condensate Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.

B. Refrigerant Suction Piping:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

C. Hot Water Space Heating Piping:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral fiber with all service jacket: 1-1/2" thick.

3.8 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 2 inches thick.

++ END OF SECTION ++

SECTION 23 09 23.23

PRESSURE MEASUREMENT DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The CONTRACTOR shall furnish and install all primary devices, transmitters, and accessory items as shown on the Contract Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 INSTRUMENTS AND ACCESSORY EQUIPMENT

- A. Altitude and Pressure Gauges:
1. All indicating gauges are pipe mounted with male and brass threaded pipe connections. Gauges shall be 4 1/2 inch liquid filled for maximum vibration and corrosion protection. Gauges shall have phosphor bronze Bourdon tubes, white laminated phenol dials. Gauges shall have micrometer adjustment of pointers and black phenol, black cast iron, brass, or aluminum case and ring, original rotary gear design, corrosion resistant, stainless steel movement, blowout protection, and bronze socket with wrench flats. Accuracy shall be within 1/2 of 1 percent of the scale range. They shall be as manufactured by Helicoid Gage Division, "410"; James P. Marsh Corporation, "Master Gauge"; Marshalltown; Ashcroft; U.S. Gauge; or equal.
 2. All gauges shall be piped with provisions for venting pressure to allow calibration (zero) checks. Valves for gauge shutoff and zeroing shall be 1/4 turn ball valves with lever handle, corrosion-resistant.
 3. Liquid filled diaphragm seals shall be installed on all gauges as indicated in the Gauge Schedule in Section 13480 of the Specifications. Diaphragm seals shall be of the continuous duty type, 3 piece construction with 1/4 inch flushing connection, 1/4 inch fill connection, 316 stainless steel lower housing and diaphragm material 1/4 inch gauge connection and 1/2 inch lower connection. Housing bolts shall also be stainless steel. Acceptable models are Marsh 42-01, Helicoid 100H, or equal. Viton diaphragms are required on low range pressure applications (less than 15 psig). Diaphragm seals shall be "permanently" attached to gauges by installation of a lead sealed wire connecting the two. This is to prevent accidental loss of fill fluid. Fill fluid shall be factory installed silicone. All gauges shall be precalibrated, as an assembly with the seal.

B. Pressure Switches

1. Pressure switches shall piston actuated with adjustable differential. Sealed piston devices shall be provided to filter the piston assembly. Range shall be as indicated, or as required for the application. Range adjustment shall be accessible from the outside of the switch housing.
2. Housing and pistons shall be stainless steel. Diaphragms and o-ring seals shall be Viton. Retaining rings shall be Teflon.
3. Switches shall have SPDT contact outputs which shall provide one N.O. and one N.C. contact rated 10A continuous at 120VAC.
4. Switch housings shall be UL listed for NEMA 4, 4X, and 13 applications.
5. Pressure switches shall be manufactured by Square D, Allen Bradley, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

- A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as accepted by the ENGINEER during construction. Obtain in the field all information relevant to the placing of process control work, proceed as directed by the manufacturer and furnish all labor and materials necessary to complete the work in an acceptable manner.
- B. The instrumentation installation details on the Drawings indicate the designed installation for the instruments specified. Where specific installation details are not specified or shown on the Drawings, the manufacturer's recommended practice shall be followed.
- C. All work shall be executed in full accordance with codes. Should any work be performed contrary to said codes and/or regulations, the CONTRACTOR shall bear full responsibility for such violations and assume all costs arising therefrom. All equipment used in areas designated as hazardous shall be designed for the Class, Division, and Group as required on the Drawings for the locations.
- D. Unless specifically shown in the Contract Documents, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves.

- E. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors, and shut-off valves.
- F. Field instruments requiring power supplies shall be provided with local electrical shut-offs and fuses as required.
- G. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.
- H. The system supplier, acting through the CONTRACTOR, shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the ENGINEER'S acceptance. He shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation. The CONTRACTOR hereunder shall schedule and coordinate his work under this Section with that of the electrical work specified under applicable Sections of Division 26.

++END OF SECTION++

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SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
 - 1. Hot-water heating piping.
 - 2. Condensate drain piping.

1.3 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
 - 1. Hot-Water Heating Piping: 150 psig at 200 deg F.
 - 2. Condensate-Drain Piping: 150 deg F.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type M.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

2.3 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be the following:
 - 1. Schedule 40 steel pipe; Class 150, malleable-iron fittings and threaded joints.
- B. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. 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.
- D. Install piping to permit valve servicing.
- E. Install piping free of sags and bends.
- F. Install piping to allow application of insulation.
- G. Select system components with pressure rating equal to or greater than system operating pressure.
- H. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- I. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.3 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 - 2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 - 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.

3.4 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. 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 unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.5 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 3. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 4. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 4. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 5. Prepare written report of testing.
- C. Perform the following before operating the system:
 1. Open manual valves fully.
 2. Set temperature controls so all coils are calling for full flow.

++END OF SECTION++

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
 - 2. Liquid Lines: 535 psig (3689 kPa).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - 1. Thermostatic expansion valves.
 - 2. Solenoid valves.
 - 3. Filter dryers.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.8 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.9 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8.
- E. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
 - 5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 3. Operator: Rising stem and hand wheel.
 - 4. Seat: Nylon.
 - 5. End Connections: Socket, union, or flanged.
 - 6. Working Pressure Rating: 500 psig (3450 kPa).
 - 7. Maximum Operating Temperature: 275 deg F (135 deg C).

- B. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 3. Seat: Polytetrafluoroethylene.
 4. End Connections: Threaded.
 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and [24] [115] [208]-V ac coil.
 6. Working Pressure Rating: 400 psig (2760 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
 8. Manual operator.
- C. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. Suction Temperature: 40 deg F (4.4 deg C).
 6. Superheat: Adjustable.
 7. Reverse-flow option (for heat-pump applications).
 8. End Connections: Socket, flare, or threaded union.
 9. Working Pressure Rating: 700 psig (4820 kPa).
- D. Moisture/Liquid Indicators:
1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in ppm.
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
- E. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina.
 4. End Connections: Socket.
 5. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 6. Maximum Pressure Loss: 2 psig (14 kPa).
 7. Working Pressure Rating: 500 psig (3450 kPa).
 8. Maximum Operating Temperature: 240 deg F (116 deg C).

2.3 REFRIGERANTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Atofina Chemicals, Inc.
 - 2. DuPont Company; Fluorochemicals Div.
 - 3. Honeywell, Inc.; Genetron Refrigerants.
 - 4. INEOS Fluor Americas LLC.

- B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines and Liquid lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor.
- B. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- C. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.
- D. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- E. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- F. Install filter dryers in liquid line between compressor and thermostatic expansion valve.
- G. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. 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.
- C. Install piping adjacent to machines to allow service and maintenance.
- D. Install piping free of sags and bends.
- E. Install fittings for changes in direction and branch connections.
- F. Select system components with pressure rating equal to or greater than system operating pressure.
- G. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- H. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- I. Slope refrigerant piping as follows:
 - 1. Install horizontal suction lines with a uniform slope downward to compressor.
 - 2. Install traps and double risers to entrain oil in vertical runs.
 - 3. Liquid lines may be installed level.
- J. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- K. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- L. Install sleeves for piping penetrations of walls, ceilings, and floors.
- M. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
- E. Threaded Joints: Thread steel 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 unless dry-seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
 - 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 - 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).

3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 1. Comply with ASME B31.5, Chapter VI.
 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Install core in filter dryers after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- B. Adjust set-point temperature of air-conditioning to the system design temperature.
- C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 1. Open shutoff valves in condenser water circuit.
 2. Verify that compressor oil level is correct.
 3. Open compressor suction and discharge valves.

4. Open refrigerant valves except bypass valves that are used for other purposes.
 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- D. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

++ END OF SECTION ++

SECTION 23 35 23

POWER VENTILATORS

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. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.6 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.

1.7 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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

1.8 COORDINATION

- A. Coordinate size and location of structural-steel support members.

PART 2 - PRODUCTS

2.1 PROPELLER FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chicago Blower Corporation.
 - 2. Cincinnati Fan.
 - 3. Greenheck.
 - 4. Hartzell Fan Incorporated.
 - 5. Howden Buffalo Inc.
 - 6. JencoFan.
 - 7. Loren Cook Company.
 - 8. PennBarry.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Drive:
 - 1. Resiliently mounted to housing.
 - 2. Statically and dynamically balanced.
 - 3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - 4. Extend grease fitting to accessible location outside of unit.
 - 5. Service Factor Based on Fan Motor Size: 1.4.
 - 6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 of 100,000 hours.
 - 8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.

9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- E. Accessories:
1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
 2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
 3. Wall Sleeve: Galvanized steel to match fan and accessory size.
 4. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- F. Capacities and Characteristics: See schedule.

2.5 MOTORS

- A. Comply with NEMA, MG1 designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23, Section 23 05 13, Common Motor Requirements for HVAC 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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

- A. Ground equipment according to Division 26.
- B. Connect wiring according to Division 26.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.

- C. Comply with requirements in Division 40, Section 23 05 93, Testing, Adjusting, and Balancing for HVAC, for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

++ END OF SECTION ++

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SECTION 23 40 00
LOUVERS AND 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. Adjustable, extruded-aluminum louvers.
- B. Related Sections:
 - 1. Division 26 Sections for electrical power connections for motor-operated adjustable 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.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following 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.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

- B. 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.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- D. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

- C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.
- D. 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 color-finished louvers, use fasteners with heads that match color of louvers.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Mullions: Louvers shall be constructed without any vertical or horizontal mullions.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. 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.
 - 1. Frame Type: Outside flange.
- E. Include supports, anchorages, and accessories required for complete assembly.
- 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.

2.3 ADJUSTABLE, EXTRUDED-ALUMINUM LOUVERS

- A. Louver Construction and Operation: Provide adjustable louvers with extruded-aluminum frames and blades not less than 0.080-inch nominal thickness, and with operating mechanisms to suit louver sizes.
 - 1. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch.
- B. Dual-Blade, Drainable-Blade, Adjustable Louver: Fixed drainable blades and adjustable plain blades combined in single frame.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Air Balance Inc.; a Mestek company.
 - b. Air Flow Company, Inc.
 - c. Airolite Company, LLC (The).

- d. All-Lite Architectural Products.
 - e. American Warming and Ventilating, Inc.; a Mestek company.
 - f. Arrow United Industries; a division of Mestek, Inc.
 - g. Cesco Products; a division of Mestek, Inc.
 - h. Construction Specialties, Inc.
 - i. Dowco Products Group; Safe-Air of Illinois, Inc.
 - j. Greenheck Fan Corporation.
 - k. Industrial Louvers, Inc.
 - l. Louvers & Dampers, Inc.; a division of Mestek, Inc.
 - m. NCA Manufacturing, Inc.
 - n. Metal Form Manufacturing Inc.
 - o. Reliable Products, Inc.
 - p. Ruskin Company; Tomkins PLC.
 - q. United Enertech Corp.
 - r. Vent Products Company, Inc.
- 2. Louver Depth: 4 inches, overall.
 - 3. Louver Performance Ratings: See schedule on drawings.
 - 4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Adjustable Louvers: Exterior face unless otherwise indicated.
 - 2. Screening Type: Bird screening except where insect screening is indicated.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Rewirable frames with a driven spline or insert.
- D. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Aluminum, 1/2-inch- square mesh.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

- A. Two coat 50% KYNAR 500.
 - 1. Color and Gloss: Classic Bronze GF108.

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.
- 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 and vents 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. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents 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 ++

SECTION 23 81 25

SPLIT SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes packaged, air-cooled air-conditioning units with refrigerant compressors and controls intended for indoor installations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For self-contained air conditioners to include in emergency, operation, and maintenance manuals.

1.6 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. Filters: Two sets of filters for each unit.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.8 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of self-contained air conditioners that fail in materials or workmanship within specified warranty period.
1. Warranty Period:
 - a. For Compressor: Five years from date of Substantial Completion.
 - b. For Parts: One year from date of Substantial Completion.
 - c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
 2. Lennox International, Inc.
 3. McQuay International.
 4. Trane Inc.
 5. York; a Johnson Controls company.

2.2 INDOOR UNITS (6 TONS OR MORE)

- A. Evaporator-Fan Components:
1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel. Baked enamel painted finish.
 2. Insulation: Faced, glass-fiber duct liner.
 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
 4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.

5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
6. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection.
7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
8. Filters: 2 inch thick, in fiberboard frames, disposable, 30 percent.
9. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004.
 - 2) Depth: A minimum of 2 inches deep.
 - b. Single-wall, non-corroding material.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

2.3 OUTDOOR UNITS (6 TONS OR MORE)

- A. Air-Cooled, Compressor-Condenser Components:
 1. Casing: Steel, finished with standard baked enamel color, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 2. Compressors: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motors shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Dual circuited unit.
 - c. Refrigerant Charge: R-410A.

- d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240. Provide with epoxy-phenolic coating.
3. Fans: Aluminum-propeller type, directly connected to motors.
4. Motors: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to -20 deg F.
6. Mounting Base: Roof equipment rails.

2.2 ACCESSORIES

- A. Thermostat: Programmable, multi-stage low voltage with subbase to control compressor and evaporator fan.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Equipment rails to support rooftop condensing unit. Thycurb or approved equivalent.
- E. Louvered hail guard package.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.
- D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation, and inspect for refrigerant leaks.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

- B. Units will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports.

++ END OF SECTION ++

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SECTION 26 05 05

GENERAL PROVISIONS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 CONTRACTOR'S UNDERSTANDING

- A. Contractors bidding work under this Contract shall read and understand Division Zero and Division 1 - 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. Furnish, install, and connect 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 telephone boxes, outlets, etc.
 - 7. Furnish, install, and connect all power distribution equipment.
 - 8. Remove and properly dispose of all existing wiring and materials not to be reused in the renovated plant, as shown on the Contract Drawings.
 - 9. Furnish and install communications system cabling, connectors, outlets, etc.

1.3 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

- A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted in the amount of 8 copies for this Division. All Shop Drawings shall be submitted in loose-leaf three-ring

cardboard reinforced vinyl binders.

- B. Shop Drawings shall be submitted on the following materials specified in this Division:
1. Conduit - all types and sizes, including liquid-tight flexible.
 2. Boxes - all types and sizes.
 3. Coal tar epoxy paint.
 4. Wiring devices.
 5. Device plates.
 6. Supporting Devices/metal framing system (Strut type 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. Wire - all types and sizes.
 11. Light fixtures - all types.
 12. Wire markers, signs and labels.
 13. Lightning/surge suppressors.
 14. Motors.
 15. Transformers.
 16. Electrical Studies and Calculations.
 17. Secondary Grounding.
 18. Medium Voltage Equipment.
 19. Communication devices.
- 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 or Codes:

1. Kentucky Building Code	KBC
2. National Electrical Code	NEC
3. National Electrical Safety Code	NESC
4. Underwriters Laboratories, Inc.	UL
5. Factory Mutual System	FM
6. National Fire Protection Association	NFPA
7. National Electrical Manufacturers Association	NEMA
8. Occupational Safety and Health Administration	OSHA
9. Insulated Cable Engineers Association, Inc.	ICEA
10. Illuminating Engineering Society of North America	IES
11. Instrument Society of America	ISA
12. Institute of Electrical and Electronic Engineers, Inc.	IEEE
13. Certified Ballast Manufacturers Association	CBM
14. American National Standards Institute, Inc.	ANSI
15. Anti-Friction Bearing Manufacturers Association, Inc.	AFBMA
16. Joint Industry Council	JIC
17. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.	ASHRAE
18. Federal Communications Commission	FCC
19. American Society for Testing and Materials	ASTM
20. American Wood Preservers Association	AWPA
21. Rural Electrification Association	REA

1.7 INSPECTIONS AND PERMITS

- A. Inspection of the electrical system on all construction projects is required. If the local government has appointed a state licensed inspector, the Contractor shall be required to use that person to perform the inspections. If a locally mandated inspector does not exist, the Contractor shall select and hire a state licensed inspector, who has jurisdiction before any work is concealed. The Contractor shall notify the electrical inspector in writing, immediately upon notice to proceed, and a copy of the notice shall be submitted to the Engineer.
- B. At the time of completion of the project, there shall be furnished to the Owner a certificate of compliance, from the agency having jurisdiction pursuant to all electrical work performed. The Engineer shall also receive a photostatic 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 1.

1.8 STORAGE

- A. All work, equipment, and materials shall be protected against dirt, water, or other injury during the period of construction.
- B. Sensitive electrical equipment such as light fixtures, motor starters, and controls, delivered to the job site, shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed. Electrical equipment other than boxes and conduit shall not be installed until the structure is under roof with doors and windows installed.
- C. No light fixtures or device plates shall be hung or installed until after painting is completed; however, temporary lighting shall be provided by the Contractor.

1.9 MATERIALS

- A. All materials used shall be new and at least meet the minimum standards as established by the NEC and/or National Electrical Manufacturers Association (NEMA). All materials shall be UL listed for the application, where a listing exists. Additional requirements are found in Division 1. 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 shall not be permitted unless specified herein or indicated on the Contract Drawings.
- D. All salvaged or abandoned electrical materials shall become the property of the Owner. Any removed equipment which the Owner does not want 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 1.
- C. Necessary changes or revisions in electrical work to meet any code or power company requirement shall be made by the Contractor without additional charge to the Owner.

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.
- C. Where defects (and damage to other Work resulting therefrom) have been corrected or removed and replaced under this Paragraph 1.11, the guarantee with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactory completed and accepted by the Engineer/Owner.
- D. Lamps shall bear the manufacturer's warranty.

1.12 TESTING

- A. After the wiring system is complete, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for acceptance. The equipment shall be demonstrated to operate in accordance with the requirements of these Specifications and the Contract Drawings. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, as well as the necessary electrical power.
- B. Before energizing the system, the Contractor shall check all connections and set all relays and instruments for proper operation. He shall obtain all necessary clearances, approvals, and instructions from the serving utility company and/or equipment manufacturers prior to placing power on the equipment.
- C. Tests may be requested by the Engineer to determine integrity of insulation on wiring circuits selected by the Engineer at random.
- D. Cost of utilities for testing done prior to beneficial occupancy by the Owner shall be borne by the Contractor.

1.13 CLEANUP

- A. Cleanup shall be completed as soon as possible after the electrical installation is complete. All light fixtures, outlets, switches, starters, motor 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. All light fixture diffusers shall be clean and the interior of all motor controls, etc., shall be free of dust, dirt, wire strippings, etc. Surplus material, rubbish and equipment resulting from the work shall be removed from the job site by the Contractor upon completion of the work.
- B. During construction, cover all Owner equipment and furnishings subject to mechanical damage or contamination in any way.

1.14 CUTTING AND PATCHING

- A. Cutting and patching shall be held to an absolute minimum and such work shall be done only under the direction of the Engineer or Owner. The Contractor shall be responsible for and shall pay for all openings that may be required in the floors or walls, and 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 EXCAVATION AND BACKFILL

A. Excavation

1. Excavation for conduits shall be of sufficient width to allow for proper jointing, alignment and encasement of the type conduit used. Conduit shall be laid in straight lines between pull boxes and/or structures unless otherwise noted on the Contract Drawings. The cost of solid rock excavation shall be included in the lump sum bid with no extra pay allowed (unclassified).

B. Backfill

1. Backfill shall be hand placed, loose granular earth for a height of 6 inches above the top of the largest conduit. This material shall be free of rocks over 2 inches in diameter. Above this, large rocks may be included but must be mixed with sufficient earth to fill all voids.

1.16 SLEEVES, CHASES AND OPENINGS

- #### A. Sleeves shall be required at all points where exposed conduits pass through new concrete walls, slabs, or masonry walls. Sleeves that must be installed below grade, or where subject to high water conditions, must be installed watertight.

- #### B. Wiring chases shall be provided where shown on the Contract Drawings. The Contractor shall have the option of installing chases below surface mounted panelboards 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 firestopping.

1.17 POWER COMPANY COORDINATION

- #### A. The Contractor is responsible for coordinating all activities onsite by the power company.

- #### B. Any special provisions required by the serving electrical utility shall be as outlined on the Contract Drawings or as advised by the utility at the time of construction, and work required by these special provisions shall be executed with no extra cost to the Owner.

1.18 OVERCURRENT PROTECTION

- #### A. Circuit breakers or fused switches shall be the size and type as written herein and shown on the Contract Drawings. Any additional overcurrent protection required to maintain an equipment listing by an authority having jurisdiction shall be installed by the Contractor at no extra cost to the Owner.

- B. The Contractor shall submit to the Engineer actual nameplate data from motors shipped to the site, stating motor identification as well as characteristics. Overload relay thermal unit selection tables shall accompany the motor data. The Engineer will select thermal unit sizes from this data for use by the Contractor in ordering proper thermal units.

1.19 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
Medium Voltage Motor Controllers	4	4
Medium Voltage Variable Frequency Drives	4	4

- F. At least 60 days prior to the training the manufacturer shall submit through the Contractor to the Engineer an outline of the training proposed for the Engineer’s review and concurrence.
- G. The Owner reserves the right to videotape all training sessions.

1.20 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.

1.21 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. If the Contractor needs to shut down normal building power for any reason or duration, a 2 week notice shall be given to the Owner and the Owner shall approve the outage.
- B. Any scheduled power outage shall be performed between midnight and 8 AM. If additional days are required for a power outage, the additional day(s) must be scheduled a minimum of 24 hours after the prior outage. The plant shall not be shut down more than once during a 24 hour period.
- C. When additions and taps to existing service(s) require electrical outages of duration in excess of a few minutes, 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.

1.22 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.

1.23 RELATED SPECIFICATION DIVISIONS

- A. Other 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.

1.24 SERVICE ENTRANCE

- A. Conductors and terminations for service entrances shall be furnished and installed

by the Contractor. Voltage, phase, and number of wires shall be as shown on the Drawings. Clearances for overhead entrance wires shall be per the Power Company, NEC, and NESC requirements.

- B. Any details not shown on the Drawings or written in the Specifications pertaining to the service entrance shall be per power company requirements. It is the Contractor's responsibility to contact the utility prior to bidding and obtain any special requirements or costs they will be imposing. Those costs shall be included in the bid.

1.25 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.

1.26 ANCHORING/MOUNTING

- A. Electrical conduits and/or equipment shall be rigidly supported. Anchors used shall be metallic expansion type, or if appropriate to prevent spalling concrete, epoxy set type. Plastic or explosive type anchors are prohibited.
- B. The Contractor shall ensure that all supports are consistent with the KBC requirements in regard to Seismic Zoning.

1.27 ELECTRICAL COMPONENT MOUNTING HEIGHTS

- A. Unless otherwise indicated, mounting height for components shall be as defined herein. In cases of conflicts with architectural or structural aspects, the components may be relocated. If an indicated height conflicts with a code requirement, the code shall govern.
- B. Mounting heights are given from finished floor elevation to the centerline of the component, unless otherwise noted.

	Component	Height	Comments
1.	Wall type light switch	4'-0"	To top of box
2.	Low wall outlet	16"	To bottom
3.	Medium height wall outlet	4'-0"	
4.	Wall type buzzers, horns, etc.	8'-0" Max.	Top 2" below ceiling
5.	Wall type exit signs	8'-0" Max.	Top of sign 2" below ceiling
6.	Push-button or control stations	4'-0"	
7.	Top of panelboards or control panels	6'-6"	Maximum (except for

	Component	Height	Comments
			handicapped areas)
8.	Top of telephone cabinets	6'-6"	Maximum
9.	Top of switch handle on motor control center	6'-6"	Maximum
10.	Top of local motor controller	6'-0"	Maximum
11.	Top of local disconnect switch	6'-0"	Maximum
12.	Wall mount exterior light fixtures	8'-0"	Unless otherwise shown on Contract Drawings

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

1.28 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.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER 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 degree Celsius temperature rise. Building wire larger than #1 may be applied at its 75 degree Celsius temperature rise.

1.2 DELIVERY, STORAGE AND HANDLING

- A. Wire and cable shall be suitably protected from weather and damage during storage and handling and shall be in first class condition when installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Building Wire (types "THWN" and "THW"-cu.) – "Collyer," "Rome," "American," "Carol," or equal.
- B. Flexible Cords and Cables (Types "SO" (600V) "SJO" - 300V) "Collyer," "American," "Carol," or equal.
- C. Instrumentation Cables (Shielded) 600V mx. – "Eaton-Dekoron," "Manhattan," "American," "Belden," "Okonite," or equal.

2.2 MATERIALS

- A. General
 - 1. In general, all conductors shall be 98 percent conductive, annealed copper unless otherwise noted on the Contract Drawings.
 - 2. Conductors shall be type THWN insulation. Conductor size shall be AWG (American Wire Gauge) Standard. Minimum conductor size shall be AWG number 12 except branch circuits in excess of 75 feet from panel to first

outlet not smaller than no. 10 AWG. Minimum voltage rating shall be 600 volts. Conductors for small power may be solid (i.e. lighting, receptacles), but conductors for control work shall be stranded.

3. Conductors with high temperature rated insulations and special construction shall be used where required in connecting to light fixtures or appliances that have special requirements.

B. Instrument Cables

1. Refer to Part 3 of this specification section.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. General

1. Conductors shall be continuous from outlet to outlet and no splices shall be made except accessible in junction or outlet boxes. Wire connectors of insulating material or solderless pressure connectors, properly taped, shall be used for all splices in wiring, wherever possible.
2. Conductors shall be color coded in accordance with the following schedule:

	480/277V 3 Phase	208/120V 3 Phase	120/240, Single Phase
Phase A	Brown	Black	Black
Phase B	Orange	Red	Red
Phase C	Yellow	Blue	
Neutral (Grounded)	White or Light Gray	White or Light Gray	White or Light Gray
3-Way Tracers			Blue
Grounding	Green	Green	Green
Remote Energized Conductors (Control)			Orange
Control	Per NFPA 79	Per NFPA 79	

3. Conductors shall be pulled into raceways in strict accordance with manufacturer's recommendations.
4. Ample slack conductors shall be allowed at each terminal point, and pull or junction box, to permit installation with ease and without crowding.
5. All conductors terminating at terminal blocks shall be identified per Specification Section 26 05 53, Identification for Electrical Systems, 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" C.
9. In general, feeder sizes shown are based on no more than three current carrying conductors in a conduit. Multiple small branch circuit feeders may be combined in a common conduit, provided conductors are derated in accordance with NEC article 310.15.
10. Unless otherwise specifically indicated, neutrals may not be shared.

B. Low Voltage Feeders

1. All feeders are of the secondary type, below 600-volts, unless otherwise noted. The Contractor shall furnish and install all feeders from the distribution center(s) to each of the other structures/subpanels as shown on the Contract Drawings.
2. Wire shall be factory color coded for each phase and neutral, with green used for the grounding conductor. As far as practical, all feeders shall be continuous from origin to panel termination without running splices in intermediate pull boxes.
3. A grounding conductor shall be installed, sized per code, within every conduit containing voltages above 24VAC. Although the metallic conduit system shall be bonded, the metallic conduit systems shall not be the sole source of bonding.

C. Single Shielded Pair Instrument Cable

1. Tinned copper, XLPE insulated stranded conductors, No. 16 AWG minimum, twisted pair with overall shield, stranded tinned No. 18 AWG copper drain wire and overall PVC jacket. Rated for 600 volts minimum and conforming to UL 1581.
2. Manufacturers: Provide products of one of the following:
 - a. Belden Company.
 - b. Okonite Company.
 - c. Dekoron Wire and Cable Company.
 - d. Or equal.

D. Multi-paired Shielded Instrument Cable:

1. Tinned copper, XLPE insulated stranded conductors, No. 16 AWG minimum, twisted pairs with shield over each pair, stranded tinned No. 18 AWG copper drain wire, and overall PVC outer jacket. Rated for 600 volts minimum and conforming to UL 1581 or UL 13.
2. Manufacturers: Provide products of one of the following:
 - a. Belden Company.
 - b. Okonite Company.
 - c. Dekoron Wire and Cable Company.
 - d. Or equal.

++ END OF SECTION ++

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SECTION 26 05 29

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. All electric equipment shall be rigidly mounted, and installed using supporting devices as indicated on the Contract Drawings, as required by the work, and described herein.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. "Kindorf," "Unistrut," or equal.

2.2 MATERIALS

- A. All mounting brackets and strut used outside shall be aluminum. Fasteners used to mount equipment outside shall be stainless steel.
- B. All mounting brackets and strut used inside shall be galvanized or aluminum. If galvanized is used, then the cut ends shall be cold galvanized and painted. Fasteners used inside to mount equipment into concrete shall also be stainless steel. Ungalvanized strut is prohibited.

PART 3 - EXECUTION

3.1 ANCHORING CABINETS

- A. All free standing equipment shall be anchored to its foundation using expansion bolts of the size and number recommended by the equipment manufacturer.

3.2 SEISMIC CONSIDERATIONS

- A. Where indicated, seismic restraints shall be provided for electrical equipment.

++ END OF SECTION ++

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SECTION 26 05 33.13

RIGID CONDUITS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section of the Technical Specifications includes all raceways for accommodation of electrical conductors, communications conductors, sleeves for underground electrical installations, conduit stubs for future installations, fittings and accessories.
- B. All raceways shall be marked with the manufacturer's name or trademark as well as type of raceway and size. This marking shall appear at least once every 10 feet and shall be of sufficient durability to withstand the environment involved. All raceways shall be furnished and installed as outlined under Part 3 of this Specification.
- C. All raceways and fittings shall be painted to match existing or surrounding surfaces except in mechanical spaces.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Tubular Raceways
 - 1. Steel, Galvanized, Rigid, Heavy-Wall, Threaded – “Wheatland Tube Co.,” “Triangle,” “Allied Tube & Conduit Corp.,” or equal.
 - 2. Aluminum, Rigid, Heavy-Wall, Threaded – “VAW,” “Alcoa,” “Reynolds,” or equal.
 - 3. Plastic (PVC); Type A (Thin Wall); Type 40 (or Schedule 40); Type 80 (or Schedule 80) (Heavy -Wall) – “Robin-Tech,” “Carlton,” or equal.
 - 4. Flexible Metal Conduit – “AFC,” “Alflex,” or equal.
 - 5. Liquidtight Flexible Metal Conduit – “Carol Cable Co., Inc.,” “Superflex,” “OZ Gedney,” or equal.
 - 6. Factory Coated Aluminum Conduit - Alumax “ALX-1”, or equal.
- B. Wireways
 - 1. “Square-D,” “Hoffman,” or equal.
- C. Raceway Fittings
 - 1. Conduit fittings – “Crouse-Hinds,” “Appleton,” “OZ Gedney,” or equal.
 - 2. Non-metallic conduit fittings – “Robin-Tech,” “Carlton,” “Scepter,” or equal.

3. Flexible conduit fittings – “Raco,” “T & B,” “OZ Gedney,” or equal.

2.2 MATERIALS

A. Aluminum Conduit

1. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type, non-toxic, corrosion resistant, and non-staining. It shall be manufactured per UL standards as well as listed/labeled by same.
2. Fittings, boxes, and accessories used in conjunction with aluminum conduit shall be die cast, copper free type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.
3. Aluminum conduit proposed for concrete slab or underground applications shall be UL listed for the purpose and factory pre-coated.

B. Rigid Steel Conduit

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

1. PVC conduit and fittings shall be Schedule 40, 80 heavy wall, or thinwall, as indicated in these Specifications manufactured to conform to UL standards. It shall be listed and labeled by UL. It shall have at least the same temperature rating as the conductor insulation. Expansion joints shall be used as recommended by the manufacturer in published literature. PVC systems shall be 90 degrees Celsius minimum UL rated, have a tensile strength of 7,000 psi @ 73.4 degrees Fahrenheit, flexural strength of 11,000 psi and compressive strength of 8,000 psi.

D. 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.

E. Conduit Fittings

1. Rigid Steel Conduit Fittings
 - a. Standard threaded couplings, locknuts, bushings, and elbows made only of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.

- b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted or use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, installed fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.
 - f. Fittings for PVC coated rigid conduit shall be manufactured by the maker of the conduit.
2. Rigid Aluminum Conduit Fittings
- a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials. Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
 - b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
 - c. Set screw fittings: Not permitted for use with aluminum conduit.
3. Electrical Metallic Tubing Fittings
- a. Only material of steel or malleable iron is acceptable.
 - b. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2-inches and smaller. Use set screw type couplings with four set screws each for conduit sizes over 2-inches. Use set screws of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
 - c. Indent type connectors or couplings are prohibited.
 - d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of “pot metal” are prohibited.
4. Expansion and Deflection Couplings
- a. Accommodate 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - b. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL, and the NEC code tables for ground conductors.
 - c. Watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material and stainless steel jacket clamps.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Exterior underground metallic conduits shall be degreased, pretreated, and coated with 2 coats of 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. Where GRS conduit penetrates a floor slab the conduit shall be painted with 2 coats of Koppers Bitumastic 300-M or equal to a point 6 inches above the penetration.
7. The final section of conduit connecting each motor or piece of utilization equipment subject to vibration shall be of the flexible type. Type "UA" shall be used in all process areas and in outdoor or wet locations. Flexible conduit to space heaters shall be long enough to allow swivel action.
8. All underground conduits entering a building shall be sealed against water/condensate entering around the conductors. Sealant may be silicone rubber based caulk.
9. In certain situations, conduit expansion joints shall be required to ensure against conduit and/or cable damage due to settling or thermal expansion and contraction. These expansion joints shall be required where required by the manufacturer or the Contract Drawings and shall be installed per manufacturers instructions.
10. Control panels, panelboards, 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.
11. 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.
12. All conduit work in the finished space of each new structure shall be concealed except for conduits to lighting fixtures in buildings with precast roof slabs, open joist ceilings, or excepted as noted on the Contract Drawings. All conduit work below ground floor level in each structure shall be exposed. Conduits entering from underground into buildings shall be watertight through the wall, both inside and outside.
13. PVC conduit installed underground for low voltage application shall be schedule 40 encased in 4" of concrete. Transition shall be made to PVC coated GRS conduit where exiting concrete to above grade.
14. Aluminum conduit shall not be used underground, in chlorine storage/feed areas, or placed in concrete slabs.
15. 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.
16. All metal raceway systems shall be grounding conductive, solidly bonded throughout and grounded in accordance with NEC requirements and/or as noted on the Contract Drawings. In addition, all raceway systems shall be provided with separate grounding conductors.
17. Minimum conduit size shall be 3/4 inch. The following table shows the minimum burial depth required for all exterior conduit or cable:

Rigid Metal Conduit	24"
Encased Schedule 40 PVC	24"

18. 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.
19. All conduits entering and leaving instrument enclosures shall be sealed around the wires with silicone caulk.
20. Areas of use for each type of conduit:

Buildings – Interior	Schedule 40 PVC	Schedule 80 PVC	EMT	GRS	Aluminum
Process Areas (Exposed)				X	X
Non Process Areas (Exposed)				X	X

Exterior Underground	Schedule 40 PVC	Schedule 80 PVC	EMT	GRS	Aluminum
Low Voltage	X	X		X	

Exterior Exposed	Schedule 40 PVC	Schedule 80 PVC	EMT	GRS	Aluminum
Low Voltage				X	X

21. Underground raceways (conduit) shall be concrete encased where they pass over or under obstructions, such as: sidewalks; roadways; piping; etc.
22. All conduit shall have an insulated ground wire pulled to all equipment and receptacles.
23. All raceway runs are shown diagrammatically to outline the general routing of the raceway. The installation shall be made to avoid interference with pipes, ducts, structural members or other equipment. Should structural or other interference prevent the installation of the raceways, or setting of boxes, cabinets, or the electrical equipment, as indicated in the Drawings, deviations must be approved by the Owner, and after approval, shall be made without additional charges and shown on the Record Drawings.
24. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.
25. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

26. No conduit shall be run exposed across roofs without first obtaining permission from the Engineer.
27. Conduit may be run inside concrete slabs as long as the slab is at least 6-inches thick and conduit will have at least 1 2-inches of cover on both sides.
28. Flexible conduit used in mechanical rooms shall be liquid tight.
29. Runs of flexible conduit above accessible ceilings shall be limited to 10 ft. Runs of exposed flexible conduit shall be limited to 5 ft. All runs of flexible conduit shall be supported in accordance with NEC requirements.
30. Where underground conduits are to be concrete encased, Contractor shall provide #4 rebar equally space for full length of concrete encasement. Rebar shall be parallel to conduit. Provide number of rebar as indicated on project drawings.

+ + END OF SECTION + +

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SECTION 26 05 33.30

WIRE CONNECTIONS AND CONNECTING DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Wire connection and connecting devices shall be as herein specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Connectors, Lugs, etc. – “T & B”, “Anderson”, “Burndy”, or equal.
- B. Termination and splice connectors – “3M Scotchlok”, “Anderson”, “T & B”, “Burndy”, or equal.

2.2 MATERIALS

- A. Wire Splicing and Terminations (600 Volts and Below)
 - 1. Electrical Terminal and Splice Connectors (#22 - #4 AWG)
 - a. Terminals and splice connectors from #22 - #4 AWG shall be compression types with barrels to provide maximum conductor contact and tensile strength. Performance, construction, and materials shall be in conformance with UL standards for wire connectors and rated for 600 volts and 105 degrees Celsius.
 - b. Connectors shall be manufactured from high conductivity copper and entirely tin plated. Terminal barrels shall be serrated on the inside surface and have a chamfered conductor entry. Terminals shall have funnel entry construction to prevent strand fold-back. All barrels shall be brazed seam or seamless construction.
 - c. Spade type terminals shall be sized for the appropriate stud and shall be locking type that snap firmly onto studs with a close fit for maximum retention. Spade type terminals shall be insulated with an insulation suitable for maintaining a high dielectric strength when crimped and be made from nylon, PVC, or equal.
 - 2. Electrical Lugs and Connectors (#6 AWG - 1000 Kcmil)
 - a. Lugs and splice connectors from #6 AWG - 1000 Kcmil shall be compression types with barrels to provide maximum conductor contact and tensile strength. They shall be manufactured from high conductivity copper and entirely tin plated. They shall be crimped with standard industry tooling. The lugs and connectors must have a current carrying capacity equal to the conductors for which they are rated and must also meet all UL requirements. All lugs above 4/0

AWG shall be 2 hole lugs with NEMA spacing. The lugs shall be rated for operation through 35 KV. The lugs shall be of closed end construction to exclude moisture migration into the cable conductor.

3. Twist-on Wire Connectors (#22 AWG - #10 AWG)
 - a. All twist-on wire connectors must have a corrosion resistant spring that is free to expand within a steel jacket. The steel jacket must be insulated with a flexible vinyl jacket capable of withstanding 105 degrees Celsius ambient temperatures and of sufficient length to cover wires that are inadvertently overstripped.
 - b. Each connector size must be listed by UL for the intended purpose and color coded to assure that the proper size is used on the wire combinations to be spliced. The connectors must be compatible with all common rubber and thermoplastic wire insulations.
4. Solderless/re-usable lugs shall be used only when furnished with equipment such as control panels, furnished by others, where specification of compression type lugs is beyond the Contractor's control. In the event their use is necessary, the Contractor shall be responsible for assuring that they are manufactured to NEMA standards, with proper number and spacing of holes and set screws.

PART 3 - EXECUTION

3.1 INSTALLATION, APPLICATION, & ERECTION

A. Insulation of Splices and Connections

1. Connections/splices with a smooth even contour shall be insulated with a conformable 7 mil thick vinyl plastic insulating tape which can be applied under all weather conditions and is designed to perform in a continuous temperature environment up to 105 degrees Celsius. The tape shall have excellent resistance to abrasion, moisture, alkalies, acids, corrosion, and varying weather conditions (including sunlight). The tape shall be equal to Scotch 33+ and shall be applied in conformance with manufacturer's recommendations. In addition, it shall be applied in successive half-lapped layers with sufficient tension to reduce its width to 5/8 of its original width. The last inch of the wrap shall not be stretched.
2. Connections/splices with irregular shapes or sharp edges protruding shall be first wrapped with 30 mil rubber tape to smooth the contour of the joint before being insulated with 33+ insulating tape specified in the previous paragraph. The rubber tape shall be high voltage (69 KV) corona-resistant based on self-fusing ethylene propylene rubber and be capable of operation at 130 degrees Celsius under emergency conditions. The tape must be capable of being applied in either the stretched or unstretched condition without any loss in either physical or electrical properties. The tape must not split, crack, slip, or flag when exposed to various environments. The tape must be compatible with all synthetic cable insulations. The tape must have a dissipation factor of less than 5 percent at 130 degrees Celsius, be

non-vulcanizing, and have a shelf life of a least 5 years. The rubber tape shall be applied in successive, half-lapped wound layers and shall be highly elongated to eliminate voids. Other manufacturer's recommendations on installation shall be adhered to. The rubber tape shall be equal to Scotch 23 or 130C electrical splicing tape.

3. Splices made in wet or damp locations shall be made submersible and watertight with special kits made for the application and compatible with type of cables employed.

B. Connection Make-up

1. Connections of lugs to bus bars, etc., shall be made up with corrosion resistant steel bolts having non-magnetic properties with matching nuts, and shall utilize a Belleville spring washer (stainless steel) to maintain connection integrity. Connections shall be torqued to the proper limits. Prior to bolting up the connection, electrical joint compound shall be brushed on the contact faces of the electrical joint.
2. All motor lead connections shall be made up to match the type of lead furnished on the motor. If the lead is not lugged, then twist-on wire connectors may be used. To prevent possible vibration problems, twist-on connectors shall be taped after installation.
3. All lugged motor lead connections (excluding motors over 200 horsepower) shall be made up using ring tongue compression lugs with proper size stainless steel nuts and bolts. Belleville type spring shall be used to maintain tension on the connections. The connections shall then be insulated using the procedure described for irregular shapes, utilizing rubber tape in conjunction with vinyl electrical tape.
4. At the time of final inspection, the Engineer may request the Contractor to disassemble 3 randomly selected motor lead connections in the Engineer's presence, to assure conformance with these Specifications.
5. The Contractor shall include all necessary tools, materials, and labor in his bid for disassembly of the connections and for remaking them with new insulating materials after inspection.

++ END OF SECTION ++

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SECTION 26 05 33.36

OUTLET BOXES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Outlet and junction boxes shall be furnished and installed where indicated on the Contract Drawings, and/or as required by the work in accordance with the NEC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Boxes – “Queen,” “Wiegmann,” “Appleton,” “Raco,” “Bauers,” “Crouse-Hinds,” “Hoffman,” “Robroy Industries,” “Cloud Concrete Products,” “Spring City,” “Carlson,” “Sedco,” or equal.

2.2 GENERAL

- A. All junction and/or pull boxes for dry (non-corrosive) areas shall be of code gauge sheet metal construction, of the inside dimensions as required by code, with covers.
- B. Junction and/or pull boxes for wet or damp locations shall be cast metal, rust and corrosion resistant (NEMA 4X), with at least 5-1/2 full threads for each (bossed) conduit opening, and shall be suitable for flush or surface mounting as required with drilled external, cast mounting extensions (bossed to provide at least 1/8" between back of box and mounting surface for drainage). Box covers shall be hinged or cap screw retained as required, of the same material as the box and provided with stainless steel (rustproof) hardware.
- C. Junction boxes for out-of-doors use, not mounted in concrete may be sheet metal (NEMA 4X), waterproof, rustproof, rain and sleetproof, with hinged covers and latches and provided means of locking by means of keyed locks, tamper-resistant screws or padlocking as required and with clamping cap-screws top and bottom door edges to provide firm contact with gasketing. All gaskets shall be molded (unbroken) neoprene or butyl rubber.
- D. NEMA 4X junction and/or pull boxes may be stainless steel, if called for on the Contract Drawings; or non-metallic or cast aluminum.

- E. Underground junction or pull boxes shall be constructed of reinforced concrete cast-in-place or pre-fabricated as detailed on the Contract Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION, APPLICATION, AND ERECTION

A. General

1. Outlets shall be installed in the locations shown on the Contract Drawings. The Contractor shall study the general building plans in relation to the space surrounding each outlet, in order that his work may fit the other work required by these Specifications. When necessary, the Contractor shall relocate outlets so that when fixtures or other fittings are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment.
2. All supports for outlet boxes shall be furnished and installed by the electrical trades.

B. Concealed Work

1. All outlet boxes shall be standard galvanized steel type at least 12 inches deep, single or gang type of size to accommodate devices shown. Exceptions shall be noted on the Contract Drawings.
2. Standard deep type outlet boxes (concrete rings with appropriate covers) shall be used in floor slab construction so concealed conduits entering sides of boxes can clear reinforcing rods.
3. Outlet boxes for concealed telephone and signaling systems shall be the 4-inch square type, unless otherwise noted or required by the telephone company.
4. Boxes for use in masonry construction shall be 22 inches deep for 4-inch block and 32 inches deep for 6- and 8-inch block. Through wall boxes are prohibited for outlets opposite each other.

C. Exposed Work

1. Outlet or junction boxes for use with exposed steel conduit shall be cast steel. In dry areas, sheet steel with rounded corners, made for the purpose.
2. Outlet or junction boxes for use with exposed aluminum conduit shall be copper free, cast aluminum type.
3. Outlet or junction boxes for use with exposed PVC conduit shall be PVC.

D. Pull Boxes

1. Pull boxes for exterior underground work are shown on the Contract Drawings and are the minimum number required. Others may be added at the Contractor's option, but no extra pay shall be allowed. Interior pull boxes are not shown but shall be used as needed. Pull box types are as follows:
 - a. Exterior – Per detail on the Contract Drawings.

- b. Interior – Interior pull boxes in dry areas shall be of code gauge steel of not less than the minimum required by the NEC and shall be provided with hinged covers. In wet areas or pipe galleries, they shall be rated watertight, of stainless steel, cast aluminum, PVC, fiberglass, or equal. Hardware shall be stainless steel.

E. Openings in Electrical Boxes

- 1. All openings in electrical equipment, enclosures, cabinets, outlet and junction boxes shall be by means of welded bosses, standard knockouts, or shall be sawed, drilled, or punched with tools specially made for the purpose. The use of a cutting torch is prohibited. Unused openings shall be plugged per the NEC.

++ END OF SECTION ++

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SECTION 26 05 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish and install cable tray systems complete, of straight sections, fittings, and accessories as defined in the latest NEMA standards publication VE-1.
- B. The general rating of trays shall be as shown on the Contract Drawings.
- C. Cable tray provided shall be UL listed as suitable as an equipment grounding conductor.

1.2 RELATED WORK

- A. Special requirements for materials and equipment are given in Division 0 and 1.
- B. Special sequence or schedule requirements are found in the Summary of Work.

1.3 QUALIFICATIONS

- A. These materials shall be furnished by a single manufacturer who is experienced, reputable, and qualified in the manufacture of cable trays. It shall be manufactured by Square D, B-Line, or equal.

1.4 SUBMITTALS

- A. Shop drawings and other items needed to establish compliance with the Contract Drawings and these Specifications shall be submitted to the Engineer in accordance with Project General and/or special Conditions. As a minimum, submittals shall include descriptive literature, dimensions, weights, layout drawings, materials of construction, NEMA load class, rung spacing, depth, and shall include accessories/fittings.

1.5 WARRANTY

- A. These materials shall be warranted for one year concurrent with the Contractor provided warranty.

PART 2 - PRODUCTS

2.1 MATERIALS AND FINISHES

- A. Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. Fabricated parts shall be made from Alloy 5052.

2.2 TRAY TYPES

A. Ladder

- 1. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 6 inches on center. Rung spacing in radiused fittings shall be measured at the center of the tray's width. Rungs shall have a minimum cable bearing surface of 7/8" with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails.

2.3 TRAY SIZE

- A. Trays shall have an overall nominal depth of 5 inches with a minimum usable loading depth of 4 inches.
- B. Straight sections side rails shall be I-beam, C rail or Z rails. All straight sections shall be supplied in standard lengths of 12 feet.
- C. Widths shall be as shown on the Drawings.
- D. Fitting radius shall be 12. Side rails of straight sections and fittings shall be compatible so that standard splice plates can be used to join straight sections and fittings. Fittings shall have 3" tangents beyond the curved section to accommodate the standard splice plates.

2.4 SPLICE PLATES

- A. Splice plates shall be the bolted type, using either square neck or ribbed-neck carriage bolts and serrated flange lock nuts. The resistance of fixed splice connections between an adjacent section of tray shall not exceed 0.00033 ohm. The cable tray shall be designed so that a splice plate located anywhere along the span shall not decrease the strength of the cable tray system.
- B. Splice plates shall be furnished with straight sections and fittings.

2.5 ACCESSORIES

- A. Covers and other special accessories shall be furnished as required to protect, support, and install the cable tray system.

2.6 LOADING CAPACITIES

- A. Cable tray shall be installed to meet NEMA class descriptions for a safety factor of 1.5.
- B. Cable tray shall be made to manufacturing tolerances as specified by NEMA.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Cable tray and accessories shall be treated as specified in General and Special Conditions.

3.2 INSTALLATION/APPLICATION/ERECTION

- A. Installation shall comply with applicable codes and manufacturer recommendations and instructions.
- B. All trapezes, hangers, and supports shall be provided as required, by the Contractor, and materials shall be compatible and similar to the tray furnished.
- C. Finish and install necessary restraints and sway bracing to comply with KBC requirements for applicable seismic zone.

3.3 FIELD PAINTING

- A. Tray shall not be painted generally. Natural finish is acceptable.

++ END OF SECTION ++

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SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 EQUIPMENT LABELING

- A. All starters, feeder units in panelboards, switchboards, disconnects, instruments, etc. shall be marked to indicate the motor, outlet, circuit they control, or variable monitored. Marking is to be done with engraved laminated nameplates and shall bear the designation shown on the Contract Drawings where this information is given. Nameplates shall be fastened to equipment with stainless steel screws, minimum of one each side. In no way shall the installation of mounting screws void the NEMA enclosure rating of the equipment in which they are installed. If there are more than one identical unit, they shall be given consecutive numbers or other descriptions as designated by the Engineer. Nameplate background color shall be white, with black engraved letters, unless otherwise noted.
- B. Branch circuits in lighting panels shall be typed on a card suitable for the card frame furnished with the panel. The card shall bear the panel designation listed on the Contract Drawings where this information is given, as well as indicate what each circuit controls.
- C. Individual wall mounted starters, panelboards, and disconnect switch shall be labeled with vinyl self-adhesive signs that warn of "High Voltage" (state the specific voltage) and Arc Flash. Main service entrance conduits to a building, where exposed, shall be labeled with the voltage of the service they carry. Other major equipment such as 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.
- D. Furnish and install "Authorized Personnel Only" signs by doors into all power distribution equipment rooms/buildings. Furnish and install other signs as indicated on the Contract Drawings.

PART 2 - PRODUCTS

2.1 CONDUIT LABELS:

- A. Products and Manufacturers: Provide one of the following:

1. B-915-xxxxx by Brady.
 2. Or equal.
- B. Shall be pre-tensioned acrylic/vinyl construction coiled to completely encircle conduit for conduit up through five-inch diameter, or pre-molded to conform to circumference of conduit six-inch diameter and larger.
- C. Attach strap-on style for six-inch diameter conduit with stainless steel springs.
- D. Shall be blank for use with custom printed labels.
- E. Custom Labels:
1. Shall have black lettering on yellow background.
 2. Shall not contain abbreviations in legend.
 3. Shall be custom printed on continuous tape with permanent adhesive using thermal printer specified below.

2.2 WIRE IDENTIFICATION:

- A. Heat Shrinkable Wire and Cable Labeling System:
1. White heat-shrinkable irradiated polyolefin shrink-on sleeves. Labels shall be thermal printed. Labels shall be at least two inches wide.
 2. Products and Manufacturers: Provide one of the following:
 - a. B-341 PS-xxx-2W by Brady.
 - b. Or equal.
- B. Wrap-Around Wire and Cable Labeling System:
1. Self-laminating white/transparent self extinguishing vinyl strips. Length shall be sufficient to provide at least 2.5 wraps. Labels shall be thermally printed and at least two inches wide.
 2. Products and Manufacturers: Provide one of the following:
 - a. THT-XX-427 by Brady.
 - b. Or equal.

2.3 DETECTABLE UNDERGROUND WARNING TAPE:

- A. Material: Polyethylene or polyester with detectable metal core and polyester underlamine.
- B. Width: Two inches.
- C. Color and Labeling: Yellow or red with permanently imprinted black letters: "CAUTION – Buried Electric Service" or "Buried High Voltage Cable", repeated continuously over full length of tape.
- D. Products and Manufacturers: Provide one of the following:
1. Indentoline by Brady.

2. Or equal.

2.4 THERMAL PRINTING SYSTEM:

- A. Utilize thermal transfer process to provide non-smearing labels and markers.
- B. Wire and Cable Markers:
 1. Portable, Products and Manufacturers: Provide one of the following:
 - a. TLS2200 by Brady.
 - b. Or equal.
 2. Desktop, Products and Manufacturers: Provide one of the following:
 - a. 200M by Brady.
 - b. Or equal.
- C. Cable Markers:
 1. Portable, Products and Manufacturers: Provide one of the following:
 - a. Handimark by Brady.
 - b. Or equal.
 2. Desktop, Products and Manufacturers: Provide one of the following:
 - a. Labelizer PLUS by Brady.
 - b. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide electrical identification in accordance with manufacturer recommendations and as required for proper identification of equipment and materials.
- B. Engraved Identification Devices (Nameplates and Legend Plates):
 1. Unless otherwise specified, attach permanent nameplates with permanent adhesive and with 3/16-inch diameter, round head, stainless steel machine screws into drilled and tapped holes.
 2. Provide nameplate with 1.5-inch letters to identify each console, cabinet, panel, or enclosure as shown or indicated.
 3. Provide nameplates for field-mounted motor starters, disconnect switches, manual starter switches, pushbutton stations, and similar equipment operating components, which shall describe motor or equipment function and circuit number.
 4. Provide nameplates with 1/2-inch letters to identify each junction and terminal box shown or indicated.
 5. On switchgear, provide nameplates for each main and feeder circuit including control fuses, and for each indicating light and instrument.
 - a. Provide nameplate with 1.5-inch letters giving switchgear designation, voltage rating, ampere rating, short circuit rating, manufacturer's

- name, general order number, and item number.
- b. Identify individual door for each compartment with nameplate giving item designation and circuit number.
- 6. Motor Control Centers:
 - a. Provide nameplate with 1.5-inch letters with motor control center designation.
 - b. Identify individual door for each unit compartment with nameplate identifying controlled equipment.
- 7. Except conduit, all electrical appurtenances including lighting panels, convenience outlets, fixtures, and lighting switches, shall be provided with nameplates indicating appropriate circuit breaker number(s).
- 8. Push Buttons:
 - a. Provide legend plates for identification of functions.
 - b. Provide nameplates for identification of controlled equipment.
 - c. Provide red buttons for stop function.
 - d. Provide black buttons for other functions.
- 9. Pilot Lights:
 - a. Provide legend plates for identification of functions.
 - b. Provide nameplates for identification of controlled equipment.
 - c. Shall have lens colors as shown or indicated. Where no color is indicated, provide the following lens colors:

Color	Legend
Green	Running, Open
Red	Stopped, Closed
Amber	Alarm
Blue	Power
White	Status

- 10. Selector Switches:
 - a. Provide legend plates for identification of functions.
 - b. Provide nameplates for identification of controlled equipment.
- 11. Panel Mounted Instruments:
 - a. Provide nameplates for identification of function.
- 12. Interiors of Cabinets, Consoles, Panels, Terminal Boxes, and Other Enclosures:
 - a. Provide nameplates for identification.
 - b. Provide each item inside cabinet, console, panel, terminal box, or enclosure with laminated plastic nameplate as shown on approved Shop Drawings and submittals. Install nameplates with adhesive.
 - c. Interior items requiring nameplates include:
 - 1) Terminal blocks and strips.
 - 2) Bus bars.
 - 3) Relays.
 - 4) Rear of face-mounted items.
 - 5) Rear of door-mounted items.

- 6) Interior mounted items that require identification when mounted externally.
 - d. Circuit Breaker Directory:
 - 1) Provide engraved laminated plastic directory listing function and load controlled for each circuit breaker within panel used for power distribution.
 13. Re-label existing equipment whose designation have changed.
- C. Safety Signs and Voltage Markers:
1. Provide safety signs and voltage markers on and around electrical equipment as shown or indicated.
 - a. Install rigid safety signs using stainless steel fasteners.
 - b. Clean surfaces before applying pressure-sensitive signs and markers.
 2. Install high voltage safety signs on all equipment doors providing access to uninsulated conductors, including terminal devices, greater than 600 volts.
 3. Provide cable tray safety signs on both sides of cable trays at maximum intervals of 20 feet. Install signs on side rails of tray as acceptable to ENGINEER.
 - a. Label cable trays that contain conductors greater than 600 volts with high voltage safety signs.
 - b. Cable trays that contain conductors greater than 208 volts and less than 600 volts shall be labeled with low voltage safety signs.
 - c. Cable trays that contain conductors of 120/208 volts shall be labeled with low voltage markers.
 - d. Do not label cable trays that contain only instrument signal cables.
 - e. Label cable trays that contain intrinsically safe wiring or cables in accordance with NEC Article 504.
 4. Install low voltage safety signs on equipment doors that provide access to uninsulated 480-volt conductors, including terminal devices.
 5. Install low voltage markers on each terminal box, safety disconnect switch, and panelboard installed, modified, or relocated as part of the Work and containing 120/208 volt conductors.
- D. Voltage System Identification Directories
1. Provide voltage system identification directories as required by NEC Article 210 and NEC Article 215.
 2. Provide in each electrical room voltage system identification directory mounted on wall or door at each entrance to room.
 3. For panelboards, switchboards, motor control centers, and other branch circuit or feeder distribution equipment that are not located in electrical rooms, provide voltage system identification directory mounted on equipment.
 - a. Directories shall be affixed using epoxy glue. Screws or bolts shall not penetrate equipment enclosures.
 - b. Directories shall be readily visible and not obscure labels and other markings on equipment.

- E. Arc-flash Safety Signs:
1. Provide arc-flash safety signs as required by NEC Article 110.
 2. Provide signs for switchboards, panelboards, motor control centers, and industrial control panels. Provide signs for control panels that contain 480 volt equipment.
- F. Conduit Labels:
1. Provide conduits with conduit labels unless otherwise shown or indicated.
 2. Do not label flexible conduit.
 3. Do not label exposed single conduit runs of less than 25 feet between local disconnect switches and their associated equipment.
 4. Conduit labels shall indicate the following information:
 - a. Contract Number: Alphanumeric, three or four digits, as applicable.
 - b. Conduit Number: Alphanumeric as shown on the Drawings, as assigned by CONTRACTOR for unlabelled conduits, and in accordance with approved submittals.
 5. Conduits that contain intrinsically safe wiring shall have an additional pipe marker provided that has blue letters on white background and reads, "INTRINSICALLY SAFE WIRING".
 - a. Install intrinsically safe pipe markers in accordance with NEC Article 504 along entire installation. Spacing between labels shall not exceed 25 feet.
 6. Provide conduit labels at the following locations:
 - a. Where each conduit enters and exits walls, ceilings, floors, or slabs.
 - b. Where conduit enters or exits boxes, cabinets, consoles, panels, or enclosures, except pull boxes and conduit bodies used for pull boxes.
 - c. At maximum intervals of 50 feet along length of conduit.
 7. Orient conduit labels to be readable.
- G. Wire and Cable Identification:
1. Color-coding of insulated conductors shall comply with Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.
 2. Use heat-shrinkable wire labels where wire or cable is terminated. Use wrap-around labels where wire or cable is to be labeled but is not terminated.
 3. Do not provide labels for the following:
 - a. Bare (uninsulated) conductors, unless otherwise shown or indicated as labeled.
 4. Provide wire and cable labels for the following:
 - a. New, rerouted, or revised wire or cable.
 - b. Insulated conductors.
 - c. Wire and cable terminations:
 - 1) Wire labels shall be applied between 1/2-inch and one inch of completed termination
 - 2) Apply cable labels between 1/2-inch and one inch of cable breakout into individual conductors.
 - a) Label individual conductors in a cable after breakout as

- specified for wires.
- d. Wire or cable exiting cabinets, consoles, panels, terminal boxes, and enclosures.
 - 1) Label wires or cables within two inches of entrance to conduit.
 - e. Wire or cable in junction boxes and pull boxes
 - 1) Label wires or cables within two inches of entrance to conduit.
 - f. Wire and cable installed in cable tray.
 - 1) Wire and cable shall have labels at maximum intervals of 20 feet.
 - g. Wire and cable installed without termination in electrical manholes.
 - 1) Wire and cable shall have wrap-around labels applied within one foot of exiting manhole.
5. Wire and Cable Identification System:
- a. Wire and cable labels shall be imprinted with an identifying designator.
 - 1) Wire and cable extending between two devices or items and that does not undergo a change of function shall be identified by a single unique designator as specified below.
 - b. Field Wiring:
 - 1) Wire or cable designator shall consist of:
 - a) Three left-most characters shall consist of the Contract number under which wiring or cable was installed.
 - b) Fourth character from the left shall be an asterisk (*), a plus sign (+) or a hyphen (-). Do not use other punctuation symbols in a wire designator.
 - c) Remaining characters shall be alphanumeric and make wire designator unique.
 - d) Numbering shall reflect actual designations used in the Work and shall be documented in record documents.
 - c. Cabinet, Console, Panel, and Enclosure Wiring, Internal:
 - 1) New Cabinets, Consoles, Panels, and Enclosures:
 - a) Wire and cable inside cabinets, consoles, panels, and enclosures shall have designators as specified in Section 40 61 13, Process Control System General Provisions.
6. Modified Cabinets, Consoles, Panels, and Enclosures:
- a. New or rerouted wire or cable in existing cabinets, consoles, panels, and enclosures shall be labeled as shown on the Drawings or be assigned a ten-character designator equivalent to field wire designator.

H. Terminal Strip Labeling:

- 1. Label panel side of terminal to match panel wire number.
- 2. Label field side of terminal to match field wire number. Terminal number shall not include the Contract number.

I. Generator System Warning Signs:

- 1. Provide warning signs for generator systems as required by NEC.
- 2. Install generator location warning sign on or immediately adjacent to service equipment, or to “normal” source disconnecting means when generator is

located out of sight of service equipment or disconnecting means.

3. Install generator grounding warning sign on enclosure or immediately adjacent to point where generator neutral is connected to grounding electrode system if connection is made remote from generator.

J. Detectable Underground Warning Tape:

1. Warning Tape shall be placed in trenches with backfill about 12 inches below finished grade on all medium voltage underground conduit runs and others as indicated on the Contract Drawings.

++ END OF SECTION ++

SECTION 26 05 73

ELECTRICAL POWER DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

- A. The electrical equipment manufacturer shall provide electrical power system studies as specified herein for the entire power system for the project, including existing equipment. The type and content of each study is specified in the following articles.

1.2 SUBMITTALS

- A. Study Report
 1. The results of the power system study shall be summarized in a final report. Five bound copies of the final report shall be submitted for review.
 2. The report shall include the following sections:
 - a. Description, purpose, basis and scope of the study and a single line diagram of that portion of the power system which is included within the scope of the study.
 - b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
 - c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse settings, fuse selection, and commentary regarding same.
 - d. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The specified electrical power system studies shall be performed by the manufacturer of the power distribution and control equipment furnished for the project.

2.2 ELECTRICAL POWER SYSTEM STUDIES

- A. Short-Circuit Analysis
 1. Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the electrical system shall be made using a digital computer.

2. Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the computer calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
3. A tabular computer printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.
4. The study shall include a computer printout of input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
5. Include a computer printout identifying the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
6. The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.
7. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
8. The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the short-circuit analysis to be completed prior to final installation.
9. The interrupting capacity of all over current devices shall equal or exceed the maximum fault current level where they are installed in the system. The system shall be fully rated in that the ability of the device to interrupt a fault at its terminals and shall not depend on the characteristics of an over current device upstream. Series rated devices shall not be acceptable.
10. Any inadequacies shall be called to the attention of the Engineer and recommendations made for improvements as soon as they are identified.

B. Protective Device Time-Current Coordination Analysis

1. The time-current coordination analysis shall be performed with the aid of computer software intended for this purpose, and will include the determination of settings, ratings, or types for the overcurrent protective devices supplied.
2. Where necessary, an appropriate compromise shall be made between system protection and service continuity with service continuity considered more important than system protection.
3. A sufficient number of computer generated log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the

- time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
4. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
 5. The study shall include a separate, tabular computer printout containing the suggested device settings of all adjustable overcurrent protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.
 6. A computer generated system one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
 7. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
 8. Significant deficiencies in protection and/or coordination shall be called to the attention of the Engineer and recommendations made for improvements as soon as they are identified.
 9. The Contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the time-current analysis to be completed prior to final installation.
 10. The Contractor shall be responsible for obtaining ratings of existing overcurrent devices to remain throughout the power system, to include in the coordination study.

C. Arc-Flash Hazard Analysis

1. The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and [API] flash protection boundary distances.
2. The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.
3. Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
4. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
5. The Arc-Flash Hazard Analysis shall be performed by a registered professional engineer.

6. The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE Standard 1584-2002, the IEEE Guide for Performing Arc-Flash Calculations.
7. The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.
8. The proposed vendor shall demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least ten actual Arc-Flash Hazard Analyses it has performed in the past year.
9. The proposed vendor shall demonstrate capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
10. The proposed vendor shall demonstrate experience in providing equipment labels in compliance with NEC-2008 Section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

PART 3 – EXECUTION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative of electrical distribution equipment being set and adjusted to assist in the setting of overcurrent protective devices within equipment.
- B. Overcurrent devices are to be visually inspected to verify that settings determined from the final Over Current Protection Coordination Devices Study have been programmed and/or set.
- C. Labels shall be applied to all enclosures, with appropriate site specific Arc Flash warnings, PPE requirements, and boundaries. Boundaries shall be painted on the floor in front of all new switchgear, switchboards, panelboards and MCC's.
- D. Upon completion of field setting, provide an updated submittal on all studies updating the changes/revisions.

++ END OF SECTION ++

SECTION 26 22 14

MEDIUM VOLTAGE POWER DISTRIBUTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The power distribution cabling system shall be installed in accordance with NEC and NESC requirements, and as written herein and as shown on Contract Drawings. For further information on components/installation not addressed in this article, refer to other sections of this Division, and the Contract Drawings.
- B. Ends of conduits shall be sealed where they enter buildings at service equipment and empty (spare) conduits shall be capped at both ends. Spare conduits shall extend 5 feet from buildings or structures unless otherwise shown on the Contract Drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Conduit
 - 1. Underground nonmetallic conduit shall be George-Ingraham, Ciba-Geigy, or equal. Other types of conduit for transitions to building interiors, etc., shall be as specified in 16130 - Raceways.
- B. Duct Spacers and Terminators
 - 1. Duct spacers and terminators shall be Formex, or equal.
- C. Medium Voltage Insulated Power Cables
 - 1. Medium voltage insulated power cables shall be Okonite, Anaconda, or equal.
- D. Prefabricated Splice Kits and Terminations
 - 1. Prefabricated stress cones, shield grounding adapters, splice kits, and terminations shall be as manufactured Elastimold, 3M, Cooper, G&W, or equal.

2.2 MATERIALS

- A. Conduit
 - 1. Underground duct lines for medium voltage shall be fiberglass duct or PVC, concrete encased.

B. Duct Spacers and Terminators

1. Spacers shall be made from high density polyethylene, and shall be double wall construction. They shall consist of interlocking modules, i.e. bases, intermediates and caps. Base pads shall be used to assure specified dimensions between trench floor and bottom of first tier of ducts. The interlocking modules shall include an internal vertical channel on both side edges of the spacers. The interlocking module spacers shall provide independent support for each duct, and 3 inch separation between ducts.
2. Terminator modules shall be made from high impact, high strength, prime virgin acrylonitrile butadiene styrene (ABS) plastic, Marbon Type G.S., or equal. Terminator module shall interlock and be sealed together using a recommended plastic solvent cement. The openings of the terminator facing the inside of the manhole shall be belled.

C. Medium Voltage Insulated Power Cables

1. 5 KV cables shall have the following specifications:

Conductor:	Uncoated copper, stranded
Cable	Single conductor
Arrangement:	
Strand Screen:	Extruded, semi-conducting
Insulation:	5 KV cable 115 mils EPR
Insulation Screen:	Extruded, semi-conducting
Shield:	Uncoated copper tape, helically wrapped, 12.5% overlap
Jacket:	PVC
Temperature	105EC continuous
Rating:	140EC emergency 250EC short circuit

D. Prefabricated Splice Kits and Terminations

1. Molded Rubber Shielded Cable Splice
 - a. The shielded cable splices must be capable of normal continuous operation at the rated voltage and current on the cable on which it is to be used (up to 35 KV). The splice must consist of an all-molded rubber splice body with black semi-conductive EPR rubber. All EPR rubber must be cured with a peroxide cure. All splices must be able to be installed without the use of mechanical advantage installation tools. Where required, shield adapters must be capable of quickly extending the cable shielding for outdoor, indoor, and buried applications.
2. Molded Rubber Cable Termination
 - a. The shielded cable termination must be capable of normal continuous operation at the rated voltage and current on the cable it is to be used on (up to 35 KV); and it should meet all the requirements of a Class 1 Termination as given in IEEE Standards. The termination must

consist of a high quality rubber molded stress cone made of track resistant peroxide cured EPR rubber and a one-piece silicone rubber skirted insulator for 15 KV (two-piece silicone skirted insulator for 25 and 35 KV). A mechanical (non-solder) ground strap assembly shall be included as a part of the kit. All materials (except lug) necessary to make three terminations shall be included as part of the basic 5 to 15 KV kit. This should include cable preparation materials. Additional materials may be necessary in order to convert the basic 5 to 15 KV kit into a 25 or 35 KV termination; however, the instructions packed with the kit should include all of the information as to what is needed for 25 and 35 KV.

3. Shield Grounding Adapter
 - a. The shield ground adapter must be capable of use at the rated voltage of the cable it is used on, and shall be totally mechanical, requiring no soldering or taping. It shall be watertight. The housing shall be molded conductive rubber. The ground lead shall be copper. Contact with the cable shield shall be by compression of a corrugated internal contact. Compression shall be accomplished by external stainless steel clamp(s).
4. Loadbreak and Deadbreak Elbow Connectors and Accessories
 - a. Insulated high voltage cable shall be terminated using deadfront elbows at padmount transformers. 200 Ampere elbows shall be loadbreak and 600 ampere elbows shall be deadbreak. Voltage class shall be 15 KV. The insulating elbows shall be molded of EPDM rubber with integral stress cones. The 200 ampere devices shall accept No. 6 - No. 4/0 conductors and the 600 ampere devices shall accept No. 2/0 - 1000 MCM conductors. Both type connectors shall be watertight and shall include all accessories needed for connection to conductor. Other characteristics:

Impulse Voltage:	95 KV BIL
Withstand Voltage:	34 KV, 60 Hz., 1 Minute
Minimum Corona Extinction Level:	11 KV
Momentary:	10,000 amps RMS
	Symmetrical

- b. Cable shield grounding adapters shall be furnished and installed as needed. Necessary bushing shall be furnished and installed in switches and transformers for proper mating with the elbow connectors. Feed through bushings shall be used at transformers so that deadfront arresters may be connected to the unused feed through bushing.
- c. The deadfront arrester shall be gapless, of solid state design using a metal oxide varistor enclosed in a molded elbow similar to the elbow connector housing.

- d. Furnish insulated protective caps where needed to maintain the deadfront, watertight arrangement where a bushing is unused.

E. Surge Arrestors

Surge arrestors shall comply with IEC 60099-4, and shall be provided for protection of cabling, switchgear, motor control centers, transformers and other indicated equipment. Arrestors shall be distribution class, rated as shown. Arrestors shall be equipped with mounting brackets suitable for the indicated installations. Arrestors shall be of the metal-oxide varistor type with silicone housing suitable for indoor or outdoor installations.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. Duct

1. General

- a. The duct system shall consist of single or multiple round-bore conduit for the electrical-distribution system. The number and size of the ducts shall be as indicated on the Contract Drawings. Duct lines shall be laid to a minimum grade of 4 inches per 100 feet. Duct shall be laid so that the top of the duct is 24 inches below finished grade or finished paving. Changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet, except that manufactured bends may be used at the ends of the run. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with ducts of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger. Conduits shall terminate in end bells where duct lines enter manholes. Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduit shall be plugged to prevent water washing mud into the conduits or manholes. Particular care shall be taken to keep the conduits clean of concrete, dirt, and any other substance during the course of construction.
- b. Where it is necessary to cut a tapered end on a piece of conduit at the site, the cut shall be made with a tool or lathe designed to cut a taper to match the taper of the particular conduit being used. After the duct line has been completed, a standard flexible mandrel not less than 12 inches long, having a diameter approximately 1/4 inch less than the inside diameter of the conduit, shall be pulled through each conduit, after which a brush with stiff bristles shall be pulled through each conduit to make certain that no particles of earth, sand, or gravel have

been left in the line. Pneumatic rodding may be used to draw in the lead wire. Where connection is made to an existing duct that is of different material and shape than the duct line being installed, a suitable coupling of a type recommended by the duct manufacturer shall be used. Conduits shall be stored to avoid warping or deterioration. Plastic conduit shall be stored on a flat surface and protected from the direct rays of the sun. Conduit joints in concrete encasement may be placed side by side horizontally but shall be staggered at least 6 inches vertically.

- c. Each single conduit of the duct bank shall be completely encased in concrete. The thickness of the concrete encasement indicated is the minimum thickness, and may be increased to fit the actual shape of the trench. Duct spacers shall be used, placed on 4 feet centers. When the duct bank is assembled, a No. 3 reinforcing rod shall be passed through the internal vertical channels on one side of the spacer bank and driven into the trench floor. At the next spacer location, the No. 3 rod shall be inserted on the opposite side, etc. The reinforcing rods shall be bent inwardly at the top of the spacer bank sufficiently to squeeze the spacer cap so the duct assembly will not float or move in any direction during the concrete pour. Concrete encasement shall not be less than 3 inches on the side, bottom, and top of the conduits.

2. Couplings

- a. Joints in conduit shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling used. The plastic or fiberglass conduit joints shall be made up by brushing a plastic solvent cement or epoxy (as applicable) on the inside of the coupling and on the outside of the conduit ends. The conduit and fitting shall then be slipped together, until seated, with a slight twist to set the joint tightly, and the conduit then rotated 2 turn to distribute the cement evenly. Excess cement build up on the inside surface of the conduit shall then be removed.

B. Medium Voltage Insulated Power Cable Systems

1. The power cable systems shall consist of ethylene-propylene rubber insulated PVC jacketed conductors. The size and number of conductors shall be as indicated on the Contract Drawings. Conductors shall be stranded. Cables for use on 2,400 and 4,160 volt power systems shall be rated 5,000 volts and cables for use on 12,470 volt power systems shall be rated 15,000 volts. Cables shall be insulated to the 133 percent level. The neutral conductors of grounded neutral systems shall consist of stranded 600 volt polyethylene jacketed cables suitable for direct burial or duct shown on the Contract Drawings. Power cables shall be installed in duct lines as specified this section.
2. It is intended that cables be continuous as much as is practical without unnecessary splices. Cable splices, however, shall be made in manholes or junction boxes if necessary, and shall be installed at no extra cost to the

Owner. Cable splices and terminations shall be made up in accordance with cable manufacturer recommendations, by persons qualified to make such splices/terminations. Qualification shall consist of proof that the person(s) working on splices and terminations has at least 3 years experience with the type cables and connectors encountered on this project.

3. Cable pulling shall be accomplished using industry recognized pulling equipment and techniques, and shall be done in accordance with cable manufacturer's recommendations. All cable shields shall be grounded at both ends.

D. Prefabricated Splice Kits and Terminations

1. Splices and terminations shall be of a type appropriate for the cable type and for the environment encountered, either indoor or outdoor. All kits shall include premolded stress cones and all necessary materials needed for proper installation. The Contractor shall furnish necessary lugs, etc. for mechanical hookup from cables to equipment.
2. All terminations and splices shall be installed in accordance with manufacturer recommendations and shall be complete with all necessary accessories for an operational system. All terminations and splices shall be made prior to cable Hipot testing. All lightning arresters shall be properly grounded. All terminations in outdoor cabinets shall be treated as outdoor and terminated accordingly.

3.2 FIELD QUALITY CONTROL

- A. A DC Hipot test shall be conducted on all cables before hookup and after pulling, when the cables are fitted with all terminating and splicing kits. Testing shall be in accordance with IEEE and manufacturer recommendations with test voltage for each cable as advised by the manufacturer. All cable shields shall be grounded during testing and ends of cables under test adequately insulated from grounded equipment and other equipment not under test. Submit a written report of test results to the Engineer on all cables.
- B. Prior to Hipot testing, the Contractor shall utilize a high voltage megger to detect gross insulation system failure. The Hipot test on a very low quality insulated cable is destructive, and screening the cables first with the megger may prevent the Contractor replacing an otherwise salvageable cable.
- C. Hipot testing shall also be performed on existing cables which have been disturbed during the course of this work.

++ END OF SECTION ++

SECTION 26 24 19

MEDIUM VOLTAGE MOTOR CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes

1. This specification covers the design, manufacture, test, supply and delivery of medium voltage control centers, specifically, including reduced voltage solid state controllers.

1.2 QUALIFICATIONS

A. Manufacturer

1. The manufacturer shall have a minimum of 10 years experience in the manufacture of medium voltage controllers for use in similar applications at the specified voltage and power ratings.
2. These specifications are based on products manufactured by Allen Bradley. Other acceptable manufacturers are Benschaw and Eaton.

B. Support

1. The manufacturer shall maintain factory trained and authorized service facilities within 100 miles of the project and shall have a demonstrated record of service for at least the previous ten years.
2. Support personnel are to be direct employees of the manufacturer.
3. The manufacturer shall provide all required start-up and training services.

C. Quality Assurance

1. The control center shall be factory pre-wired, assembled and tested as a complete package by the controller supplier.
2. All inspection and testing procedures shall be developed and controlled under the guidelines of the Supplier's quality system. This system must be registered to ISO 9001 and regularly reviewed and audited by a third party registrar.
3. All incoming material shall be inspected and/or tested for conformance to quality assurance specifications.
4. All sub-assemblies shall be inspected and/or tested for conformance to Supplier's engineering and quality assurance specifications.
5. All printed circuit boards with active components shall be burned-in for a minimum of 48 hours at 60°C (140°F).

1.3 REFERENCES

- A. Controller
 - 1. American National Standards Institute (ANSI) "Instrument Transformers C57.13"
 - 2. Institute of Electrical & Electronic Engineers (IEEE) (IEEE C37.20.7, Guide for Testing Arc Resistant Medium Voltage Switchgear)
 - 3. Electrical & Electronic Manufacturers Assoc. of Canada (EEMAC)
 - 4. National Electrical Manufacturers Association (NEMA) "Medium Voltage Controllers Rated 1501 to 7200V AC ICS 3-2 (formerly ICS 2-324)"
 - 5. Underwriters Laboratories, Inc. (UL) (High Voltage Industrial Control Equipment 347)
 - 6. European Directives for Safety and EMC
 - 7. National Electrical Code (NEC)
 - 8. Occupational Safety & Health Act (OSHA)

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Confirm to specified service conditions during and after installation of products
- B. Maintain area free of dirt and dust during and after installation of products

1.5 PRE-MANUFACTURE SUBMITTALS

- A. Refer to Section Division 1 for submittal procedures
- B. Drawings
 - 1. Elevation drawings showing dimensional information
 - 2. Structure Descriptions showing
 - a. Enclosure ratings
 - b. Fuse ratings
 - c. Load/line cable size and entry/exit direction
 - d. Other information as required for approval
 - 3. Conduit locations
 - 4. Unit Descriptions including amperage ratings, frame sizes, pilot devices, etc.
 - 5. Nameplate Information
 - 6. Schematic wiring diagrams
- C. Product Data
 - 1. Publications related to the controller(s)
 - 2. Data Sheets and Publications on all major components such as the following
 - a. Contactors
 - b. Circuit Breaker and Fuse information including time current characteristics

- c. Control Power Transformers
- d. Pilot devices
- e. Relays
- f. Operator Interface

D. Spares

- 1. Recommend spare parts list and list prices shall be supplied.
- 2. Critical Spares - Spare parts that are identified as being associated with long lead times and/or are critical to the unit's operation.
- 3. Maintenance Spares - Spare parts that are identified as being required to regularly perform scheduled maintenance on their equipment. These spares include, but are not limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.

E. Specification Response

- 1. Detailed response to this specification showing where in the literature and drawings each requirement is satisfied.
- 2. All clarifications and exceptions must be clearly identified.

F. Testing and Test Reports

- 1. Testing shall be per manufacturer's standard.
- 2. A copy of the test reports shall be provided as part of the Closeout documentation, if requested.

1.6 CLOSEOUT SUBMITTALS

- A. Refer to Section Division 1 for procedure on submittal of closeout documentation.
- B. Contractor shall provide certification that the controller has been installed in accordance with the manufacturer's instructions.
- C. The Contractor shall provide certification that the Contractor has properly adjusted any timing devices required in the starting circuitry.
- D. Final Drawings. The manufacturer shall provide final drawings reflecting the "As-Shipped" status of the controller. The Contractor shall be responsible for making any changes to the "As-Shipped" drawings from the manufacturer to reflect any field modifications.
- E. Maintenance Data
 - 1. Controller installation instructions and User Manual
 - 2. Installation / Operation instructions for major components such as circuit breakers, contactors, isolation transformers, etc.
 - 3. Field Service report from start-up service
 - 4. Spare parts listing and pricing
 - 5. Include name and phone number for a local distributor of spare parts.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall coordinate the shipping of equipment with the manufacturer.
- B. Contractor shall store the equipment in a clean and dry space according to manufacturer's specification.
- C. The contractor shall protect the units from dirt, water, construction debris and traffic.

1.8 FIELD MEASUREMENTS

- A. The Contractor shall verify all field measurements prior to the fabrication of the controller(s).

1.9 SPARE MATERIALS

- A. Fuses
 - 1. Provide a minimum of one set (3) of each type of medium voltage fuse supplied with the controller for each set of five installed.
 - 2. Provide a minimum of one set of each type of low voltage fuse supplied with the controller for each set of five installed.
- B. Contactors
 - 1. Provide one set of 3 contactor vacuum bottles for each size of medium voltage vacuum contactor supplied with the controller.
 - 2. Provide one spare vacuum contactor control module (IntelliVAC).
- C. Isolation Switch
 - 1. Provide one spare isolation switch blade assembly for each amp rating installed.
 - 2. Provide one spare isolation switch auxiliary contact for each set of five installed.
 - 3. Provide one spare isolating switch cam follower for each type installed.
 - 4. Provide one spare isolating switch stationary stab for each amp rating installed.
- D. Provide one spare motor protection relay for each type supplied with the controller.
- E. Provide one spare overload relay supplied with the controller.
- F. Provide one spare control relay for each type of relay supplied with the controller.

- G. Provide one spare MOV assembly of each type supplied with the controller.
- H. Furnish all cables required for connection to the controllers with a laptop, and all software necessary for configuration and programming.

1.10 WARRANTY

- A. The manufacturer shall provide their standard parts warranty for a minimum of one year from the date of project Substantial Completion.
- B. The manufacturer shall confirm this warranty as part of the submittal.

PART 2 – PRODUCTS

2.1 RATINGS

- A. Voltage
 1. The controller shall accept nominal plant power of 2400V at 60Hz.
 2. The supply input voltage tolerance shall be plus or minus 10 percent of nominal line voltage.
 3. The supply frequency tolerance shall be plus or minus 3 percent.
- B. Environmental Ratings
 1. Storage ambient temperature range: -20 C to 75 C (-4 to 149 degrees F).
 2. Operating ambient temperature range: 0 C to 40 C (32 to 104 degrees F) without derating.
 3. The relative humidity range is 0% to 95% non-condensing.
 4. Operating elevation: up to 1,000 Meters (3,300ft) without derating.

2.2 STRUCTURE

- A. The structure shall consist of a metal enclosed free-standing dead-front vertical steel assembly.
- B. The structure shall also have a non-removable base channel and removable lifting means for ease of installation.
- C. The controller(s) shall be designed for front access to allow for installation with no rear access. Equipment that requires rear or side access for installation shall not be accepted.
- D. Enclosure
 1. Controller enclosures shall be NEMA Type 1A, with door gaskets

2. The enclosure shall be properly sized to dissipate the heat generated by the controller at its full ratings within the limits of the specified environmental operating conditions.
 3. LV door latches shall be heavy-duty ¼-turn type units.
 4. Medium Voltage doors shall be held closed using 3/8" bolts.
 5. All back plates shall be removable.
- E. Low Voltage Wireway
1. A low voltage wireway, shall be available across the roof at the front of the structure.
 2. The low voltage wireway shall provide a convenient method of interconnecting control wire from one controller to another.
 3. Low voltage wireway shall be separated from MV and LV control compartments.
- F. Structure Finish
1. All exterior metal parts (except for low voltage panel and power cell back plates) shall be painted with hybrid epoxy powder paint ANSI 49 medium light gray.
 2. All mounting plates in the power cell and low voltage compartments shall be painted high gloss white for enhanced visibility.
 3. Painting shall be done on a continuous paint line through air-atomized electrostatic spray. All parts shall be painted before assembly.
 4. The preparation shall be Alkaline wash/rinse; iron phosphate rinse; iron-chrome sealer rinse; re-circulated de-ionized water rinse and virgin de-ionized water rinse
 5. Total paint thickness – 0.002" (0.051 mm) minimum
 6. Baking process shall be by Natural gas oven at 179°C (355°F) minimum.
 7. All unpainted steel parts shall be plated with a zinc plate/bronze chromate process for corrosion resistance.
- G. Nameplates
1. Provide master nameplate for controller.
 2. Provide unit nameplates.
 3. Provide legend plates for all pilot devices.
 4. Nameplates plates shall be engraved phenolic (1.125 inches x 3.625 inches) with black background and white lettering.
- H. Seismic Qualifications
1. The equipment shall be bolted down (mounted) per the Manufacturer's recommended installation instructions.
 2. The properly installed equipment shall be capable of withstanding horizontal and vertical accelerations in accordance with KBC requirements, without overturning or lateral movement.

2.3 POWER AND GROUND BUS

A. Bus Bracing

1. The horizontal/vertical buswork and the cabling/bus in the main power cell(s) shall be braced and tested in accordance with NEMA ICS 3-2 and UL 347.
2. The bus work and cabling shall be braced to withstand the let-through energy allowed by the largest fuse during a short circuit fault.
3. The horizontal bus fault withstand current rating shall be 60 kA RMS symmetrical for 10 cycles.
4. The vertical bus fault withstand current rating shall be 50 kA RMS symmetrical for one half cycle.

B. Horizontal Bus

1. The main horizontal power bus shall be located in the center, at the back of the structure, to provide optimum heat distribution, ease of maintenance and splicing.
2. To provide better short-circuit withstandability and to protect against the accumulation of dust and tracking between phases, the power bus shall be mounted on edge to a molded bus support insulator in a common vertical plane.
3. The power bus shall be made of tin-plated copper and shall have a continuous current rating of 2000A. The main power bus will be non-insulated.
4. Access plates shall be provided to the bus compartment from the front or the rear of the structure to allow for installation and regular maintenance of the power and ground bus splice connections.
5. The horizontal buswork, the cabling/bus from the main power cell shall be braced and tested in accordance with NEMA ICS 3-2 and UL 347 (paragraph 30).

C. Vertical Bus

1. Provide vertical power bus risers from the main horizontal power bus to the isolating switch line terminals.
2. The vertical risers shall be tin-plated copper.
3. Cabling from the main horizontal power bus to the isolating switch is not acceptable.

D. Ground Bus

1. A continuous copper ground bus shall be provided along the entire length of the controller line-up.
2. A mechanical lug for #8 to #1/0 AWG or #6 to 250 MCM cable shall be supplied at the incoming end of the line-up.
3. The ground bus shall be 1/4" x 2" (6.4 x 51 mm), bare [tin-plated] copper.

2.4 MAIN UNIT

- A. The withstand rating of the main shall be greater than or equal to the bus bracing for the controllers.
- B. The main breaker shall be compact design which will fit in the space identified.
- C. The main breaker shall be a three position draw out type with disconnect, test, and connect positions and spring loaded primary disconnects and breaker control switch.
- D. The breaker shall be rated for up to 20,000 operations.
- E. The assembly shall be furnished with a drawout tray, levering-in crank, and lifting yoke.
- F. LED indicating lights shall be provided for indicating breaker position.
- G. Provide lugs to accommodate the line conductors as indicated on the drawings.
- H. Provide metal oxide station type surge arrestors.

2.5 FEEDER DISCONNECT

- A. Provide feeder disconnects with overcurrent protection as indicated on the drawings.
- B. The disconnect shall be a fused load break switch.
- C. A quantity of (3) current limiting power fuses shall provide the overcurrent protection.
- D. Units shall be provided in two high construction for units rated 400 Amps and below.
- E. The feeder disconnect unit shall consist of three isolated compartments.
 - 1. Power Bus Compartment
 - 2. Power Cell
 - 3. Low Voltage Panel
 - 4. The functional compartment specifications shall follow the motor specification where applicable.
- F. Provide (3) load cable terminals

2.6 SMC UNIT DESIGN

- A. The controller shall be manufactured by a single vendor. The medium voltage,

solid-state controller shall be mounted in the MCC lineup as described herein..

- B. The controller shall be of modular design to provide for ease and speed of maintenance. The modules are to be manufactured by one supplier, designed to allow ease of maintenance, including removal of medium voltage components and power electronic components.
- C. The structure shall be divided into isolated compartments as follows:
 - 1. Main power bus and ground bus compartment
 - 2. Power cell compartment
 - 3. Low voltage compartment
- D. Metal or glass polyester barriers shall be provided between the low voltage compartment and the power cell and/or main power bus compartment, and between the power cell and main power bus compartment. Personnel shall have access to the low voltage compartment, with the controller energized, without being exposed to any medium voltage.
- E. Vacuum Contactor Specifications (Input And Bypass)
 - 1. The electrically held medium voltage contactor shall be the Allen-Bradley model 1502 vacuum type or equivalent
 - 2. The following current ratings shall be available:
 - a. 400 A
 - b. 800 A
 - 3. The contactor shall have visual contact wear indicators. No special tools are required for checking contact wear.
 - 4. Vacuum bottle and coil maintenance shall be performed on the contactor while it is mounted. Removal of contactor is not required.
- F. Isolation Vacuum Contactor
 - 1. The vacuum input contactor shall be fixed mounted inside the power cell. Fixed mounting provides solid, continuous contact, lowering maintenance requirements considerably. The contactor shall be interlocked with the non-load-break isolating switch, both electrically and mechanically, which shall provide the following safety features:
 - a. Prevent the isolating switch from being opened or closed when the contactor is in the closed position.
 - b. Prevent the opening of the medium voltage door when the isolating switch is in the closed position.
 - c. Prevent the closing of the isolating switch when the medium voltage door of the controller is open.
 - d. Remove control power from the control power transformer (CPT), power transformers (PTs) or external power source to the control circuit when the isolating switch and contactor are in the open position.

G. Bypass Vacuum Contactor

1. A contactor shall be provided to bypass the SCRs once the motor is up to full speed. When a stop option is selected, the bypass contactor will open, bringing the SCRs back into the power circuit. It shall be fixed mounted in the main power cell.
2. The bypass contactor shall be capable of providing a full voltage start in case of emergency bypass.

H. Control Wire Specification

1. The control wire shall be an insulated (with a flame retarding thermoplastic compound), flexible stranded, tinned copper wire supported and neatly bundled. Red wire shall indicate AC power, blue wire shall indicate DC power and green wire shall indicate ground. Other colors or combinations may be used for specific applications. The control wire shall be isolated from high voltage components in the power cell (whenever possible), and wire tube markers which are numbered according to the electrical diagram, shall be provided at each end of the wire.
2. All of the control wire terminations shall be a screw-type, copper-compression-type terminal block or connector which firmly grips the conductor. Non-insulated, locking-type, fork tongue lugs shall be provided on the control wire terminating on the control power transformer(s) and current transformers.

I. LOW VOLTAGE CONTROL PANEL

1. Each controller shall have a separate, front accessible, low voltage control compartment. The compartment shall be completely isolated, using metal barriers between the low voltage compartment and the power cell and/or main power bus compartments for utmost safety. Optional meters, motor protection relays, selector switches, operators, indicating lights, etc., shall be mounted on the front of the low voltage control panel, and arranged in a logical and symmetrical manner. The low voltage panel shall provide the following features:
 - a. Space shall be provided for low voltage control devices, transducers and metering.
 - b. There shall be necessary terminal blocks supplied. Extra terminal blocks can be supplied as an option.
 - c. There shall be low voltage control panel access without turning the controller "OFF" when opening the low voltage control panel door.
 - d. All remote low voltage cables shall be able to enter from the top or bottom of the structure. Access to the wireways shall be by means of removable entry plates on the top and bottom of the structure.
 - e. As standard, the combination controllers shall incorporate a swing-out low voltage panel which provides easier access to the power cell to make bus splicing and load cable connections. All products shall have a swing-out low voltage panel, which is interlocked with the power cell compartment (the panel shall not have the ability to swing open

until the power cell is “OFF” and isolated from the main power bus) to allow easy access to medium voltage equipment, i.e. power stacks, power bus, power factor correction capacitor, or other similar equipment.

- f. Pilot control relays shall be used to operate and economize the vacuum contactor.
- g. The control panel supply voltage shall be 120 V AC, 50/60 Hz. It shall be rectified to provide a DC operating voltage for the vacuum contactor coils and economizing relay.
- h. There shall be a two-pole, three-conductor (with a grounding prong) male plug to provide a means for connecting a two-pole, three-conductor receptacle from a remote 120 V AC, 50/60 Hz supply to operate the control circuit when it is in the TEST position (combination controllers only).
- i. The low voltage control panel door shall have a viewing window, allowing the user to monitor the MV SMC-Flex controller operation via the built-in display.

J. INTERLOCKING

1. Mechanical interlocking, including cable interlocks, horizontal and vertical ram interlocks, shall be provided to prevent the opening of any power cell door or medium voltage compartment until the non-load-break isolating switch is fully in the open position and power is removed (the external operating handle must be in the OFF position).
2. Optional key interlocks configured to operate with the operating handle or power cell door shall be available when interlocking is required with another specified device, i.e. main breaker, load-break switch, starter, etc.

K. POWER FUSES AND FUSE HOLDERS

1. R-rated current limiting power fuses shall be provided. R-rated fuses shall be used for the short circuit protection of medium voltage motors and motor controllers.
2. The medium voltage product shall have fixed power fuse holders that are separately mounted in the power cell, not on the contactor, and be located to allow easy inspection and replacement without any disassembly. The power fuses shall have a spring actuated blown fuse indicator. The power fuse size shall be selected when motor data and the protective device characteristics are known.

L. CONTROL POWER TRANSFORMER

1. The control power shall be 110/120 V AC, and shall be obtained from a control power transformer (CPT) located in each controller power cell, or from a separate control source. The dry-type CPT shall be sized as required for the control system load, plus 350 VA extra capacity for the customer’s use when the standard control circuit is supplied and shall have primary and

secondary fuses.

2. The secondary circuit of the transformer(s) shall be disconnected from the control circuit by means of the isolating switch auxiliary contacts. This is to prevent backfeeding through the transformer(s) and to isolate the power cell when the control circuit is in the TEST mode.
3. The standard control power transformers used in the controller shall be a compensated type with an output accuracy of approximately 4% over nominal at no load. They shall be designed to maintain voltage at in-rushes of up to 600%, which results in a 2% overvoltage at full load.

M. PRIMARY FUSES

1. The primary side of the control power transformers and/or potential transformers shall be protected by current limiting fuses sized according to requirements. The interrupting rating of the primary fuses shall be 50 kA symmetrical.

N. SECONDARY FUSES

1. The secondary side of the control power transformer and/or potential transformers shall be fused appropriately to protect the transformer(s) from overloads. The standard control circuit shall have one leg of the secondary grounded.

O. CURRENT TRANSFORMERS

1. The medium voltage power cell shall include three (3) current transformers of sufficient VA capacity to meet the requirements of all the devices connected to them.
2. Each current transformer shall have the primary rating sized appropriately in relation to the full load current rating of the motor or feeder. The secondary of the current transformers shall have a five (5) amp output and an accuracy suitable for the type and quantity of protection or metering devices connected to it. All current transformer control wiring shall be terminated on the current transformer with locking type, fork tongue lugs.
3. An appropriate load termination location shall be provided to accommodate lugs with single or two-hole mounting, for connection of the load cables, when either bar or donut type current transformers are supplied.
4. The power cell shall have provisions to locate a toroid (donut) style, ground fault sensing current transformer, when the zero sequence ground fault protection feature is required (Combination Controller only).

P. CONTROL MODULE • LOGIC DESIGN FEATURES

1. Mechanical
 - a. The control module shall be designed for mounting within the low voltage panel (for safety reasons) and shall be compatible with the full range of current and voltage ratings.
 - b. The control module shall consist of a power supply, logic control

circuitry, silicon controlled rectifier (SCR) firing circuitry, I/O circuitry, a digital programming keypad, a backlit LCD display, and a serial communication port.

2. Programming and Display
 - a. Digital parameter adjustment shall be provided through a standard built-in keypad. Analog potentiometer adjustments are not acceptable. A built-in backlit LCD display shall be provided for controller set-up, diagnostics, status, and monitoring. The display shall be three-line, 16-characters minimum.
 - b. The display shall be capable of depicting alphanumeric characters in any of the following languages, by adjustment of a single parameter:
 - 1) English
 - 2) French
 - 3) Spanish
 - 4) German
 - 5) Portuguese
 - 6) Mandarin
3. Communications
 - a. A serial communications port DPI (Drive Programming Interface), shall be provided as standard. Optional communications protocol interface modules shall be available for connection to Remote I/O, DeviceNet™, ControlNet™, Ethernet, RS-485, and Profibus-DP.
4. Electrical
 - a. The control module shall provide closed-loop digital microprocessor control and supervision of all controller operations, including SCR pulse firing control. The control module shall be the same as used for the SMC-Flex low voltage product family.
5. SMC-Flex Control Modes
 - a. The control module shall offer the following functions:
 - 1) Soft Start -with Selectable Kickstart
 - 2) Soft Stop
 - 3) Current Limit Start -with Selectable Kickstart
 - 4) Dual Ramp -with Selectable Kickstart
 - 5) Full Voltage
 - 6) Preset Slow Speed
 - b. Pump Control
 - 1) The Pump Control option shall be implemented to provide closed loop control of a motor to match the specific torque requirements of centrifugal pumps for both starting and stopping. This shall aid in eliminating the phenomena commonly referred to as "water hammer". Methods utilizing Soft Start and Soft Stop shall not be acceptable.
 - 2) Closed loop control shall be achieved without using external sensors or feedback devices.
 - 3) The Pump Start time shall be user adjustable from 0 to 30 seconds.

- 4) Pump Stop shall be initiated by a dedicated Pump Stop input. A coast-to-rest stop shall still be possible with a separate stop input.
 - 5) The Pump Stop time shall be user adjustable from 0 to 30 seconds.
 - 6) Extended Pump Start or Stop times may be made available, upon consultation with qualified factory personnel.
 - 7) Kick-start shall provide an adjustable time pulse of current prior to the normal start mode. The current shall be controlled to provide 0-90 % of locked rotor torque for a time between 0.0 and 2.0 seconds. This feature shall be field selectable.
6. SMC-Flex Monitoring
- a. The controller shall provide the following monitoring functions indicated though the built-in LCD display; or remotely via the communication port:
 - 1) Phase-to-phase supply voltage
 - 2) Three-phase line current
 - 3) Three-phase power (MW, MWh, power factor)
 - 4) Elapsed time
 - 5) Motor thermal capacity usage
 - 6) Motor speed (with optional use of tachometer input)
7. SMC-Flex Protection and Diagnostics
- a. The following protection and diagnostics shall be provided as standard with the controller:
 - 1) Power loss (with phase indication; pre-start)
 - 2) Line fault (with phase indication; pre-start) advising: –Shorted SCR
 - 3) Missing load connection
 - 4) Line fault (running protection) advising: –Power loss –Shorted SCR
 - 5) Voltage unbalance *
 - 6) Phase reversal *
 - 7) Undervoltage *
 - 8) Overvoltage *
 - 9) Stall *
 - 10) Jam *
 - 11) Overload *
 - 12) Underload *
 - 13) Excessive starts/hour *
 - 14) Open gate (with phase indication)
 - 15) Overtemperature (power stack, with phase indication)
 - 16) Communication loss
 - 17) Motor temperature (via PTC input)

* These protective features shall be selectable.
 - b. Overload Protection shall include:
 - 1) The control module shall meet applicable standards as a motor overload protective device
 - 2) Three-phase current sensing shall be utilized; the use of two current transformers shall be unacceptable.
 - 3) Overload trip classes of 10, 15, 20 and 30 shall be provided and

- user-programmable.
- 4) Electronic thermal memory shall be provided for enhanced motor protection
- 5) Protection shall be available through the controller while in bypass configuration
- 6) Separate overload relay shall be provided for emergency bypass operation

Q. SCR POWER CIRCUIT DESIGN

1. The SCRs shall be protected from voltage transients with an R-C snubber network to prevent false SCR firing.
2. The SCRs shall be protected from overvoltage with voltage threshold gating circuitry.
3. The SCR firing circuitry shall be fully isolated from the control circuits. Fiber optic cables shall be used for isolation from the logic circuits.
4. Current loop gate driver boards shall be utilized to increase efficiency of the controller, reducing power consumption and heat.

2.9 UNIT MODIFICATIONS

A. Motor Run Time Meter

1. Provide a digital, non-resettable, door-mounted elapsed time meter.
2. The meter shall have six digits with tenths.
3. The meter shall be electrically interlocked with the contactor to indicate actual motor operating hours.

B. Low Voltage Surge Suppressors

1. Provide low voltage surge suppressors across each 120 V coil in the control circuit.

C. Metering

1. Main Switch or Incoming Section
 - a. Provide a digital metering system.
 - b. The metering system shall consist of a monitoring unit and display module. The unit shall be shipped with the necessary current transformers and potential transformers.
 - c. Monitoring Unit
 - 1) The monitoring unit shall be Multilin PQM, or equal.
 - 2) The monitor shall have the following metering capability
 - a) Phase current (A-B-C) with plus or minus 0.2 percent accuracy
 - b) Average three phase current and neutral current with plus or minus 0.2 percent accuracy
 - c) Phase to phase and phase to neutral voltages with plus or minus 0.2 percent accuracy
 - d) Current and voltage unbalance

- e) Power functions kW, kVA and kVAR with plus or minus 0.4 percent accuracy
 - f) Demand functions kW and kVA with plus or minus 0.4 percent accuracy
 - g) Energy functions kWh and kVAh with plus or minus 0.4 percent accuracy
 - h) Power factor with plus or minus 0.4 percent accuracy
 - i) Frequency with plus or minus 0.05 percent accuracy
 - j) Distortion analysis with THD, Crest Factor (I, V) and Distortion Power Factor.
 - k) Maximum metering update rate of 50ms.
- 3) The monitor shall have a control relay output.
 - 4) The monitor shall be ANSI/IEEE tested to meet or exceed the Surge Withstand Capability (SWC) C37.90.1 – 1989 for protective relays and relay systems on all power connection circuit terminations.
- d. Display Module
 - 1) The display module shall have a highly visible LED display.
 - 2) The display shall be five inches square and designed to fit into a circular cut-out that is four inches in diameter.
 - 3) The display shall be utilized for viewing data and for programming of the monitoring unit.
 - e. Potential Transformers
 - a) A common set of two (2) PT's shall provide voltage reference for one MCC line-up.
- 2. Controllers
 - a. Provide switchboard type (4 ½ inch) metering.
 - b. Provide analog ammeter with ammeter switch.
 - c. Provide analog voltmeter with voltmeter switch.
 - d. Provide (3) current transformers.
 - e. Provide (2) potential transformers with primary and secondary fusing.
 - 3. Feeder Units
 - a. Provide switchboard type (4 ½ inch) metering.
 - b. Provide analog ammeter with ammeter switch.
 - c. Provide analog voltmeter with voltmeter switch.
 - d. Provide (3) current transformers.
 - e. Provide (1) potential transformer with primary and secondary fusing.

D. Pilot Devices

- 1. Pilot devices shall be Allen-Bradley Bulletin 800H (NEMA Type 4/4X/13) and shall be mounted on the enclosure door.
- 2. For motor starter provide pilot lights, mounted on the enclosure door, for indication of ON, OFF and OVERLOAD. Pilot lights shall be transformer type.

E. Terminal Blocks

1. Provide ten additional unwired terminal blocks in each unit.
 2. Allen-Bradley type 1492 or equal.
- F. Auxiliary Relays
1. Provide auxiliary control relays as indicated on the drawings.
 2. The relays shall be Allen-Bradley 700P or 700CF relays or equal.
- G. Power Factor Correction Capacitors
1. Power factor correction capacitors shall be provided for each controller in the MCC, sized to correct the power factor to 0.95%.
 2. Contactors shall be provided ahead of the capacitors, and interlocked with the shorting contactor, to prevent energizing until the controller has completed the ramping sequence and the shorting contactor is closed.
 3. The capacitors shall be furnished with fusing and overload protection.
 4. Provide cooling fans as required.

2.10 MOTOR PROTECTIVE RELAY

- A. The motor management relay shall provide primary protection and management to medium voltage motors. The relay shall be equipped with the following protection functions.
1. Motor Thermal Overload Model (49)
 - a. Include 15 standard overload curves, a custom curve feature, and a curve specifically designed for the starting of high inertia loads, when the acceleration time exceeds the safe stall time.
 - b. The stator protective thermal model shall combine inputs from phase and unbalance currents, and RTD winding feedback. This will then cause the model to become dynamic in nature in order to follow the loading and temperature of the motor.
 - c. Motor cooling time constants
 - d. Rotor protection during stall and acceleration. To achieve this a speed switch input shall be available.
 2. The relay shall detect ground faults or earth leakage currents as low as 0.25 A using a 50:0.025 Ground CT.
 3. Use phase and unbalance current heating to calculate motor thermal capacity during starting and running states
 4. Settable motor stopped and motor running cooling time constants
 5. Phase and residual overcurrent elements (50P/50G)
 6. Unbalance / single phase biasing (46)
 7. Load-loss (undercurrent) (37)
 8. Mechanical jam (48)
 9. Motor stall protection
 10. Re-start blocking timer to be used as a start permissive to ensure the motor had slowed to a safe speed or to a complete stop, before it can be re-started again

11. Antibackspin protection ensuring that the motor can only be re-started when it has slowed to within acceptable limits. A backspin detection voltage input shall be provided to measure frequency. If the measured frequency is below a programmed minimum threshold, the backspin start inhibit shall be removed
12. Starts-per-hour (66)
13. Minimum-time-between-starts
14. The relay shall provide an option for voltage transformer inputs, which shall be used to provide overvoltage (59), undervoltage (27), voltage phase reversal (47), overfrequency (81O) and underfrequency (81U) functions
15. The relay shall be equipped with an Undervoltage Auto-restart function that will restart the motor after an undervoltage trip caused by a momentary loss of power.
16. 12 RTD inputs with associated over-temperature protection functions including alarm and trip settings, with corresponding settable time delays, and associated outputs. The following additional functionality shall be provided, associated to RTDs:
 - a. Able to configure each of the twelve RTDs as “None” or any one of four application types: “Stator”, “Bearing”, “Ambient”, or “Other”
 - b. RTD type shall be selectable between four different RTD types: “100 Ohm Platinum”, “120 Ohm Nickel”, “100 Ohm Nickel”, or “10 Ohm Copper”
 - c. The motor relay shall incorporate the RTD inputs to support the following:
 - 1) Thermal overload model biasing
 - 2) Temperature alarms and trips (49/38)
 - 3) RTD open- or short-circuit alarm
 - d. The motor relay shall include trip voting for extra reliability in the event of RTD malfunction. If enabled, a second RTD must also exceed the trip temperature of the RTD being checked before a trip is issued
 - e. Provisions shall be included to allow the RTDs to be identified by name
17. The relay shall be able to monitor up to four remote RTD modules, each with 12 RTD inputs, with associated over-temperature protection functions including alarm and trip settings, settable time delays, and associated outputs. Additional functionality shall be identical to that provided by the on board RTDs as describer above.
18. Protection functions associated to Power, which include alarm and trip settings, with corresponding settable time delays, and associated outputs:
 - a. Power Factor (55)
 - b. Reactive Power
 - c. Under Power (37)
 - d. Reverse Power

- B. The relay shall operate with either wye-connected (four wire) or open-delta-connected (three wire) potential transformers, and three phase, four wire connected current transformers.
- C. The relay shall include provisions to allow its use in conjunction with variable frequency drives. All of the elements shall function properly with the exceptions of voltage and power elements.
- D. The motor protection relay shall have five (5) output relays, and six (6) digital inputs. The output relays shall be as follows: Trip Relay, Alarm Relay, two auxiliary relays, and a service relay. Five of the six digital inputs shall have the following pre-assigned default functions:
 - 1. Access Switch to allow changing of any setpoint values from the face plate,
 - 2. Differential Switch to accept inputs from an external differential protection relay
 - 3. Emergency Restart to allow a hot motor to be restarted
 - 4. External Reset, to allow resetting trips or latched alarms
 - 5. Speed Switch to accept a trip signal from a speed monitoring device
- E. Although assigned default functions, these five inputs, along with the one remaining spare input, can be user programmable to alternate functions. The function that the input is used for may be chosen from the following list of functions: Starter Status configured for either an 'a' or 'b' auxiliary contact, Waveform Capture, Digital Counter, DeviceNet Control, and General Switch functions in which an alarm and/or trip may then be configured for that input. The relay shall be able to monitor the digital inputs of up to four remote RTD modules.
- F. The relay shall allow motor starting and stopping via any of the communication ports. When a Stop command is sent the TRIP relay shall be activated for 1 second to complete stop sequence. When a Start command is issued, an output relay shall be assigned for starting control, which shall be activated for 1 second to complete the start sequence. The Serial Communication Control function shall also be used to reset the relay and activate a waveform capture.
- G. The relay shall be capable of protecting the motor during the entire starting process in Reduce Voltage starting applications.
- H. The relay shall provide complete monitoring and metering functions. These shall include:
 - 1. Current: Phasors, RMS Values of per Phase, Average, Motor Load, Current Unbalance, Unbalance Biased Motor Load, Ground, Differential Currents
 - 2. Voltage: Phasors, RMS Values of Phase-Phase and Phase-Neutral, Average Voltage

3. Frequency
 4. Temperature of each RTD Inputs
 5. Motor Speed (RPM)
 6. Power: Power Factor, Three phase Real (kw, hp), Reactive (kvar), Apparent (kva) Power
 7. Energy: Watt-hours, Var-hours
 8. Demand: Rolling Demand method, time interval, programmed to 5 to 90 min in steps of 1 minute
 9. An event recorder with a record of the last 512 events, time tagged with a resolution of 10 ms.
 10. The waveform capture feature is similar to a transient/fault recorder. The relay shall storage of up to 16 cycles of data, captured for Phase A, B, and C currents (Ia, Ib, and Ic), Ground currents (Ig), Phase A-N, B-N, and C-N voltages (Van, Vbn, and Vcn) for wye connections, Phase A-B and B-C (Vab and Vbc) for open-delta connections
 11. The relay shall be able to provide data in the form of trending or data logger, sampling and recording up to eight actual values at an interval defined by the user. Several parameters shall be trended and graphed at sampling periods ranging from 1 second up to 1 hour. The parameters which can be trended by the Setup software shall be: Phase Currents A, B, and C, and Average Phase Current, Motor Load, Current Unbalance, Ground Current, System Frequency, Voltages Vab, Vbc, Vca Van, Vbn & Vcn, Power Factor, Real (kW or hp) Reactive (kvar), and Apparent (kVA) Power, Positive Watt-hours, Positive and Negative Var-hours, Hottest Stator RTD, Thermal Capacity Used, RTDs 1 through 12 temperature, Remote RTDs 1 through 12.
 12. The relay shall include four transducer outputs with a settable DC output range of 0 to 20 mA, 4 to 20 mA or 0 to 1 mA, which may be assigned to any measured parameter. The range of these outputs shall be scalable.
 13. The relay shall be able to monitor up to four remote RTD modules, each with four Analogue Outputs, with settable DC output range and functionality identical to the on board Analogue Outputs. The remote RTD Module Analogue Outputs shall be assigned to any temperature measured by the module RTDs.
 14. Latest trip report containing date and time, cause, phase, ground, motor load, current unbalance, Line-Line and Line-ground voltages, hottest stator RTD, system frequency, real, reactive and apparent power, and power factor
 15. Alarm status information reflecting Alarm Name as programmed and status.
 16. Start block timer status including overload lockout, start inhibit, starts per hour, time between starts, and restart block
- I. The Motor Learned Data shall capture up to 250 sets of motor starting values, averaged over up to five motor starts. The motor learned data must be graphically

represented through a PDF report. The following is the learned data captured and stored and can also be printed and filed.

1. Learned Acceleration Time
 2. Learned Starting Time
 3. Learned Starting Capacity
 4. Learned Running and Cool Time Constant
 5. Learned Stopped Cool Time Constant
 6. Learned Unbalance K Factor
 7. Learned Average Motor Load
 8. Learned Run Time After Start
 9. Date of last learned Date average calculation or last record
- J. The relay must provide a high-speed data logger to capture analog signals during motor starting conditions. A total of six individual logs (1 baseline and rolling buffer of last 5 starts), each 30 seconds long are available to record key analog quantities at a sampling rate of 200 milliseconds. The following information shall be captured.
1. General:
 - a. True RMS Phase A, B and C Currents
 - b. Phase Current Unbalance
 - c. True RMS Ground Current
 - d. True Phase to Phase or Phase to Ground Voltages
 - e. Thermal Capacity Accumulated (%)
 - f. System Frequency
 - g. Breaker / Contactor Status
 2. Preventive Maintenance Information:
 - a. The relay shall keep count of number of trips by type
 - b. Number of motor starts or start attempts
 - c. Number of Emergency Restarts
 - d. Motor running hours
 - e. Autorestart start attempts
 - f. Time to autorestart
 - g. Digital input counters
- K. The relay shall have starter failure detection feature which shall produce an alarm in the event that the motor relay does not detect a starter/breaker open condition after a trip is initiated.
- L. The relay shall have the capability to display up to 5 user programmable text messages.
- M. Under normal conditions, if no front panel activity is detected within a settable time, the screen shall sequentially display up to 30 default messages. Any actual value or setpoint message shall be selectable for default display.
- N. Security / Change History Report

The relay must comply with NERC CIP security reporting requirements and provide traceability. The relay must maintain a history of the last changes made to the configuration, including modifications to settings and firmware upgrades. A summary history of the last ten sessions and a list the last 100 specific setting changes made must be recorded and stored in non-volatile memory. The report must be available to be saved and printed in PDF format.

1. Security Setting Reports shall include the following information:
2. Dates and times of security setting changes
3. MAC address of user making setting changes
4. Listing of modified changes
5. How setting changes were made (Keypad, Front serial port, Ethernet)

O. User interfaces shall include:

1. A 40 character LCD display, and navigation keys
2. Indicator LEDs on the front panel which shall provide a quick visual indication of status
3. A front panel RS232 serial port that shall provide easy computer access. The communications protocol shall be Modbus RTU
4. Two rear RS485 ports. The communications protocol shall be Modbus RTU
5. An RS485 communications port shall be provided specifically designed to communicate to Remote RTD modules. The relay shall be capable of communicating with up to four Remote RTD modules. Access to the remote RTD modules for setpoints and actual values shall be achieved through the motor relay via any of the available communication ports. The remote RTD communication port standard media shall be a three terminal port. Optional media shall be fiber optic, with a maximum baud rate of 19.2 kBs, fiber sizes 50/125, 62.5/125, 100/140, and 200 μ m, and emitter fiber type 820 nm LED, multimode.
6. An optional RJ45 Ethernet port shall be provided to allow 10BaseT Ethernet connectivity to Local or Wide Area Networks. The communications protocol shall be Modbus TCP
7. An optional terminal port shall be provided to allow DeviceNet or Profibus connectivity to Local DeviceNet or Profibus Networks.
8. The relay shall be capable of being set by Windows-based, Easy to use, Setup graphical terminal interface
9. To make the data acquisition more efficient, the motor relay shall provide a User Definable Memory Map, which shall allow a remote computer to read up to 125 nonconsecutive data registers by using one Modbus packet. The User Definable Memory Map shall be programmed to join any memory map address to one in the block of consecutive User Map locations, so that they can be accessed by means of these consecutive locations. The User Definable area shall have two sections:

- a. A Register Index area containing 125 Actual Values or Setpoints registers
 - b. A Register area containing the data located at the addresses in the Register Index
- P. A testing feature shall be included to allow testing analogue outputs and relays, without the need for external voltage and current inputs.
- Q. The relay shall be capable of being programmed through a windows based software program that is capable of the following:
- 1. The software program will operate in the following fashion
 - a. Request system and motor nameplate data from user through display screens.
 - b. Generate cautionary notes based on inputted information
 - c. Generate settings file
 - d. Review settings with user with the option to disable any configured settings that are not required
 - e. Provide PDF report outlining the settings that have been generated, as well as any cautionary notes required
 - f. Report and Settings file to be saved in user-selectable location
 - 2. The following system and protection settings will be generated based on inputted information
 - a. All CT, VT and Power System settings
 - b. All Thermal Model settings including
 - 1) Short Circuit
 - 2) Mechanical Jam
 - 3) Unbalance
 - 4) Undercurrent
 - 5) Ground Fault
 - c. All Motor Start / Inhibit protections
 - d. Local RTD configuration, alarming and tripping
 - e. Under / Over Voltage
 - f. Under / Over frequency
 - g. Phase Reversal
 - h. Local Digital input for 52A / B contact
 - i. All other settings will have default values
 - 3. Include Typical Wiring Diagram based on CT / VT type
 - 4. Provide a summary of all enabled settings in a PDF format that can be saved or printed.

R. Motor Health Report

The Motor Health Report included with the relay will provide a detailed history of the operation and performance of the associated motor in both graphical and data format. The following information will be provided in the Motor Health Report.

The report can either be saved to a location in a soft copy or be printed in PDF format.

The report shall be divided into seven categories and provide the following information:

1. Device Summary
 - a. Requested Period
 - b. Report Created By
 - c. Motor Name
 - d. Protection Device
 - e. Firmware Version
 - f. Motor FLA
 - g. Rated Voltage
 - h. Phase Rotation
 - i. System Frequency
 - j. Motor Running Time
2. Status Overview
 - a. Provide historical learned data of the following
 - b. Acceleration Time
 - c. Starting Current
 - d. Starting Capacity
 - e. Motor Load
 - f. Run Time After Start
3. Trip Summary
 - a. Overload / Thermal
 - b. Current
 - c. Voltage / Frequency / Power
 - d. Miscellaneous
 - e. Information shall be represented both graphically and numerically
4. Motor Operating History
 - a. The Motor Operating History will provide information extracted from the Events Record
 - b. Motor Start / Running
 - c. Manual Stop Command
 - d. Trip Command
 - e. Lockout
 - f. Alarm Conditions
 - g. Emergency Restarts
 - h. Information shall be represented both graphically and numerically
5. Motor Starting Learned Information
 - a. Learned Data will be captured for every motor start
 - b. 250 Learned Data Records will be stored in the relay
 - c. Learned Acceleration Time
 - d. Learned Starting Current
 - e. Learned Starting Capacity
 - f. Learned Average Motor Load

- g. Learned Average Run Time After Start
- h. Information shall be represented both graphically and numerically
- 6. Motor Start Data Logger
 - a. The Motor Start Data Logger consists of Baseline Record and 5 additional records
 - b. Each record shall contain 6 channels of information
 - c. Each channel shall contain 150 samples, sampled at 200ms intervals for a total of 30 seconds
 - d. Information to be included in the Motor Start Data Logger:
 - e. Average Current
 - f. Average Current Unbalance in Percent
 - g. Ground Current
 - h. Average Voltage
 - i. Thermal Capacity Used
 - j. Frequency
 - k. Breaker Status
 - l. Information shall be represented both graphically and numerically
- 7. Motor Stopping / Tripping
 - a. Events that are related to the stopping or tripping of the motor
 - b. Overload Trip
 - c. Mechanical Jam
 - d. Short Circuit
 - e. Under Power
 - f. Current Unbalance
 - g. RTD Temperature
 - h. Ground Fault
 - i. Under/Over Voltage
 - j. Under/Over Frequency
 - k. Manual/Remote Stop
 - l. Information shall be represented both graphically and numerically

S. To help extend product life, and to protect the motor protection relay from hostile and harsh environments including moisture, temperature variations, salt spray, organic attack (fungus), and aggressive chemicals and vapors, the product manufacturer shall provide optional harsh environment conformal coating.

T. The motor protective relay shall be the Multilin 369, or equal.

PART 3 – EXECUTION

3.1 MANUFACTURE TESTING AND INSPECTION

A. Standard Testing

- 1. The following tests shall be carried out in accordance with applicable requirements and/or specifications of Canadian Standards Association

(CSA), Underwriters Laboratories (UL), National Electrical Manufacturers Association (NEMA), European Standard (EN), and International Electrotechnical Commission (IEC).

2. Start-up of the medium voltage motor control equipment shall be coordinated with the start-up of the driven equipment, and other related equipment which may pertain to drive settings. The controller field service representative shall be available during the entire start-up procedure to adjust settings as required for the entire system operation.
2. Functional checks shall be performed wherever possible; otherwise, inspection and continuity checks shall be made.
3. A "HI-POT" dielectric withstand test shall be performed on all buswork and cables from phase-to-phase and phase-to-ground (except solid-state components, low voltage controls and instrument transformers). The voltage level used for this test depends on the product's nominal AC voltage.
4. Component devices shall be functionally operated in circuits as shown on electrical diagrams or as called for by specific test instructions.
5. Instruments, meters, protective devices and associated controls shall be functionally tested by applying the specified control signals, current and/or voltages.
6. Medium Voltage starters shall be inspected for the following:
 - a. Electrical interlocking
 - b. Motor protection and ground fault if applicable

B. Physical Inspection

1. The product must meet all applicable engineering and workmanship standards and specifications. All components shall be verified against engineering documentation to be present and correctly installed.
2. All bus and bus connections shall be checked for proper clearance, creepage, phasing, and torque.
3. Warning plates, isolation barriers, and mechanical interlocks must provide sufficient safety/isolation for personnel and equipment.
 - a. Warning labels and nameplates must be present and in their specified positions to advise personnel of possible hazards.
 - b. Isolation barriers must be in place within the cabinet. Such barriers protect personnel from touching live medium voltage components in an area that otherwise does not have power supplied to it.
 - c. Operation of isolation switch handle and door interlocks must be verified. The interlocking prevents the opening of any medium voltage door on a medium voltage cabinet when the isolation switch handle has been moved to the full ON position.

3.2 MANUFACTURE'S FIELD SERVICES

- A. The service division of the controller manufacturer shall perform all start-up services. The use of third party supplier start-up personnel is not allowed.

- B. Start-up personnel shall be direct employees of the controller manufacturer.
- C. At a minimum, the start-up service shall include:
 - 1. Pre-Installation Meeting
 - a. The start-up plan
 - b. The start-up schedule
 - c. Installation requirements
 - 2. Pre-Power Check
 - a. Inspect the starter's mechanical and electrical devices enclosed
 - b. Perform a tug test on all internal connections within the starter and verify wiring.
 - c. Verify critical mechanical connections for proper torque requirements.
 - d. Verify and adjust mechanical interlocks for permanent location.
 - e. Confirm all sectional wiring is connected properly.
 - f. Re-verify control wiring from any external control devices.
 - g. Set up auxiliary equipment with customer supplied parameters.
 - h. Confirm cabling of starter to motor and line feed.
 - i. Megger Motor Resistances.
 - 3. Power-up and Commissioning
 - a. Apply medium voltage to the starter and perform operational checks.
 - b. Exercise the starter in Test Mode (combination controllers).
 - c. Run the starter motor system throughout the operational range to verify proper performance.
 - 4. Record of all measurements

3.3 TRAINING

- A. An authorized factory representative shall provide training in accordance with Section 26 05 05, General Provisions for Electrical Systems.
- B. The manufacturer shall outline the training session duration and content.
- C. The basis of the training shall be the controller, the engineered drawings and the user manual.
- D. The instruction shall include the operational and maintenance requirements of the controller.
- E. At a minimum, the training shall:
 - 1. Review of the engineered drawings identifying the components shown on the drawings.
 - 2. Review starting / stopping options for the starter.
 - 3. Review starter and contactor hardware.
 - 4. Review the maintenance requirements of the controller.
 - a. Hardware replacement procedures
 - b. Power device replacement procedures

- c. Fault analysis and troubleshooting
 - d. Preventative maintenance procedures
5. Review safety concerns with operating the controller.

++ END OF SECTION ++

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SECTION 26 27 26.13

LOW VOLTAGE WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Wiring devices shall be installed where indicated on the Contract Drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. "Hubbell," "Wiremold," "P&S," "Leviton," "Daniel Woodhead," or equal.

2.2 EQUIPMENT

A. General

1. Sump pumps shall be equipped with the proper cord and plug for receptacles.
2. Switch and receptacles for sump pump motors shall be rated at 20 amps at 125 volts and shall be equipped with a manual motor starting switch in lieu of toggle switch, as specified elsewhere this division.

B. Receptacles

1. Twin-convenience - outlet (interior) – "Hubbell" Cat. No. 5362GRY, or equal.
2. Twin-convenience - outlet (exterior) – "Hubbell" Cat. No. 5362GRY, with Taymac Corporation or Intermatic, Inc., safety outlet enclosure.
3. Special purpose outlet - Per equipment requirements.
4. Single receptacle for sump pump - 20A/125 VAC – "Hubbell" Cat. No. 2310, or equal.
5. Ground fault interrupting receptacles shall be required where shown on the Contract Drawings, and shall be indicated by the abbreviation "GFI" beside the circuit symbol on the Contract Drawings. They shall be rated 20 amps (125 volts) and shall be of the duplex, feed through type, capable of protecting all downstream receptacles on the same circuit. They shall be UL listed and interrupt the current between 4-6 milliamps of ground fault leakage. Appropriate plates shall be furnished and installed. The 20 ampere rating shall apply not only to device internals but to the faceplate as well. Device shall be "Hubbell" Cat. No. GF5362GRY, or equal.

C. Plates and Covers

1. Furnish and install plates of the appropriate type and size for all wiring and control devices, signal and telephone outlets.
2. All plates on surface mounted boxes shall be of 302 stainless steel (nonmagnetic) with rounded or beveled edges, except in pump rooms, pipe galleries, and pipe trenches, then weatherproof covers shall be installed. All plates on flush mounted boxes shall be stainless steel. All device plate screws shall be stainless steel with countersunk heads. Plates shall be installed vertically and with an alignment tolerance of 1/16 inch. Device plates shall be of the one-piece type, of suitable shape for the devices to be covered. Plates shall have a smooth finish with no crevices to collect dirt. Oversize plates are not acceptable.
3. Covers for boxes serving equipment where flexible conduit is to be tapped into cover plates shall be sheet metal drilled for conduit. Gaskets shall be required as well as all special adapters for mounting.

D. Wall Switches (Tumbler Type)

1. Single pole (interior) – “Hubbell” Cat. No. 1221GRY, or equal.
2. Single pole (exterior) – “Hubbell” Cat. No. 1222GRY, or equal, and Bryant 7420 or equal plate.
3. 3-way switches (interior) – “Hubbell” Cat. No. 1223GRY, or equal.
4. 4-way switches (interior) – “Hubbell” Cat. No. 1224GRY, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. Wall Switches

1. Wall switches shall be mounted at a height as indicated in Section 26 05 05, General Provisions for Electrical Systems, unless otherwise noted on the Contract Drawings.

B. Receptacles

1. Outlets shall be located as shown on the Contract Drawings. Where located in special interior finishes, they shall be properly centered. Boxes shall be of the type noted and accepted for the specific installation.
2. Furnish and install receptacle circuits where called for on the Contract Drawings and/or by these Specifications. Circuits shall be installed in conduit from panel to receptacle, with flush mounted boxes except as noted on the Contract Drawings.
3. Receptacles and lighting circuits shall not be combined on the same overcurrent device. For runs over 75 feet or for 30 amp receptacles, minimum wire size shall be AWG No. 10.
4. Receptacles for specific devices (i.e., sump pumps), shall be rated at the correct voltage and amperage for that unit.

5. The minimum free length of conductor at each box for the connection of a fixture, switch or receptacle shall be 8 inches. All connections shall be made mechanically and electrically secure.
6. Receptacles shall be duplex type, rated at 20 amps, 125 volts, gray colored, unless otherwise noted. Mounting height shall be as specified for low outlets in Section 26 05 05, General Provisions for Electrical Systems, except in pipe galleries and pump rooms subject to floods, where they shall be medium height. All receptacles shall be of the grounding type.
7. Receptacles over workbenches or countertops or at medium or high mountings shall be mounted so that the grounding slot is below the neutral and hot. All other receptacles shall be mounted with the grounding slot above the neutral and hot.
8. Weatherproof receptacles, shall be weatherproof while in use. This requirement shall apply on all outdoor units and on others as indicated on the Drawings. To meet this requirement, appropriate safety outlet covers as manufactured by Taymac Corporation, Intermatic Guardian Series, or equal shall be utilized in these areas.
9. Wiring devices in wet locations shall bear a weather resistant mark per UL Listing.

+ + END OF SECTION + +

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SECTION 26 29 01

MOTORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope

1. Motors are to be furnished with driven equipment except where otherwise noted on the Contract Drawings or elsewhere in this Division of the Specifications. All motors shall conform to the following Specifications and any special requirements of the driven equipment. Special requirements of the driven equipment shall take precedence over these Specifications should a discrepancy occur. Starting torque and slip ratings shall conform to the requirements of the driven equipment.
2. Polyphase motors shall be of the squirrel cage induction type and single phase of the capacitor start-induction run type except as otherwise noted. Conduit boxes shall be tapped for the size conduit shown on the Contract Drawings.
3. All motors shall be manufactured and installed in accordance with applicable NEMA standards and NEC provisions, latest revisions.

B. Related Sections:

1. Section 43 21 40, Vertical Turbine Pumps

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ASTM A48/A48M, Specification for Gray Iron Castings.
2. IEEE 112, Test Procedure for Polyphase Induction Motors and Generators.
3. IEEE 522, Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating Current Electric Machines.
4. IEEE 1043, Recommended Practice for Voltage Endurance Testing of Form-Wound Bars and Coils.
5. NEMA MG 1, Motors and Generators.
6. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems
7. UL 1004, Electric Motors.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:
 - a. Manufacturer shall have not less than five years experience producing equipment substantially similar to that required and shall be able to submit documentation of at least five installations in satisfactory

operation for at least five years each.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Data sheets indicating nameplate data for fractional-horsepower motors.
 - b. Outline drawing or data sheet indicating complete motor dimensions for motors rated greater than 1/3-hp. Several motors of the same type and rating for the same application may be covered by an appropriate single drawing or data sheet. Drawings and data sheets shall have complete identifying data including frame size, speed, horsepower ratings, and application for each particular motor.
 - c. Details of motor heaters, winding thermal protection, and other accessories.
 - d. Copies of motor characteristic curves and data inputs when required for programming motor protection and management relays.
2. Product Data:
 - a. Submit motor test data sheets for each motor rated one horsepower or greater. Values indicated on test data sheets shall be from tests of a previously manufactured, electrically duplicate motor or calculated data. Mark each test data sheet to indicate the Project motor application location, manufacturer, type, frame size, horsepower, voltage, speed, bearing type, lubrication medium and enclosure type. Test data sheet shall also include:
 - 1) Winding resistances.
 - 2) Torques.
 - 3) Efficiencies.
 - 4) Power factors.
 - 5) Slip.
 - 6) Full load amperes.
 - 7) Locked rotor and no load amperes.
 - 8) Nameplate temperature and results of dielectric tests.
3. Testing Plans and Procedures:
 - a. When witnessed source quality control testing is required in the Section for associated driven equipment, submit description of proposed shop testing methods, procedures, and testing apparatus with calibration dates, together with proposed testing schedule and proposed travel and logistical plans for testing.

B. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:
 - a. Instructions and recommendations for handling, storing, protecting the motors.
 - b. Installation data for motors, including setting drawings, templates, and

- directions and tolerances for installing anchorage devices.
2. Source Quality Control Submittals:
 - a. Written reports presenting results of required shop testing. Shop test reports shall be dated and signed by motor manufacturer.
 - b. When witnessed shop tests are required, shop test results shall be signed by and shall bear the seal of registered professional engineer. Name on seal, registration or license number, and jurisdiction or registration of license shall be legible.
 3. Field Quality Control Submittals:
 - a. Written reports presenting results of required field testing and inspections. Field testing reports shall be dated and signed by CONTRACTOR.
 4. Supplier Reports:
 - a. Submit written report of results of each visit to Site by Supplier's service personnel, including purpose and time of visit, persons contacted, problems encountered and resolved, tasks performed, results obtained, and other pertinent information. Submit within two days of completion of visit to the Site.
 5. Qualifications Statements:
 - a. Submit manufacturer's qualifications data when requested by ENGINEER.
- C. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data:
 - a. Furnish operation and maintenance data for motors as part of the operations and maintenance data for the associated driven equipment.
 - b. Comply with Section 01 78 23, Operations and Maintenance Data.
- D. Maintenance Material Submittals: Submit the following:
1. Spare Parts and Extra Stock Materials: For each motor size and type, furnish spare parts in accordance with motor manufacturer's recommendations, including the following for three-phase motors:
 - a. One set of fans and guards for each set of three or fewer motors, for each size of totally-enclosed fan-cooled motor.
 - b. One set of bearing liners, or renewable ball or roller bearings, for each set of three or fewer motors, for each type and size of motor.
 - c. One set of oil rings, for each sleeve bearing motor.
 - d. One set of bearing temperature detectors, for each set of three or fewer motors, of each type of motor.

1.5 DELIVERY, STORAGE, & HANDLING

- A. All electrical motors shall be protected against the accumulation of moisture, dust and debris and physical damage during the course of installation of the job. Motors shall be shipped with openings sealed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Motors – “U.S. Motors”, “Baldor”, “Marathon”, “Reliance”, or equal.

2.2 EQUIPMENT

A. General:

1. Ratings and Electrical Characteristics

- a. Time: All motors shall be rated for continuous duty.
- b. Temperature: Based on NEMA standards for a maximum ambient temperature of 40 degrees Celsius and an altitude of 3,300 feet or less, according to service factor and insulation class employed.
- c. Voltage: The new motor specified herein shall be rated for 2300 volts. All motors shall be capable of normal operation at balanced voltages in the range of ± 10 percent from rated winding voltage.
- d. Frequency: All a-c motors shall be rated for 60 Hz. operation. All motors shall be capable of normal operation at frequencies 5 percent above or below the nominal rating of 60 Hz.
- e. Horsepower: Horsepower of the motors shall be as shown on the Contract Drawings.
- f. Locked Rotor Current: Locked rotor current shall be in accordance with NEMA standards.
- g. Efficiency and Power Factor: Efficiency and power factor shall be given consideration during Shop Drawing review. The ratings at full, 3/4, and 1/2 load shall be compared to similar motors manufactured by acceptable suppliers listed in these Specifications. Excessive variation shall be considered grounds for rejection.
- h. Speed: Synchronous speed of motors shall correspond to standard NEMA ratings. Actual speed shall be as given in the Specification Division on the driven equipment. Slip shall not exceed 5 percent at full load.
- i. Service Factor: The service factor shall be 1.0 unless requirements of the driven load necessitate a higher service factor.
- j. Insulation Class: Insulation shall be NEMA Class B, except as otherwise noted. Submersible motors shall be Class F, and motors to be operated at variable speed shall be Class F. Class F insulated motors shall operate at a Class B rise at nameplate horsepower loading.
- k. Design Level: Motors shall be NEMA design B, except as otherwise noted.
- l. Inverter Duty Rating: Motors used for variable frequency drive applications shall be inverter duty rated. Motors used for variable

- frequency drive applications shall comply with the performance standards of NEMS MG 1-31.
- m. Insulated Bearings: Motors over 100 hp used for variable frequency drive applications shall be furnished with insulated or ceramic bearings.
 - n. Shaft Grounding Kit: Motors used for variable frequency drive applications shall be furnished with a shaft grounding ring kit.
 - o. Frame Size: Frame designations shall be in accordance with NEMA standards.
 - p. Winding Overtemperature Sensors: All motors 15 horsepower and over shall be provided with motor winding thermostats. The devices shall be hermetically sealed, snap-acting thermal switches, actuated by a thermally responsive bi-metallic disk. A minimum of 1 per phase is required, with switches wired into the control circuit of the starter to provide de-energization should overheating threaten.
2. Mechanical Characteristics
- a. Integral Horsepower Motor Construction
 - 1) Motor frames for vertical motors shall be cast iron, heavy fabricated steel, or extruded aluminum (alloy 6063-T4 or 6063-T6). Endshields for vertical motors must be cast iron.
 - 2) If an aluminum frame is used, the endshields and/or all other steel hardware must be plated with zinc or cadmium and coated with grease before assembly to minimize the galvanic action between the steel and aluminum.
 - 3) Motor frames and endshields shall be of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type enclosure employed. Lifting lugs of all motors shall conform to NEMA standards.
 - 4) Windings shall be random or form wound, adequately insulated and securely braced to resist failure due to electrical stresses and vibration. If the windings are aluminum, there shall be a cold welded aluminum-copper transition joint at the termination of the windings to permit the use of standard copper to copper connection techniques by the electrician and to prevent galvanic action between the copper power wires and the aluminum windings.
 - 5) The motor shaft shall be made of high grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of that particular rating. Bearing journals shall be ground and polished.
 - 6) Rotors shall be made from high grade steel laminations adequately fastened together and to the shaft. Rotor cage windings may be cast aluminum of bar type construction with brazed end rings.

- 7) Integral horsepower motors shall be equipped with cone, roller, or ball bearings made to AFBMA standards, Grade 1 and shall be of ample capacity for the motor ratings. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent relubrication (ten years normal operation without lubrication), but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight running fits or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of lubricant out of the bearing cavity.
3. Tests, Nameplates, and Shop Drawings
 - a. Tests
 - 1) Tests shall be required on integral horsepower motors only. The test shall be certified by the factory and shall contain a statement to the effect that complete tests affirm the guaranteed characteristics published in the manufacturer's catalogs or descriptive literature.
 - 2) Tests will be in accordance with IEEE test procedures.
 - b. Nameplates
 - 1) Each motor shall have a permanently affixed nameplate of brass, stainless steel, or other metal of durability and corrosion resistance. The data contained on the nameplate shall be in accordance with NEMA standards.
 - c. Shop Drawings
 - 1) Shop Drawings shall consist of motor dimensions, nameplate data from each motor and tests as outlined above. Also included shall be efficiency and power factor at 100, 75, and 50 percent load. Operation, maintenance, and lubrication information (including bearing catalog numbers) shall be submitted with Shop Drawings for review.
 4. Efficiency Requirements

Motors shall meet full load efficiency ratings per NEMA MG1, Table 52 for premium efficient motors.
- B. Motors Over 200 Horsepower
1. Motors specified in this section shall comply with the requirements of preceding Section 2.2, Sub-article A unless otherwise noted herein. Motors shall be furnished by the pump supplier to be installed by the Contractor. Terminal housings shall be as specified in Sub-article D which follows, and extra long motor leads shall be provided to accommodate the large terminal housing.
 2. Motors shall be vertical, solid shaft, NEMA Design B, (with NEMA P base). Motors shall be especially suitable both electrically and mechanically to drive the equipment specified in other divisions. The speed, horsepower, torque, base, bearings, shaft and motor tolerances shall

- be coordinated closely with the equipment manufacturer's requirements so as to provide a satisfactory, efficient drive without overloading, overheating, or abnormal vibration.
3. Motors shall meet the NEMA temperature rise as defined for Class B insulation. Service factor shall be 1.15 and the motor shall be tested for temperature rise at its service factor load above a 40 degree C ambient. All motors shall be dynamically balanced and vibration shall be measured per NEMA methods. Critical speed of the shaft and motor assemble shall be above the operating speed of the motor by at least 10 percent.
 4. Motor enclosure shall be NEMA WP I with non-hygroscopic encapsulated windings. Screens shall be provided over all frames and endshield openings.
 5. Motors shall be equipped with nonreverse ratchets to prevent damage to pumps.
 6. Bearings shall be selected to have AFBMA rated minimum life of 1 year when operating continuously at rated speed of the motor and at total load consisting of the weight and hydraulic thrust load imposed on the motor by the pump. Angular contact ball thrust bearings, spherical roller thrust bearings, or plate thrust bearings shall be used depending on thrust requirements. Motors shall have oil lubricated thrust and guide bearings, with visual level indicators, accessible drain plugs and accessible filling plugs. Oil lubrication system shall be so designed as to provide the correct quantity of lubricant with minimum foaming or aeration. A nameplate shall be provided on all motors showing bearing numbers and oil type and required viscosity.
 7. Motors shall be high thrust capable of carrying 30 percent momentary upthrust. High thrust motors shall be furnished with angular contact ball bearings.
 8. In addition to the test report required in the preceding Sub-article, the manufacturer shall submit data indicating: guaranteed efficiencies and power factor at 100 percent, 75 percent, and 50 percent load; full load current; locked rotor current.
 9. Motor Construction
 - a. The stator winding insulation system shall be Class B. The insulation system shall be of non-hygroscopic materials and processes which provide high resistance to moisture, temperatures, and contaminants as generally experienced in applications of this nature.
 - b. The maximum temperature rise of Class B insulated windings as measured by the resistance methods, shall not exceed 80 degrees Celsius when the motor operates continuously at rated nameplate horsepower, voltage and frequency with an ambient temperature not exceeding 40 degrees Celsius.
 - c. The motor shall be capable of successful operation under running conditions with variations from rated voltage and rated frequency in accordance with NEMA Standard MG1-20.45.

- d. The stator winding and end turn connections shall be sufficiently braced to withstand repeated full voltage starts. The bracing system shall essentially eliminate coil vibration under the high current conditions of starting as well as during normal operation. If a tied bracing system is used, it shall be such that no tie depends upon the integrity of any other tie within the system.
 - e. The squirrel-cage of the rotor shall be of cast or fabricated aluminum preferably, although fabricated copper or copper alloy shall be acceptable. The material and construction selected shall be unaffected by moderately corrosive atmospheres containing chlorine, hydrogen sulfide, and methane found in wastewater treatment facilities.
 - f. Rotor surface losses shall be minimized by the use of thin, high strength steel laminations. The rotor shall have provisions for convenient touch-up balance in the field after final installation if necessary.
 - g. The motors shall be equipped with suitable corrosion-resistant guard screens.
10. Bearings and Couplings
- a. Each motor shall be equipped with two end shield bearings of the sleeve type. Where necessary, the bearings shall be insulated to prevent shaft currents and resulting bearing damage. Sleeve bearings shall be ring-oiled with an adequate integral self-cooled oil reservoir whenever possible. The bearing sleeves shall be lined with a high tin content babbitt to minimize oil contamination. Close running shaft seals shall prevent oil leakage as well as prevent entrance of foreign material, such as water and dirt, into the bearing area. Oil level sight gages with permanently marked-easily discernable oil level shall be provided. Inspection openings to observe oil ring operation shall be provided.
 - b. Each motor shall be direct-connected to the equipment through a flexible coupling suitable for imposed load torque and end-thrust.
11. Protective Devices
- a. Each motor shall be provided with two resistance temperature detectors per phase. Each shall possess 10 or 120 ohms resistance, shall be embedded in the stator windings, and their leads brought out to a suitable termination.
 - b. The control circuit will include a monitoring relay as specified elsewhere in these Specifications.
 - c. Surge capacitors shall be furnished, mounted in the motor conduit box and connected to the motor phase leads. These connections shall be provided by the motor manufacturer.
 - d. Lightning arrestors shall be provided, mounted in the motor conduit box and connected to the motor phase leads. These connections shall be provided by the motor manufacturer.

- Lightning arrestors shall be designed specifically for rotating machine protection.
- e. Provide a bearing temperature detector for each motor bearing. Each shall be of the resistance temperature detector type with 10 or 120 ohms resistance.
12. Terminal Boxes and Terminations
- a. Motor supply cables shall be shielded and shall terminate in stress cones.
 - b. Terminal boxes shall be cast iron or fabricated steel, neoprene gasketed and bolted with adequate space for connections. The motor leads shall be permanently marked in agreement with connection diagram. Separate water-tight terminal boxes shall be provided for connection of the thermal protective circuit.
13. Motor Nameplate
- a. Each motor shall have a stainless steel nameplate which shall indicate the motor connection diagram and shall also give the following information: type, frame, insulation class, HP, full load current, RPM, Celsius degree rise, manufacturer's name and serial number, model, voltages, locked rotor KVA code, and bearing numbers.
14. Tests
- a. General
 - 1) Each motor shall be given a routine factory certified test as defined in NEMA Standards to determine that it is free from electrical or mechanical defects and to provide assurance that it meets design specifications.
 - 2) One motor shall be subjected to a complete IEEE test consisting of full load heat run, percent slip, locked rotor current, breakdown torque (calculated), starting torque, winding resistance, high potential, efficiencies and power factors at 100, 75, 50, and 25 percent of full load, and bearing inspection.
 - 3) All motor components and accessories shall be in place for motor shop testing. All test variables shall conform to actual field values and shall be maintained throughout all tests. Any lubrication leaks, excessive noise, and overheating shall be corrected prior to shipment. In case of failure of any unit to meet test requirements and specified performance, the motor manufacturer shall make such alterations as are necessary and the tests shall be repeated without additional cost to the Owner until the equipment is satisfactory.
 - b. Vibration Requirements
 - 1) Testing shall demonstrate that the vibration with the motor bolted to a steel floor, stator at design temperature, motor shaft extension with half-key, and lubrication at normal operating temperature shall not exceed 0.10 inches/second at rotational

frequency and at all multiples through 120 Hz and one-half of rotational frequency or 0.15 inches/second unfiltered. Vibration shall be as measured in any plane on bearing caps of both ends.

- 2) Stator temperature for vibration tests may be accomplished by restricting cooling air flow or by other industry standard methods; however, the motor manufacturer shall evaluate all effects of the method of testing, and vibration readings shall be taken while air flow is not restricted. During the testing, the motor shall be complete and shall have nothing removed for convenience except the power lead conduit box.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

- A. Installation of motors shall comply with motor manufacturer instructions as well as applicable NEMA recommendations and requirements of the driven equipment OEM (original equipment manufacturer).
- B. Motors shall be aligned to acceptable tolerances and shall not vibrate excessively.
- C. Shaft grounding ring kits shall be bolted directly to the motor end bracket to ensure ground connection to the motor frame.

3.2 FIELD QUALITY CONTROL

- A. Site Tests:
 1. Inspect motors prior to supplying electricity to (energizing) equipment. Do not energize equipment without ENGINEER's permission. Inspections shall include the following:
 - a. Inspect motor and equipment for physical damage.
 - b. Inspect motor for proper anchorage, mounting, grounding, connection, and lubrication.
 - c. Check for unusual noise and indications of overheating during initial or test operation.
 2. Perform testing at the Site for motors larger than 200 hp, as follows:
 - a. Testing shall be witnessed by ENGINEER.
 - b. Initial inspections and testing shall include the following:
 - 1) Electrical and grounding connections.
 - 2) Shaft alignment, proper mounting and lubrication.
 - 3) Check ventilating air passageways for blockage.
 - 4) Excessive noise.
 - 5) Overheating.

- 6) Correct rotation.
- 7) Protective detectors operation.
- 8) Excessive vibration.
- 9) Space heater operation.
- c. Electrical testing shall include the following:
 - 1) Insulation resistance test.
 - 2) Surge comparison test.
 - 3) Vibration test.
 - 4) Bearing insulation resistance test on insulated bearings.
 - 5) Running current and voltage measurements and evaluations relative to load conditions over full range of operations and nameplate full-load amperes.
 - 6) High-potential test.
 - 7) For wound rotor motors, additional testing at minimum and normal operating load points and at ring short.
 - 8) Motor operation with the driven equipment for not less than 48 continuous hours per motor, with checks for overheating and vibration during operation.
- d. Tests and values shall be in accordance with motor manufacturer's recommendations and ANSI/NETA ATS.
- e. Prepare and submit field testing report in accordance with ANSI/NETA ATS.

B. Manufacturer's Services:

1. For motors larger than 200 hp, furnish services of motor manufacturer's qualified service representative to assist with installing motors, checking installed motors before initial operation, assisting in performing field quality control tests and inspections, observing and assisting initial operations, and training operations and maintenance personnel in caring for, operating, and maintaining motors. The representative shall make a minimum of 4 visits to the site per motor with a minimum 4 hours on-site for each visit. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to the requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the OWNER.
2. Preparing and submitting manufacturer's field report for each visit to the Site.

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SECTION 26 29 23

MEDIUM VOLTAGE VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
1. This specification covers materials, equipment and start-up services required to place into operation an integrated medium voltage variable frequency drive (VFD) system. This specification may be applied to Induction or Synchronous AC motor applications.
 2. Every VFD system shall consist of all components required to meet the performance, protection, safety, and certification criteria of this specification.
 3. The following components must be integrated into the VFD System:
 - Integral input line reactor
 - Active Front End (PWM converter)
 - PWM inverter
 - DC Link with common mode voltage protection
 - Input and output filters if applicable
 4. Contractor to include all material and labor necessary to interconnect any VFD system elements, even if shipped separately. All cost to use alternative equipment, including redesign, will be born by the VFD manufacturer. VFD's which require phase shifting transformers will not be acceptable.

1.2 QUALIFICATIONS

- A. Manufacturer
1. The manufacturer shall have a minimum of 10 years experience in the manufacturer of medium voltage variable frequency drives for use in similar applications at the specified voltage and power ratings. A user list, complete with contact names and telephone numbers, shall be furnished upon request.
 - a. These Specifications are based on products manufactured by Allen Bradley. Other acceptable manufacturers are Benschaw and Eaton.

B. Support

1. The manufacturer shall maintain factory trained and authorized service facilities within 100 miles of the project and shall have a demonstrated record of service for at least the previous ten years owned and operated by the VFD drive manufacturer.
2. Support personnel are to be direct employees of the manufacturer.
3. The manufacturer shall provide all required start-up and training services.

C. Certification

1. The VFD shall be factory pre-wired, assembled and tested as a complete package by the VFD supplier. Customer specific drive, motor, and application data shall be pre-loaded into the operator interface and tested prior to shipment.
2. All inspection and testing procedures shall be developed and controlled under the guidelines of the Supplier's quality system. This system must be registered to ISO 9001 and regularly reviewed and audited by a third party registrar.
3. All incoming material shall be inspected and/or tested for conformance to quality assurance specifications.
4. All sub-assemblies shall be inspected and/or tested for conformance to Supplier's engineering and quality assurance specifications.
5. All printed circuit boards with active components shall be burned-in per the manufacturer's standards.
6. Third party manufacturers and brand labeling shall not be allowed.

1.3 REFERENCES

A. Variable Frequency Drive

1. Canadian Standards Association (CSA) "Industrial Control Equipment C22.2 No. 14"
2. American National Standards Institute (ANSI) "Instrument Transformers C57.13"
3. Institute of Electrical & Electronic Engineers (IEEE)
4. Electrical & Electronic Manufacturers Assoc. of Canada (EEMAC)
5. Guide for Harmonic Control and Reactive Compensation of Static Power Converters (IEEE 519-1992)
6. National Electrical Manufacturers Association (NEMA) "Medium Voltage Controllers Rated 1501 to 7200V AC ICS 3-2 (formerly ICS 2-324)"
7. Underwriters Laboratories, Inc. (UL) (High Voltage Industrial Control Equipment 347)
8. UL 347A Medium Voltage Power Conversion Equipment Preliminary Standard

9. International Electrotechnical Commission (IEC) 61800-5 AC Drives Standard
10. European Directives for Safety and EMC
11. National Electrical Code (NEC)
12. Occupational Safety & Health Act (OSHA)

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Confirm to specified service conditions during and after installation of products
- B. Maintain area free of dirt and dust during and after installation of products

1.5 PRE-MANUFACTURE SUBMITTALS

- A. Refer to Division 1 for submittal procedures
- B. Shop Drawings
 1. Elevation drawings showing dimensional information
 2. Structure Descriptions showing
 - a. Enclosure ratings
 - b. Fault ratings
 - c. Other information as required for approval
 3. Conduit locations
 4. Unit Descriptions including amperage ratings, frame sizes, trip settings, pilot devices, etc.
 5. Nameplate Information
 6. Schematic wiring diagrams
- C. Product Data
 1. Publications on variable frequency drive
 2. Data Sheets and Publications on all major components
 - a. Contactors
 - b. Circuit Breaker and Fuse information including time current characteristics
 - c. Control Power Transformers
 - d. Pilot devices
 - e. Relays
 - f. Operator Interface
- D. Spares
 1. Recommend spare parts list and list prices shall be supplied.
 2. Critical Spares - Spare parts that are identified as being associated with long lead times and/or are critical to the unit's operation. These spares should be held in reserve by the Purchaser to limit unforeseen downtime.

3. Maintenance Spares - Spare parts that are identified as being required to regularly perform scheduled maintenance on their equipment. These spares include, but are not limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.
- E. Specification Response
1. Detailed response to this specification showing where in the literature and drawings each requirement is satisfied.
 2. All clarifications and exceptions must be clearly identified.
- F. Testing and Test Reports
1. Testing shall be per manufacturer's standard
 2. A copy of the test reports shall be provided as part of the Closeout documentation

1.6 CLOSEOUT SUBMITTALS

- A. Refer to Division 1 for procedure on submittal of closeout documentation
- B. Contractor shall provide certification that the variable frequency drive has been installed in accordance with the manufacturer's instructions.
- C. The contractor shall provide certification that the Contractor has properly adjusted any timing devices required in the starting circuitry.
- D. Final Drawings. The manufacturer shall provide final drawings reflecting the "As-Shipped" status of the motor control center. The contractor shall be responsible for making any changes to the "As-Shipped" drawings from the manufacturer to reflect any field modifications.
- E. Maintenance Data
1. Variable frequency drive installation instructions and User Manual
 2. Installation / Operation instructions for major components such as circuit breakers, contactors, isolation transformers, etc.
 3. Drive Parameter Listing
 4. Field Service report from drive start-up service
 5. Variable Frequency spare parts listing and pricing
 6. Include name and phone number for a local distributor for the spare parts.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall coordinate the shipping of equipment with the manufacturer.
- B. Contractor shall store the equipment indoors in a clean and dry space.

- C. The contractor shall protect the units from dirt, water, construction debris and traffic.
- D. During storage the contractor shall connect internal space heaters (if specified) with temporary power.

1.8 FIELD MEASUREMENTS

- A. The Contractor shall verify all field measurements prior to the fabrication of the variable frequency drives.

1.9 SPARE MATERIALS

- A. The following spare parts shall be furnished for each size drive:
 1. Three of each type power and control fuse
 2. Two power modules (SGCT) or 20%, whichever is greater
 3. Two spare LEDs of each type used
 4. Two spare control relays of each type used
 5. Two sets of all replacement air filters
 6. One hoisting mechanism for removal and replacement of power cells, if required
 7. One set of all control printed circuit boards
 8. Furnish all cables required for connection to the drives with a laptop, and all software necessary for configuration and programming.

1.10 WARRANTY

- A. The manufacturer shall provide their standard parts warranty for a minimum of one year from the date of project Substantial Completion.
- B. The manufacturer shall confirm this warranty as part of the submittal.

PART 2 PRODUCTS

2.1 RATINGS

- A. Voltage
 1. The VFD shall accept nominal plant power of 2400V at 60Hz
 2. The supply input voltage tolerance shall be $\pm 10\%$ of nominal line voltage.
- B. Displacement power factor

1. The VFD shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of .98 from 60-100% load.
2. If the VFD vendor cannot meet the true power factor requirement, then a power factor correction unit shall be quoted as an option.
3. The true power factor that can be met (with and without power factor correction unit) shall be stated clearly in the proposal.

C. Efficiency

1. VFD system efficiency shall be a minimum of 96% at 100% speed & 100% load. System efficiency shall include VFD, input transformer or line reactor, harmonic filter (if applicable) power factor correction unit (if applicable), and output filter (if applicable). (Assuming a minimum motor PF of 0.86)
2. Control power supplies, control circuits, cooling fans or pumps, shall be included in all loss calculations.

D. Environmental Ratings

1. Storage ambient temperature range: -40 degrees C to 70 degrees C.
2. Operating A. ambient temperature range: 0 degrees C to 40 degrees C without derating.
3. The relative humidity range is 0% to 95% non-condensing.
4. Operating elevation: up to 1000 Meters (3,300ft) without derating.

E. Audible Noise Level

1. The maximum audible noise from the variable frequency drive shall comply with OSHA standard 3074, Hearing Conservation, which limits noise level to 85 dB(A).
2. The variable frequency drive shall comply with the OSHA standard at a distance of one meter from the front of the equipment (with doors closed at any speed or load condition).
3. Variable frequency drives with audible noise in excess of this limit must be provided with sufficient noise abatement treatment to reduce the sound pressure level below 85dB(A).

F. Motor Compatibility

1. The variable frequency drive shall be capable of operating a standard AC squirrel cage induction motor (standard AC synchronous motor, standard AC wound rotor induction motor) of equivalent power and speed rating over the speed range specified. Drives which require motors with higher insulation values will not be acceptable.
2. The variable frequency drive shall provide near sinusoidal voltage and current waveforms to the motor at all speeds and loads. Output current THD shall be less than 5%. Standard induction or synchronous motors shall not require de-rating or upgraded turn-to-turn insulation and shall not require additional service factor.

3. The motor insulation system shall not be compromised thermally or due to dv/dt stress. Dv/dt at the motor terminals (line-to-line) shall be limited to 10 volts per microsecond. If dv/dt at the motor terminals (line-to-line) exceeds 10 volts per microsecond, the vendor must state the actual value in the attached data sheets and include steps taken to guarantee the long term life of the motor insulation system.
4. The variable frequency drive shall provide stable operation of the motor without compromising the motor insulation system, with motor cable distances that exceed 500ft. The vendor shall clearly state the limitations in motor cable distance with the proposal. If an output filter is required to mitigate reflected waves, or to meet any special requirements of the application, it must be integral to the VFD controller.
5. If output filters are used in the variable frequency drive, a selective harmonic elimination (SHE) switching technique must be available to eliminate a potential harmonic resonance in the operating speed range.
6. Variable frequency drive induced torque pulsations to the output shaft of the mechanical system shall be less than 1% to minimize the possibility of exciting a resonance.

G. Sizing

1. Loads shall be as shown on the drawings.

H. Definitions

1. The Drive Unit shall refer to the actual drive that will be mounted within the specified enclosure.
2. The Drive System shall refer to the drive unit and all items specified under Drive System Options.

2.2 DRIVE UNIT DESIGN

A. Hardware

1. The VFD shall be designed for a minimum availability of 99.9%.
2. The VFD shall be designed for a Mean Time Between Failures (MTBF) of 100,000 hours.
3. In order to optimize reliability and minimize complexity, inverter power switch component count shall be minimized by utilizing 6500V peak inverse voltage (PIV) rated devices, with double sided cooling and integral gate driver card. Preference will be given to designs exhibiting the lowest overall power component count.
4. The VFD shall have a control power monitoring system that monitors all power supply voltages and signals.
5. Fiber optic interface boards shall be used to provide gating and diagnostic feedback signals for power semiconductor devices. The diagnostic feedback system shall allow constant control of the

device as well as constant monitoring of device health and temperature feedback.

6. Field programmable gate arrays (FPGA) shall be utilized on drive control boards to provide high speed handling of diagnostics and fault handling routines. High speed digital control systems shall continuously monitor all hardware and software faults including sensing of all power circuit voltage and currents as well as any internal equipment faults.
7. Power switch device diagnostics shall detect and protect against device short, over or under gate voltage, loss of gating, loss of diagnostic feedback, heat sink temperature feedback as well as overload monitoring and protection.
8. Failed power switch components (SGCTs) shall be replaceable without removal of the entire power module. Special tools or force measuring transducers shall not be required. Failed power switch components shall be replaceable in less than 5 minutes. Power cells shall weigh less than 50lbs.
9. VFD components shall not require maintenance or replacement during the first 5 years of operation.

B. Control Logic

1. The VFD shall produce a variable voltage and variable frequency output to provide continuous operation over the application speed range.
2. The VFD shall be capable of operating with the output short circuited at full current.
3. The drive system shall provide controlled speed over the range specified. Speed accuracy within this range, expressed as a percent of top speed, shall be within 0.1% of base speed without encoder or pulse tachometer feedback (0.01% with encoder or pulse tachometer feedback).
4. The VFD shall have a “normal duty” rating of 100% continuous current with a short-time duty rating of 110% overload for one minute, once every 10 minutes (suitable for variable torque loads).
5. The variable frequency drive shall be capable of 100% breakaway torque without tachometer feedback.
6. For high inertia loads, a preference shall be given to variable frequency drives capable of regenerative motor braking.

2.3 DRIVE UNIT FEATURES

A. Control Mode

1. The variable frequency drive shall utilize sensorless direct vector control or full vector control, with pulse tachometer feedback, for optimum performance.

B. Auto Tuning

1. The variable frequency drive shall have a programmable auto tuning function.
2. The function shall be capable of being disabled.
3. The function shall be programmable for the following tuning options.
 - a. Commutation inductance
 - b. DC link time constant
 - c. Motor stator resistance
 - d. Motor leakage inductance
 - e. Flux regulator
 - f. Total Inertia

C. Starting Mode

1. The variable frequency drive shall offer two starting modes.
2. The S-Curve profile shall consist of both nonlinear and linear portions.
 - a. A parameter shall exist that specifies the duration that the drive is ramping in the non-linear portion.
 - b. A parameter shall define the total time to accelerate to rated speed in S-Curve.
3. The Ramp Mode shall be programmable with four ramp speed break points
 - a. The Ramp Mode shall have programmable acceleration and deceleration times.
 - b. The Ramp Mode shall have a parameter for Ramp Start Delay that specifies the time the speed reference remains at zero after the drive is started.

D. Stopping Mode

1. The variable frequency drive shall have three stop modes.
2. The Ramp Mode shall be programmable with four deceleration times.
3. In the Coast Mode, a programmable parameter shall be set to specify the speed at which the drive shuts off and coasts when stopping.
4. Regen Mode

E. Auto-Restart Capability

1. The VFD shall be capable of automatically restarting in the event of a momentary loss of power.
2. An automatic restart delay parameter shall be available in the drive with an adjustment range of 0 -10 seconds.

F. Flying Re-Start

1. The VFD shall be capable of restarting and taking control of a motor attached to a spinning load in the forward or reverse direction.

- G. Preset Speeds
1. The variable frequency drive shall have three (3) preset speeds.
 2. The preset speeds shall be programmable between 0.5 and 75.0 Hz.
- H. Skip Speeds
1. The variable frequency drive shall have three (3) skip speeds.
 2. The skip speeds shall be programmable between 1.0 and 75.0 Hz.
 3. The skip speeds shall have a programmable band width between 0.0 and 5.0 Hz.
- I. Ride Through
1. The VFD shall be capable of riding through a loss of power of 5 cycles.
 2. If specified, a UPS shall be supplied inside the VFD controller for an extended ride through of up to 2 minutes.
 3. The VFD system shall be capable of operating with a 30% voltage sag on the input power line. The motor shall not be allowed to reach a pull out condition.
- J. Load Loss Detection
1. The drive shall have a parameter to specify the response of the drive to a loss of load condition.
 2. The parameter shall have the following configuration options: disabled, warning or fault.
- K. Digital I/O
1. Sixteen (16) isolated digital inputs shall be available as standard on the drive.
 2. Sixteen (16) isolated digital outputs shall be available as standard on the drive.
 3. Digital I/O shall be rated 12V to 260V AC or DC.
- L. Fault Configuration
1. The variable frequency drive shall have fault classes that define the following.
 - a. Class of drive input protection
 - b. Class of rectifier magnetic protection
 - c. Class of dc link protection
 - d. Class of motor protection
 - e. Class of isolation transformer protection
 - f. Auxiliary trip class
 - g. External fault class
 2. Each fault class shall have the following configurations.
 - a. Disable the fault input

- b. The drive will shut down immediately
 - c. The drive will perform a controlled shutdown
 - d. The drive will not shutdown but a warning will be displayed
3. The variable frequency drive shall have fault and warning masks.

M. Protection Features

1. Fault information shall be accessible through the Human Interface
2. The variable frequency drive shall have the following minimum line side protective features.
 - a. Line current unbalance trip with programmable delay
 - b. Line overcurrent trip with programmable delay
 - c. Line overload warning and trip with programmable delay
 - d. Line overvoltage trip with programmable delay
 - e. Line undervoltage trip with programmable delay
 - f. Line voltage unbalance trip with programmable delay
 - g. Ground fault overvoltage trip with programmable delay
 - h. Ground Fault overcurrent trip with programmable delay
3. The variable frequency drive shall have the following minimum system level protective features.
 - a. DC Overcurrent trip with programmable delay
 - b. DC overvoltage trip with programmable delay
 - c. Rectifier heatsink temperature warning and trip
 - d. Cabinet temperature warning and trip
 - e. Inverter heatsink temperature warning and trip
 - f. Control Power warning and fault
 - g. Adapter (communication port) loss warning and fault
 - h. XIO adapter loss
4. The variable frequency drive shall have the following minimum load side protective features.
 - a. Ground fault overvoltage trip with programmable delay
 - b. Ground fault overcurrent trip with programmable delay
 - c. Machine side dc link overvoltage trip with programmable delay
 - d. Motor overcurrent trip with programmable delay
 - e. Motor overload warning and trip with programmable delay
 - f. Motor overvoltage trip with programmable delay
 - g. Motor stall delay
 - h. Motor overspeed trip with programmable delay
 - i. Motor flux unbalance trip with programmable delay
 - j. Motor current unbalance trip with programmable delay
 - k. Load loss level, speed and programmable delay

N. Metering

1. The variable frequency drive shall display metered parameters through the operator interface.
2. The variable frequency drive shall meter the following.
 - a. Root Mean Square value of the motor current
 - b. Root Mean Square value of the motor terminal voltage
 - c. Motor output power in kilowatts
 - d. Motor speed in revolutions per minute
3. The metered values shall be capable of being assigned to an analog output to drive an optional output meter.

2.4 DRIVE SYSTEM CONSTRUCTION

A. Structure (Air Cooled VFD's)

1. Enclosure
 - a. Air-cooled VFD enclosures shall be NEMA 1 (IP21). Door vents shall consist of louver-panel assemblies that can be removed from the front in order to replace air filters. Safety screens shall be located behind each louver panel. Cabinets and doors shall be fabricated using minimum 12 gauge (2.64 mm thick) steel for sturdy construction. All doors shall be gasketed to provide environmental protection and secure fits.
 - b. Door latches shall be heavy-duty ¼-turn type units which are operated with an Allen wrench. The converter cabinet door and cabling cabinet door shall be interlocked with upstream isolators or breakers with a key lock. Interlocking shall be fully coordinated to prevent access to all medium voltage compartments.
 - c. The VFD shall be designed for front access to allow for installation with no rear access. Equipment that requires rear or side access shall not be accepted.
2. Structure Finish
 - a. All variable frequency drive exterior metal parts (except for low voltage panel, external isolating switch handle assembly, lifting angles, lifting brackets and low voltage wireway cover) shall be painted with hybrid epoxy powder paint per manufacturer's standard color.
 - b. Low voltage panel, external isolating switch handle assembly, lifting angles, lifting brackets and low voltage wireway cover shall be painted with hybrid epoxy powder paint using manufacturer's standard color.
 - c. All metal back plates in the power cell and low voltage compartments shall be painted high gloss white for high visibility.

- d. Touch-up spray can(s), matching the enclosure color, shall be supplied.
 - e. Painting shall be done on a continuous paint line through air-atomized electrostatic spray. All parts shall be painted before assembly.
 - f. The preparation shall be Alkaline wash/rinse; iron phosphate rinse; iron-chrome sealer rinse; re-circulated de-ionized water rinse and virgin de-ionized water rinse
 - g. Total paint thickness – 0.002” (0.051 mm) minimum
 - h. Baking process shall be by Natural gas oven at 179°C (355°F) minimum.
 - i. All unpainted steel parts shall be plated with a zinc plate/bronze chromate process for corrosion resistance.
3. Cooling System (air cooled system)
- 1. The VFD system shall be air-cooled unless otherwise specified.
 - 2. Air-cooled VFDs shall be provided with a single, mixed flow cooling fan, mounted integral to the VFD enclosure. The VFD shall include air flow pressure switches and temperature detectors to monitor proper operation of the air cooling system. If a fan fails, the system must generate alarm indication of the fan failure. Vane type air flow switches are not acceptable.

G. Cabling

- a. The VFD shall contain a power cable termination assembly designed for easy termination and access to line and load cables. The termination assembly cabinet shall allow for top and bottom entry and exit of line and load cables.
- b. A low voltage wire way shall be provided at the top front of the VFD and shall be available with a removable cover.
- c. All power and control terminations and termination strips shall be identified in accordance with all schematics and wiring diagrams.
- d. Low voltage control wire shall be TEW tinned, 600 volt AC rated.

H. Harmonic Mitigation Techniques

- 1. VFDs shall comply with the latest edition of IEEE 519 Harmonic Guidelines.
- 2. Preference shall be given to drive systems that meet IEEE 519 harmonic guidelines with the lowest possible design complexity. The VFD supplier shall detail the number of main power components supplied in the VFD in the vendor’s proposal.
- 3. The following VFD rectifier solutions are acceptable:
 - a. PWM rectifier (Active Front End)

- I. Auxiliary Relays
 - 1. Provide relays for Drive Warning, Drive Fault, Drive Run and Drive Ready.
 - 2. Provide (2) additional relays to be wired per custom requirements.
 - 3. The relays shall consist of 2 form C contacts, 2N.O. & 2N.C. The relay contacts shall be rated for 115V AC/30V DC, 5.0 Amp resistive, 5.0 Amp inductive.

- J. Communications
 - 1. The VFD shall be provided with Ethernet IP digital communication capability.

- K. Isolated Analog Input and Output
 - 1. The analog interfaces shall be isolated.
 - 2. The analog signal interfaces shall be configurable for:
 - a. Speed reference input (4-20 mA input signal).
 - b. Speed output (4-20 mA output signal).

- L. Pilot Devices
 - 1. Pilot devices shall be NEMA Type 4/4X/13 and shall be mounted on the drive system enclosure door.
 - 2. Provide the operator interface devices, including but not limited to hand-off-auto and start-stop pushbuttons, as shown on the Contract Drawings.
 - 3. Provide pilot lights, mounted on the enclosure door, for indication of Ready, Run, Fault and Warning. Pilot lights shall be transformer type.
 - 4. Provide a NEMA Type 1/4/12, single turn speed pot mounted on the drive system enclosure door.

- M. Motor Run Time Meter
 - 1. Provide a digital, non-resettable, door-mounted elapsed time meter.
 - 2. The meter shall be electrically interlocked with the Drive Run relay and Bypass contactor (if required) to indicate actual motor operating hours.

- N. Operator Interface Module
 - 1. The VFD shall have a user-friendly operator interface terminal.
 - 2. The interface terminal shall have the following minimum features.
 - a. 10 Inch color touch screen with Windows CE 6.0 Operating System
 - b. Built in .pdf viewer that allows VFD specific drawings and manuals to be displayed on the interface screen
 - c. Option to be mounted locally at the VFD panel or remotely via EtherNet communication link

- d. User configurable analog metering for motor speed, load, torque, and voltage
- e. On screen operator interface devices for start, stop, E-Stop and speed control
- f. Elapsed time indication
- g. Extensive diagnostic functions that provide separate fault and warning queues in non-volatile memory that retain information under all conditions
- h. Ability to perform diagnostic and troubleshooting functions from a user supplied laptop computer
- i. On-line help that provides enhanced fault text messages
- j. Trend buffers for at least 8 variables that allow one-shot or multi-shot trending
- k. Multi-level (minimum of four levels) password access to ensure that only qualified personnel have access to critical parameters but still allow easy access to other levels of personnel
- l. Extended use of plain language messages to eliminate need to look up error codes or decipher the meaning of error messages
- m. Start-up wizard, including auto tuning, that is interactive and user-friendly

P. Motor Protection Options

- 1. Furnish and install a motor protective relay as specified in Section 26 24 19.

2.5 AC LINE REACTORS

- A. An AC line reactor shall be supplied as part of the VFD package. The VFD system with line reactor shall include common mode voltage protection for the motor. (special motor insulation shall not be required).
- B. Multi-secondary, phase shifting transformers are not acceptable.
- C. Line reactors shall be integral to the VFD line-up.
- D. The line reactor K-factor shall be designed for rectifier service (AFE rectifier).
- E. The line reactor shall be convection cooled with Class H insulation.
- F. The line reactor shall include thermal protection.

2.6 INPUT CONTACTOR WITH ISOLATION UNITS

- A. The medium voltage input contactor and isolation unit shall be provided with the following features:
1. Fixed mounted vacuum contactor
 2. The 400A units shall include one three-pole, gang-operated, non-load break isolating switch with one single external operating handle. Isolation switch is to be mechanically interlocked with the contactor and power cell doors.
 3. Three R-rated current-limiting power fuses.
 4. Bar type current transformers.
 5. Low voltage control panel complete with pilot control relays; control circuit fusing; DC economizing circuits; "Normal-Off-Test" circuit; receptacle for remote test supply; set of control circuit terminal blocks.
 6. Low voltage and power cell doors with viewing windows in both power cell doors to view the position of the isolating switches.

EXECUTION

3.1 TESTING AND INSPECTION

- A. Standard Testing
1. The following tests shall be carried out in accordance with applicable requirements and/or specifications of Canadian Standards Association (CSA), Underwriters Laboratories (cULus), National Electrical Manufacturers Association (NEMA), European Standard (EN), and International Electrotechnical Commission (IEC).
 2. Functional checks shall be performed wherever possible; otherwise, inspection and continuity checks shall be made.
 3. A "HI-POT" dielectric withstand test shall be performed on all buswork and cables from phase-to-phase and phase-to-ground (except solid-state components, low voltage controls and instrument transformers). The voltage level used for this test depends on the product's nominal AC voltage.
 4. Component devices shall be functionally operated in circuits as shown on electrical diagrams or as called for by specific test instructions.
 5. Instruments, meters, protective devices and associated controls shall be functionally tested by applying the specified control signals, current and/or voltages.
 6. Medium Voltage Drives shall be inspected for the following:
 - a. Control Power Failure Test
 - b. Rectifier Gating Checks
 - c. Inverter Gating Checks

- d. Line Converter Tests
 - e. Machine Converter Tests
 - f. Load Tests
 - 7. Cycle Testing
 - a. Drives shall be accelerated to the test motor's nominal frequency, under load on a dynamometer.
 - b. Drives shall be decelerated to 10 Hz and then accelerated back to test motor's nominal frequency with a ramp time of approximately ten seconds.
 - c. This cycle shall be repeated continuously for up to one hour.
 - 8. Load Testing
 - a. Drives shall be tested under load at the test motor's nominal frequency on a dynamometer. Testing on load banks not acceptable.
- B. Physical Inspection**
- 1. The product must meet all applicable engineering and workmanship standards and specifications. All components shall be verified against engineering documentation to be present and correctly installed.
 - 2. All bus and bus connections shall be checked for proper clearance, creepage, phasing, and torque.
 - 3. Warning plates, isolation barriers, and mechanical interlocks must provide sufficient safety/isolation for personnel and equipment.
 - a. Warning labels and nameplates must be present and in their specified positions to advise personnel of possible hazards.
 - b. Isolation barriers must be in place within the cabinet. Such barriers protect personnel from touching live medium voltage components in an area that otherwise does not have power supplied to it.
 - c. Operation of isolation switch handle and door interlocks must be verified. The interlocking prevents the opening of any medium voltage door on a medium voltage cabinet when the isolation switch handle has been moved to the full ON position.

3.2 MANUFACTURE'S FIELD SERVICES

- A. The service division of the variable frequency drive manufacturer shall perform all start-up services. The use of third party supplier start-up personnel is not allowed.
- B. Start-up of the variable frequency drives shall be coordinated with the start-up of the driven equipment, and other related equipment which may pertain to drive settings. The VFD field service representative shall be

available during the entire start-up procedure to adjust VFD settings as required for the entire system operation.

- C. Start-up personnel shall be direct employees of the variable frequency drive manufacturer and shall be degreed engineers.
- D. Provide a minimum of 4 days of on-site start-up service for each VFD.
- E. At a minimum, the start-up service shall include:
 - 1. Pre-Installation Meeting
 - a. The start-up plan
 - b. The start-up schedule
 - c. The drive's installation requirements
 - 2. Pre-Power Check
 - a. Inspect the drive's mechanical and electrical devices enclosed
 - b. Perform a tug test on all internal connections within the drive and verify wiring.
 - c. Verify critical mechanical connections for proper torque requirements.
 - d. Verify and adjust mechanical interlocks for permanent location.
 - e. Confirm all sectional wiring is connected properly.
 - f. Re-verify control wiring from any external control devices.
 - g. Set up all drive internal power supplies and thyristor control circuits.
 - h. Verify proper phasing from isolation transformer to drive.
 - i. Confirm cabling of drive to motor, isolation transformer and line feed.
 - j. Megger Motor Resistances.
 - 3. Drive Power-up and Commissioning
 - a. Apply medium voltage to the drive and perform operational checks.
 - b. Bump motor and tune drive to the system attributes
 - c. Run the drive motor system throughout the operational range to verify proper performance.
 - 4. Record all measurements
 - 5. Provide Drive Parameter Listing

3.3 TRAINING

- A. Manufacturer to provide on-site instruction as specified in Specification Section 26 05 05.
- B. The service engineer shall perform training.
- C. The manufacturer shall outline the training session duration and content.

- D. The basis of the training shall be the variable frequency drive, the engineered drawings and the user manual.
- E. The instruction shall include the operational and maintenance requirements of the variable frequency drive.
- F. At a minimum, the training shall:
 - 1. Review of the engineered drawings identifying the components shown on the drawings.
 - 2. Review starting / stopping and speed control options for the controller.
 - 3. Review operation of the Operator Interface for programming and monitoring of the variable frequency drive.
 - 4. Review cooling system operation.
 - 5. Review the maintenance requirements of the variable frequency drive.
 - a. Board replacement procedures
 - b. Power device replacement procedures
 - c. Fault analysis and troubleshooting
 - d. Preventative maintenance procedures
 - 6. Review safety concerns with operating the variable frequency drive.

++END OF SECTION++

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SECTION 26 41 00

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. Electrical equipment and connections associated with existing Flocculation/Sedimentation Basins.
 - 2. Interior electrical, lighting, etc. in the third floor area of the existing Filter Building, as called out on contract drawings.
 - 3. Electrical equipment and connections located within the existing Tunnel. Majority of equipment will be relocated.
- 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 USED)

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 1 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 utility service connections to equipment and areas to be demolished before starting demolition.
- B. Preserve in operating condition all active utilities transversing the project site. Protect all equipment that remains (electrical and mechanical) during demolition, and repair all damage caused by this work to satisfaction of Engineer.

3.3 APPLICATION

- A. Maintain the continuity of the existing branch circuits serving all existing light fixtures, receptacles, or equipment 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. At the discretion of the Owner, all existing switchgear, lighting fixtures, receptacles, control equipment and switches being removed shall be disposed of by the Contractor. Refer to 16050 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, and the Contractor shall turn over and store any such materials at the Owner's direction.
- B. All materials not turned over to Owner shall become property of Contractor and removed promptly from project site at no additional cost to the Owner. Any permits or fees for disposal shall be the responsibility of the Contractor.

3.5 CLEANUP

- A. Burn no materials or debris on premises.
- B. Remove from site rubbish and debris found thereon and, except as otherwise specified, materials and debris resulting from work of demolition. Leave site in safe and clean condition.

++ END OF SECTION ++

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SECTION 26 43 00

SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Instrumentation Surge Protection Devices
 - 1. Surge Protection Devices 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 40.
- B. Secondary Power Arrestors (480, 240, or 240/120 Volts a-c)
 - 1. Secondary power arrestors shall be furnished and installed on all control equipment supplied as outlined on the Contract Drawings.
- C. Surge Protection Devices (480, 240, or 240/120 Voltage)
 - 1. Surge Protection Devices shall be furnished and installed in all Power Distribution Panels and on all equipment supplied having solid state components as the central control/monitoring device. These shall included, but not be limited to, computer systems, level control systems, and/or variable speed equipment. They shall be shown on the Drawings where required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Secondary Power Arrestors
 - 1. "Dale," "General Electric," or equal.
- B. Hybrid Surge Protection Devices
 - 1. "Atlantic Scientific Corporation," "LEA Dynatech," "Current Technology," "Advanced Protection Technologies," or equal.

2.2 EQUIPMENT

- A. Secondary Power Arrestors
 - 1. The arrestor shall be hermetically sealed with pre-ionized spark gap. The unit shall be capable of repeated overvoltages without significant change in breakdown level or insulation resistance. The arrestor shall be capable of mounting in any position and shall be capable of mounting through a box knockout with standard locknuts, and shall be weatherproof.
 - 2. Capacitance shall be less than 50 picofarads, and insulation resistance shall be at least 100 megohms. Maximum arc-over with 10 KV/micro second

rise time pulse applied shall be 1,500 volts. The arrestor shall be capable of withstanding repeated application of 10 kiloampere current surges and extinguish power-follow current in 2 cycle or less. Maximum voltage between terminals shall be 2,500 volts when conducting 10 kiloampere current surges.

3. Operating temperature range shall be -40 degrees Celsius to +75 degrees Celsius.

B. Surge Protection Devices

1. The nominal operating voltage and configuration shall be as indicated on the contract drawings.
2. The maximum continuous operating voltage (MCOV) of all suppression components utilized in the unit shall not be less than 115% of the facility's nominal operating voltage.
3. SPD shall be UL labeled with 20kA Inominal (I-n) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
4. The system shall provide a noise filtering system capable of attenuating noise levels produced by electromagnetic interference and radio frequency interference. The system's filtering characteristics shall be expressed in decibels (dB) of attenuation per NEMA LS1 publication. The noise filtering system shall also be UL 1283 listed as an Electromagnetic Interference Filter.
5. The SPD unit, in the configuration required by this project (integral disconnect or no integral disconnect), shall have a minimum interrupt rating of 200kAIC.
6. NEMA LS-1-1992 (R2000) Clamping Voltage Data. The unit's clamping voltages shall be in compliance with test and evaluation procedures outlined in NEMA LS-1-1992 (R2000), paragraphs 2.2.10 and 3.10.
7. The unit shall be UL 1449 3rd Edition Listed. The UL 1449 2nd Edition suppressed voltage ratings (SVR) for the unit including integral disconnect shall be equal to or below the following values:

UL 1449 3rd Edition Suppressed Voltage Ratings (SVR)				
System Voltage	Mode of Protection			
	L-N	L-G	N-G	L-L
120/240	700	700	900	1000
120/208	700	700	500	700
277/480	1000	1200	1200	1800

8. Tested Single Pulse Surge Current Capacity.
 - a. 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% is not acceptable.

9. Minimum Repetitive Surge Current Capacity.
 - a. Per IEEE C62.41-1991 and C62.45-2002, the product shall be repetitive surge current capacity tested in every mode utilizing the following:
 - 1) 1.2 x 50 μ sec, 20 KV open circuit voltage, 8 x 20 μ sec, 10 kA short circuit current Category C3 combo-wave at one minute intervals without suffering either performance degradation or more than +10% deviation of clamping voltage at the specified surge current.
 - 2) The device shall be capable of surviving a minimum of 11,000 impulses without failure or performance degradation.
10. Service Entrance Suppressors
 - a. Equipment shall be a multi-stage parallel protector rated for 480Y/277. See online diagram and panelboard schedule to confirm voltages. The equipment's minimum surge current capacity shall be 200kA per mode (L-N, L-G, L-L and N-G).
 - b. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.
 - c. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug-in module or components shall be used in surge carrying paths.
 - d. Each protection module shall have a visual indicator that signifies that the protection circuitry is on line. The unit shall not be taken off line to verify integrity of system. Redundant status indicators shall be mounted on the front of the door that monitors the system protection circuitry (or be visible through the enclosure front).
 - e. The system shall be modular with field replaceable modules. Modular units shall contain a minimum of one module per phase.
 - f. Equipment shall utilize a NEMA 1 enclosure.
11. Panelboard Suppressors & Auxiliary Panel Suppressors
 - a. Device shall meet all specification requirements for service entrance suppressors except as follows:
 - 1) . Equipment shall be a multi-stage parallel protector rated for 480Y/277 or 208Y/120. See online diagram and panelboard schedule to confirm voltages. The equipment's minimum surge current capacity shall be 100kA per mode (L-N, L-G, L-L and N-G).
 - 2) . The system protection shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV).

Each MOV will be individually coordinated to pass UL 1449.
The unit shall be non-modular type.

- 3) . Equipment shall utilize a NEMA 1 enclosure.
12. Accessories
- a. Device Monitoring
 - 1) . As a minimum, device monitoring shall include: Audible alarm with alarm disable switch, surge counter, and two sets of Form C contacts for remote monitoring.
 - b. Integral Disconnect Switch
 - 1) The unit shall include an integral safety interlocked disconnect located in the unit enclosure with an externally mounted manual operator. If fuses are included with this switch, the fusing shall not effectively lower the rating of the SPD unit.

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 600VAC. 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 200kAIC. Connection means utilizing breakers shall be sized at 60A/3P and 30A/3P respectively for service entrance/switchboard/switchgear and branch panelboard units unless otherwise recommended by manufacturer.
- B. The specified SPD system shall be installed with #6 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 service entrance/switchboard/switchgear units and 1.5 electrical feet for branch panelboard units, and shall avoid any unnecessary or sharp bends. The input conductors are to be twisted together to reduce the SPD system inductance.
- C. The SPD shall be installed following the SPD manufacturer's recommended practices and in compliance with these specifications and all applicable codes.

3.2 WARRANTY

- A. Manufacturer shall provide a full 5-year limited warranty against failure or workmanship defects when installed in compliance to the manufacturer's written installation instructions, UL listing requirements and the National Electrical Code.

++ END OF SECTION ++

SECTION 26 50 00

LIGHTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The specific characteristics of the light fixtures to be furnished and installed shall be as detailed in the Light Fixture Schedule on the Contract Drawings. Should a fixture of a different type or manufacturer than that specified be submitted for the Engineer's review, it will be compared to that specified on: construction, dimensions, and photometrics. Failure to compare equally to what was specified will be grounds for rejection.
- B. The Contractor shall be prepared to submit sample equipment for appraisal when requested by the Engineer, and shall assume all transportation costs involved in the shipment and return of samples. All sample fixtures submitted shall be provided with lamps and shall be wired with cord and plug, to facilitate lighting for appraisal.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. All fixtures shall be delivered complete with suspension and mounting accessories, ballasts, diffusers, reflectors, etc., all wired and assembled. All accessory wiring shall be furnished and installed as shown on the Contract Drawings.
- B. All steel supports required for luminaires in addition to that furnished under the general building construction shall be furnished and installed by the Contractor.
- C. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.
- D. All outside luminaires shall be a type that will prevent insect accumulation inside the luminaire.
- E. Exterior luminaires shall be weatherproof and rustproof.
- F. Luminaire wire shall be fixture type of non-asbestos construction.

2.2 ENCLOSED AND GASKETED LED LUMINARE

- A. The fixture shall be constructed of one-piece fiberglass housing with continuous poured-in-place, closed-cell gasket, tool-less ballast and wiring access.
- B. The fixture shall house injection-molded, impact-resistant clear acrylic diffuser with frosted ends and side lineal prisms securely tethered to fixture for ease of maintenance.
- C. The fixture shall house high-efficiency LEDs mounted to core circuit board.
- D. The fixture shall include integral surge protection tested in accordance with IEEE/ANSI C62.41.2 to Category C Low.
- E. The fixture shall include a temperature sensing component that limits the temperature of the LEDs in case of excessive ambient temperatures or mis-application.
- F. The fixture expected service life shall be minimum of 60,000 hours at 80% lumen maintenance.
- G. Fixture shall have an option of ceiling or suspend mounted.
- H. Surface conduit entry provisions shall have watertight plugs.
- I. Mounting pendants and all associated hardware shall be provided.
- J. The fixture shall be suitable for wet location and NEMA 4X rated. IP65, IP66 and IP67 rated and certified to meet NSF Splash Zone 2. 1500 PSI hose-down.
- K. The LED driver(s) shall operate at 120VAC.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/ERECTION

A. General

- 1. The Contractor shall furnish all light fixtures, lighting equipment, components, hangers, etc., as shown on the Contract Drawings and shall install them at the locations shown on the Contract Drawings.
- 2. All fixture wiring shall be in conformance with the latest revision of the NEC and UL standards.

3. Locations of fixtures shall be coordinated with Engineer's reflected ceiling plans where they exist. Any conflicts between electrical plans and Engineer's reflected ceiling plans, the reflected plans shall override.

B. Luminaires

1. Fixtures shall be rigidly mounted against the surface of the ceiling unless otherwise noted on the Contract Drawings. Conduit runs to and between fixtures shall be rigid metallic type. Use of flexible conduit for connection to fixtures is prohibited, except where concealed above a suspended ceiling.
2. All ferrous metal surfaces of fixtures and plaster frames shall be treated and given rust inhibiting and finish coat adherence properties before final enamel coats are applied. Finish enamel coat shall be baked on at approximately 320° F.
3. Similar fixtures in each room or area shall be installed with bottom of fixtures at same elevation, unless otherwise noted.
4. Minimum wire size shall be AWG No. 10 for runs over 75 feet.
5. Outlets shall be as specified herein and shall be suitable for the installation conditions encountered.
6. Flexible fixture hangers shall be used for all pendant-mounted fixtures.
7. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits and junction boxes shall be supported from the structure.
8. No light fixtures shall be hung or installed until after painting is completed, however, temporary lighting shall be provided by the Contractor. Fixtures in suspended ceilings shall be fastened to the main tees of the ceiling grid for seismic considerations, although they shall be supported from the building structure.
9. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

++ END OF SECTION ++

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SECTION 40 05 05

EXPOSED PIPING INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to install and test all exposed piping, fittings, and specials. The Work includes the following:
 - a. All types and sizes of exposed piping, except where exposed piping installations are specified under other Sections or other contracts.
 - b. Unless otherwise shown or specified, this Section includes all piping beginning at the outside face of structures or structure foundations and extending into the structure. Piping embedded in concrete within a structure or foundation shall be considered as exposed and is included herein. Piping that is permanently or intermittently submerged, or installed in sub-aqueous environments, is considered as exposed and is included in this Section.
 - c. Work on or affecting existing exposed piping.
 - d. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all Work required for a complete exposed piping installation.
 - e. Supports, restraints, and other anchors.
 - f. Field quality control, including testing.
 - g. Cleaning and disinfecting.
 - h. Incorporation of valves, meters, and special items shown or specified into the piping systems per the Contract Documents and as required

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before exposed piping Work.
2. Coordinate with appropriate piping Sections of Division 40, Mechanical.

C. Related Sections:

1. Section 09 91 00, Painting.
2. Section 10 14 00, Signage.
3. Section 40 05 07, Pipe Hangers and Supports.
6. Section 40 05 96, Vibration, Seismic, and Wind Controls.

1.2 REFERENCES

- A. Standards referenced in this Section are:
1. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings
 2. ASME Boiler and Pressure Vessel Code.
 3. ASME B31.3, Process Piping.
 4. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Non-destructive Testing.
 5. ASTM A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
 6. ASTM B32, Specification for Solder Metal.
 7. ASTM D4161, Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
 8. ASTM D4174, Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems
 9. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
 10. AWS D1.1/D1.1M, Structural Welding Code-Steel.
 11. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 12. ANSI/AWWA C206, Field Welding of Steel Water Pipe.
 13. ANSI/AWWA C600, Installation of Ductile Iron Water Mains and Their Appurtenances.
 14. ANSI/AWWA C606, Grooved and Shouldered Joints.
 15. ANSI/AWWA C651, Disinfecting Water Mains.
 16. AWWA M9, Concrete Pressure Pipe.
 17. AWWA M11, Steel Pipe - A Guide for Design and Installation.
 18. AWWA M23, PVC Piping - Design and Installation.
 19. AWWA M41, Ductile-Iron Pipe and Fittings.
 20. AWWA M45, Fiberglass Pipe Design.
 21. AWWA M55, PE Pipe - Design and Installation.
 22. SAE J1227, Method for Assessing the Cleanliness Level of New Hydraulic Fluid.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Comply with requirements and recommendations of authorities having jurisdiction over the Work.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Detailed drawings in plan and, as applicable, section.
 - b. Details of piping, valves, supports, accessories, specials, joints, harnessing, and main anchor supports, and connections to existing piping, structures, equipment, and appurtenances.
 - 2. Testing Plans, Procedures, and Testing Limitations
 - a. Submit description of proposed testing methods, procedures, and apparatus, and obtain ENGINEER's approval prior to testing.

- B. Informational Submittals: Submit the following:
 - 1. Certificates:
 - a. Submit a certificate, signed by manufacturer of each product, certifying that product complies with applicable referenced standards.
 - 2. Source Quality Control Submittals:
 - a. Submit copies of testing report for each test.
 - 3. Site Quality Control Reports:
 - a. Submit copies of testing report for each test.

- C. Closeout Submittals: Submit the following:
 - 1. Record Documentation:
 - a. Maintain accurate and up-to-date record documents showing field and Shop Drawing modifications. Record documents for exposed piping Work shall show actual location of all piping and appurtenances on a copy of the Drawings, unless otherwise approved by ENGINEER.
 - b. Record documents shall show piping with elevations referenced to the project datum and dimensions from permanent structures. For straight runs of pipe provide offset dimensions as required to document pipe location.
 - c. Include section drawings with exposed piping record documents when the Contract Documents include section Drawings.
 - d. Conform to Section 01 78 39, Project Record Documents.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery:
 - 1. Deliver products to Site to ensure uninterrupted progress of the Work.
 - 2. Upon delivery, inspect pipe and appurtenances for cracked, gouged, chipped, dented, and other damage and immediately remove damaged products from Site.
 - 3. Conform to requirements of Section 01 65 00, Product Delivery Requirements.

B. Storage:

1. Store products for convenient access for inspection and identification. Store products off the ground using pallets, platforms, or other supports. Protect packaged products from corrosion and deterioration.
2. Pipe and fittings other than thermoplastic materials may be stored outdoors without cover. Thermoplastic pipe and fittings stored outdoors shall be covered.
3. Conform to requirements of Section 01 66 00, Product Storage and Handling Requirements.

C. Handling:

1. Handle pipe, fittings, specials, and accessories carefully with approved handling devices. Do not drop or roll material of delivery vehicles. Do not otherwise drop, roll, or skid piping.
2. Avoid unnecessary handling of pipe.
3. Keep pipe interiors free of dirt and foreign matter.
4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage. Repair damaged coatings.
5. Conform to requirements of Section 01 65 00, Product Delivery Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Piping materials are specified in the Exposed Piping Schedule at the end of this Section. Piping materials shall conform to Specification for each type of pipe and piping appurtenances in applicable sections of Division 40, Process Integration.
- B. Markings and Identification:
1. Pipe Markings:
 - a. Clearly mark each piece of pipe or fitting with a designation conforming to that shown on the approved Shop Drawings.
 - b. Manufacturer shall cast or paint on each length of pipe and each fitting the pipe material, diameter, and pressure or thickness class.
 2. Pipe Identification Markers and Arrows: Refer to Section 10 14 00, Signage.
- C. Appurtenances: Provide products that comply with:
1. Section 40 05 07, Pipe Hangers and Supports.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Install piping as shown, specified and as recommended by the pipe and fittings manufacturer.
2. If there is a conflict between manufacturer's recommendations and the Contract Documents, request in writing instructions from ENGINEER before proceeding.
3. Provide pipe manufacturer's installation specialist at Site as specified on this Section.

B. Temporary Blind Flanges, Plugs, Caps, and Bulkheads:

1. Temporarily plug installed pipe at the end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.
2. Install standard plugs in all bells at dead ends, tees, and crosses. Cap all spigot and plain ends.
3. Fully secure and block blind flanges, plugs, caps, and bulkheads installed for testing, designed to withstand specified test pressure.
4. Where plugging is required for phasing of Work or subsequent connection of piping, install watertight, permanent type blind flanges, plugs, caps, or bulkhead acceptable to ENGINEER.

C. Piping Installation:

1. Conform to manufacturer's instructions and requirements of standards and manuals listed in this Section, as applicable:
 - a. Ductile Iron Pipe: ANSI/AWWA C600, AWWA M41.
 - d. Thermoplastic Pipe: AWWA M23
2. Install straight runs true to line and elevation.
3. Install vertical pipe truly plumb in all directions.
4. Install piping parallel or perpendicular to walls of structures. Piping at angles and 45 degree runs across corners of structures will not be accepted unless specifically shown on the Contract Documents or approved by the ENGINEER.
5. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, and other obstructions.
6. Install piping to leave all corridors, walkways, work areas, and similar spaces unobstructed. Unless otherwise approved by ENGINEER provide a minimum

headroom clearance under piping and pipe supports of 7.5 feet. Clearances beneath piping shall be measured from the outermost edge of piping, flanges or other type of joint that extends beyond the nominal outside diameter of piping.

7. Protect and keep clean interiors, fittings, and valves of pipe that will convey potable water, chemicals, and other pipe designated by ENGINEER.
8. Cutting: Cut pipe from measurements verified at Site. Field cut pipe, where required, with a machine specially designed for cutting type of pipe being installed. Make cuts carefully without damage to pipe, coating, or lining, and with a smooth end at right angles to axis of pipe. Cut ends of push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.
9. Additional General Requirements for Thermoplastic Piping:
 - a. Utilize wide band supports as recommended by pipe manufacturer and approved by ENGINEER to minimize localized stresses.
 - b. Provide piping passing through walls with a sleeve of wearing material to prevent abrasion damage to piping.
 - c. Provide anchored supports at elbows, valves, bends in piping, and at connections to equipment and tanks.
 - d. Spacing of supports shall be in accordance with the manufacturer's published recommendations at maximum design operating temperature of pipe.
 - e. Provide U-clamps with wide band circumferential contact.
 - f. Provide guides on long runs of piping to maintain alignment and reduce chance of elastic failure of pipe. Space guides as recommended by pipe manufacturer.
 - g. Provide anchored supports to restrain joints that allow expansion. Minimize use of bellows style joints. Where required and approved by the ENGINEER provide bellows style joints with low axial force to take up pipe expansion. Flexible connectors may be used to absorb thermal movement when approved in writing by ENGINEER.

D. Jointing Pipe:

1. General:
 - a. Make joints in accordance with pipe manufacturer's recommendations and Contract Documents.
 - b. Cut piping accurately and squarely and install without forcing or springing.
 - c. Ream out pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.
 - d. Remove all cuttings and foreign matter from inside of pipe and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.
2. Ductile Iron Flanged Joints:
 - a. Assemble flanged joints using ring-type gaskets, with thickness as recommended by pipe manufacturer but not less than 1/8-inch thick, for raised-face flanges. Use full-face gaskets for flat-face flanges, unless

otherwise approved by ENGINEER or recommended by pipe manufacturer. Gaskets shall be suitable for the service intended in accordance with the manufacturer's ratings and instructions. Gaskets shall be properly centered.

- b. Tighten bolts in a sequence that provides equal distribution of bolt loads.
 - c. Length of bolts shall be uniform. Bolts shall not project beyond the nut more than 1/4-inch or fall short of the nut when fully taken up. Machine-cut ends of bolts to be neatly rounded. Do not use washers.
 - d. Prior to assembly of flanged joints, lubricate bolt threads and gasket faces.
 - e. Alternately tighten bolts 180 degrees apart to compress the gasket evenly.
 - f. After assembly, coat all bolts and nuts, except stainless steel bolts and nuts, with same coating specified in Section 09 91 00, Painting, for material of pipe and fittings being joined.
3. Thermoplastic Pipe Joints:
- a. Solvent Cement Welded Joints:
 - 1) Bevel pipe ends and remove all burrs before making joint. Clean pipe and fittings thoroughly. Do not make solvent cement joints if temperature is below 40 degrees F. Do not make solvent cement welded joints in wet conditions.
 - 2) Use solvent cement supplied or recommended by pipe manufacturer.
 - 3) Apply joint primer and solvent cement and assemble joints in accordance with recommendations and instructions of manufacturer of joint materials and pipe manufacturer.
 - 4) Implement appropriate safety precautions when using joint primers and solvent cements. Allow air to circulate freely through pipelines to allow solvent vapors to escape. Slowly admit fluid when flushing or filling pipelines to prevent compression of gases within pipes.
 - b. Threaded Joints:
 - 1) Cut pipe square and smooth and remove burrs or raised edges with a knife or file.
 - 2) Hold pipe firmly in a pipe vise. Protect pipe at the point of grip by inserting a rubber sheet or other material between pipe and vise.
 - 3) Thread pipe in accordance with pipe manufacturer's recommendations. Brush threads clean of chips and ribbons.
 - 4) After threading pipe, starting with second full thread, and continuing over thread length, wrap 100-percent virgin TFE (Teflon) thread tape in direction of threads. Overlap each wrap by one-half width of tape.
 - 5) After application of the TFE thread tape, screw fitting or coupling onto the pipe end to be joined and tighten by hand. Using a strap wrench only, further tighten connection an additional one to two threads past hand tightness.
 - c. Bell and Spigot Joints:
 - 1) Bevel pipe ends, remove all burrs, and provide a reference mark at correct distance from pipe end before making joint.
 - 2) Clean spigot end and bell thoroughly before making the joint. Insert

O-ring gasket while ensuring that gasket is properly oriented. Lubricate spigot with manufacturer's recommended lubricant. Do not lubricate bell and O-ring. Insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.

E. Installing Valves and Accessories:

1. Provide supports for large valves, flow meters, and other heavy items as shown or required to prevent strain on adjoining piping.
2. Position flow measuring devices in pipe lines so that they have the amount of straight upstream and downstream runs recommended by the flow measuring device manufacturer, unless specific location dimensions are shown.
3. Position swing check valves and butterfly valves so that they do not conflict with upstream and downstream elements of the piping system.

F. Unions:

1. Install dielectric unions where dissimilar metals are connected, except for bronze or brass valves in ferrous piping.
2. Provide a union downstream of each valve with screwed connections.
3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

G. Transitions from One Type of Pipe to Another:

1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

H. Closures:

1. Provide closure pieces, such as blind flanges and caps, shown or required to complete the Work.

3.2 THRUST RESTRAINT

- A. Provide thrust restraint on all pressure piping systems and where otherwise shown or specified.
- B. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Exposed Piping Schedule at end of this Section.

3.3 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown on Drawings is approximate.
2. Determine the true location of existing piping to which connections are to be made, crossed, and that could be disturbed, and determine location of other facilities that could be affected by the Work.

- B. Taking Existing Pipelines Out of Service:
 - 1. Conform to Section 01 14 16, Coordination with Owner's Operations.

- C. Work on Existing Pipelines:
 - 1. Cut or tap pipes as shown or required with machines and tools specifically designed for cutting or tapping pipelines.
 - 2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.
 - 3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.
 - 4. Conform to applicable requirements of Section 01 14 16, Coordination with Owner's Operations and Section 01 73 24, Connections to Existing Facilities.

3.4 PAINTING

- A. Field painting shall conform to Section 09 91 00, Painting.

3.5 FIELD QUALITY CONTROL

- A. Testing, General:
 - 1. Test all piping, except as exempted in the Exposed Piping Schedule.
 - 2. Notification:
 - a. Notify ENGINEER at least 48 hours prior to testing.
 - b. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.
 - 3. Conduct all tests in presence of ENGINEER.
 - 4. Remove or protect pipeline-mounted devices that could be damaged by testing.
 - 5. Provide all apparatus and services required for testing, including:
 - a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.
 - b. Temporary bulkheads, bracing, blocking, and thrust restraints.
 - 6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
 - 7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into the pipe being tested. CONTRACTOR shall provide fluid for other types of testing required.
 - 8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.
 - 9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of ENGINEER or OWNER. Repair of existing piping will be paid as extra work unless otherwise specified.

10. When testing existing chlorine gas and sulfur dioxide gas systems to the nearest isolation valve, provide a tee in the line adjacent to valve. Branch outlet on tee shall be provided with a valve and used for cleaning, testing, draining, and drying pipe. Unless otherwise indicated, existing chlorine or sulfur dioxide system shall not be shut down during testing or for installing tee and valve. Prior to placing the pipeline in service, valve on the branch outlet of tee shall be plugged or sealed with a blind flange or threaded plug. Repair damage to system as a result of this Work at no extra cost to OWNER.

B. Test Schedule:

1. Refer to the Exposed Piping Schedule for type of test required and required test pressure.
2. Unless otherwise specified, the required test pressures are at lowest elevation of pipeline segment being tested.
3. For piping not listed in Exposed Piping Schedule:
 - a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires a separate test.
 - b. Disinfect for bacteriological testing piping that conveys potable water.
4. Test Pressure:
 - a. Use test pressures listed in Exposed Piping Schedule.
 - b. If test pressure is not listed in Exposed Piping Schedule, or if a test is required for piping not listed in the Exposed Piping Schedule, test pressure will be determined by the ENGINEER based on the maximum anticipated sustained operating pressure and the methods described in the applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:

1. Preparation for Testing:
 - a. For thermoplastic pipe, follow procedures described in Section 7 of ANSI/AWWA Standard C605.
 - b. For other piping follow procedures described in AWWA Manual M9. A wetting period is not required for pipe that is not cement mortar-lined.
 - c. Prior to testing, ensure that adequate thrust protection is in place and all joints are properly installed.
 - d. Piping for Hydraulic Fluid, Lube Oil, and Diesel Fuel: Hydrostatically test system using the fluid with which system will function permanently. Allowable leakage is zero. For fluid power systems, manufacturer shall supervise installation and testing of system components, including field piping.
2. Test Procedure:
 - a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in the pipe being tested.

- b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.
 - c. Examine joints and valves, and make repairs to eliminate visible leakage.
 - d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
 - e. Timed test period shall not begin until after the pipe has been filled, exposed to the required wetting period, air has been expelled, and pressure stabilized.
 - f. Timed Test Period: After the stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure. For HDPE pipe, after three hour expansion phase, reduce test pressure by ten psig and do not add liquid. The test pressure shall then remain steady for one hour, indicating no leakage.
 - g. Pump from a test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at fifteen minute intervals for duration of test.
3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of the test pressure during timed test period. Allowable leakage rates for piping are:
- a. No Leakage: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.
 - b. Rates based on formula or table in AWWA Manual M41:
 - 1) Metal and fiberglass pipe joined with rubber gaskets as sealing members, including the following joint types:
 - a) Bell and spigot and push-on joints.
 - b) Mechanical joints.
 - c) Bolted sleeve type couplings.
 - d) Grooved and shouldered couplings.
 - c. Rates based on make-up allowance in AWWA Manual M9:
 - 1) Prestressed concrete cylinder pipe and other types of concrete pipe joined with O-ring rubber gasket sealing members.
 - d. Rates based on formula or table in ANSI/AWWA C605:
 - 1) Plastic pipe joined with O-ring gasket sealing members.
- D. Bacteriological Testing:
- 1. Bacteriological testing for potable water lines, finished water lines, and other piping per Exposed Piping Schedule, is specified in Article 3.6 of this Section.

3.6 CLEANING AND DISINFECTION

- A. Cleaning, General: Clean pipe systems as follows:
- 1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in a manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.

2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.
 3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with a five percent hypochlorite solution.
- B. Cleaning of Hydraulic and Fluid Power Oil Systems: Upon completion of field piping, but before connection to control components, hydraulic and fluid power oil systems shall be flushed and cleaned by circulating special flushing oil through the system. Flushing oil and procedures shall comply with ASTM D4174. System shall be cleaned such that internal contamination of system, when tested using procedures specified in SAE J1227, Section 2.3, shall not exceed the Allowable Cleanliness Level (ACL). Unless otherwise specified, ACL value shall be established by manufacturer of major hydraulic system components in accordance with SAE J1227, Section 9.1.
- C. Disinfection:
1. Disinfect all potable and finished water piping.
 2. A suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures may be considered for acceptance by ENGINEER.
 - a. Prior to disinfection, clean piping as specified and flush thoroughly.
 - b. Conform to procedures described in ANSI/AWWA C651. Continuous feed method of disinfecting shall be used, unless alternative method is acceptable to ENGINEER.
 3. Water for initial flushing, testing, and disinfection will be furnished by OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances, and services required. Cost of water required for re-disinfection will be paid by CONTRACTOR to OWNER at the water utility's standard rates.
 4. Chlorine shall be provided by CONTRACTOR.
 5. Bacteriologic tests will be performed by OWNER. A certified test laboratory report will be provided to CONTRACTOR, if requested.
 6. Chlorine concentration in the water entering the piping shall be between 50 and 100 ppm, such that a minimum residual concentration of 25 mg/l remains after a 24-hour retention period. Disinfect the piping and all related components. Repeat as necessary to provide complete disinfection.
 7. After required retention period, the chlorinated water shall be flushed to a closed drain line, unless otherwise directed by ENGINEER. Properly dispose of chlorinated water in accordance with applicable regulations. Do not discharge chlorinated water to storm sewers, ditches, or overland.

3.7 EXPOSED PIPING SCHEDULE

- A. The schedules listed below, following the “End of Section” designation, are a part of this Specification section.
 - 1. Table 40 05 05-A, Exposed Piping Schedule.

++ END OF SECTION ++

**TABLE
40 05 05-A, EXPOSED PIPING SCHEDULE**

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/ Thickness	Joint	Test	Remarks
FW	ALL	DI	CL	P	CLASS 53	FLG	HYD (150 psig) DBT	
AVD	4	PVC	--	--	SCHEDULE 80	FLG	NR	
D	ALL	PVC	--	--	SCHEDULE 80	SW	NR	

The following abbreviations are used in the Exposed Piping Schedule.

A. Service Abbreviations

Service	Abbrev.		Service	Abbrev.
Finished Water	FW		Drain	D
Air Valve Drain	AVD			

B. Material Abbreviations

Material	Abbrev		Material	Abbrev.
Ductile Iron	DI		Polyvinyl Chloride	PVC

C. Lining/Coating Abbreviations

Lining	Abbrev		Coating	Abbrev.
Cement Mortar Lined	CL		Painted	P

D. Joint Abbreviations

Joint Type	Abbrev		Joint Type	Abbrev.
Solvent Weld	SW		Flanged	FLG

E. Test Abbreviations

Test	Abbrev		Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ()		Disinfection and Bacteriological Testing	DBT
No Test Required	NR			

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SECTION 40 05 06

COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all couplings, adapters, and specials for process piping.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before couplings, adapters, and specials for process piping Work.

C. Related Sections:

1. Section 09 91 00, Painting.
3. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
2. ANSI B16.39, Malleable Iron Threaded Pipe Unions.
3. ASME B31, Standards of Pressure Piping.
4. ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-dipped, Zinc-Coated, Welded and Seamless.
5. ASTM A105/A105M, Specification for Carbon Steel Forgings and Piping Applications.
6. ASTM B169/B169M Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar.
7. ASTM B650, Specification for Electro-Deposited Engineering Chromium Coatings of Ferrous Substrates.
8. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
9. AWWA C606, Grooved and Shouldered Joints.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer shall have at least five years experience producing substantial similar products to those specified and shall be able to provide documentation

of at least five installations in satisfactory operation for at least five years each.

- B. Component Supply and Compatibility:
1. Obtain each type of coupling, adapter, and special for process piping product included in this Section, regardless of component manufacturer, from a single couplings, adapters, and specials manufacturer.
 2. Supplier shall prepare, or review, and approve all submittals for components furnished under this Section.
 3. Components shall be suitable for specified service conditions and be integrated into overall assembly by the Supplier.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
1. Shop Drawings:
 - a. Submit piping layout Shop Drawings in accordance with Section 40 05 05, Exposed Piping Installation.
 2. Product Data:
 - a. Submit product data on each type of coupling, expansion joint, and other piping specialties and accessories, including gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.
- B. Informational Submittals: Submit the following:
1. Certificates:
 - a. When requested by ENGINEER submit certificate attesting to compliance with standards referenced in this Section, signed by manufacturer.
 2. Manufacturer's Instructions:
 - a. Provide instructions for handling, storing, installing, and adjusting of products.
 3. Source Quality Control:
 - a. When requested by ENGINEER, submit results of source quality control tests.
 4. Qualifications Statements:
 - a. Submit qualifications of manufacturer when requested by ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer Section 40 05 05, Exposed Piping Installation.

PART 2 – PRODUCTS

2.1 TAPPING SLEEVES

- A. Fabricated Steel Tapping Sleeves:
1. Pressure and Service: Same as connected piping.
 2. Products and Manufacturers: Provide products of one of the following:
 - a. Style FTS420, as manufactured by Romac Industries, Inc.
 - b. Or equal.
 3. Material: Carbon Steel, Grade A36.
 4. Gaskets: Suitable for specified service, as recommended by manufacturer.
 5. Bolts and Nuts: Trackhead bolts, heavy hex nuts, Type 304 stainless steel.
 6. Outlet Gaskets: SBR per ASTM D 2000, compounded for water service use. For 3”-12” size-on-size flanges, the gaskets are reinforced with a metal ring. Larger than 12” size-on-size sleeves use a square profile o-ring NBR per ASTM D2000 set in a full body thickness cavity.
 7. Test Plug: 3/4-inch NPT type 304 stainless steel test plug.
 8. Flange Gaskets: 3”-12” full face SBR per ASTM D 2000, compounded for water service use.
 9. Coating: Per Section 09 91 00, Painting.
 10. Flange: AWWA Class “D” plate flange, ANSI Class 150 Drilling, proper recessing for tapping valves.

2.2 PAINTING

- A. Shop Painting:
1. Clean and prime-coat ferrous metal surfaces of products in the manufacturer’s shop in accordance with Section 09 91 00, Painting, unless otherwise specified in this Section
 2. Coat machined, polished and non-ferrous surfaces bearing surfaces and similar unpainted surfaces with corrosion prevention compound that shall be maintained during storage and until products are placed into operation.
- B. Field painting shall conform to Section 09 91 00, Painting.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect materials for defects in material and workmanship. Verify compatibility of products with pipe, fittings, valves, and appurtenances.

3.2 INSTALLATION

- A. Installation:
 - 1. Install piping specialties in accordance with the Contract Documents and manufacturer's instructions.
 - 2. For exposed installations, refer to Section 40 05 05, Exposed Piping Installation.

- B. Adjust expansion joints as required to ensure that expansion joints will be fully extended when ambient temperature is at minimum operating temperature, and fully compressed at maximum operating temperature for the system in which expansion joints are installed.

++ END OF SECTION ++

SECTION 40 05 07

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required to design, furnish, and install all hangers, supports and appurtenances necessary to complete the Work.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the pipe hangers and supports Work.

C. Related Sections:

1. Section 03 00 05, Concrete.
2. Section 05 05 33, Anchor Systems
3. Section 05 50 13, Miscellaneous Metal Fabrications.
4. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American Society for Testing and Materials, (ASTM).
 - a. ASTM A 575, Specification for Steel Bars Carbon, Merchant Quality, M-Grades.
 - b. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
2. Federal Specification, (FS).
 - a. FS A-A-1192, Hangers, Pipe.
3. Manufacturers Standardization Society of the Valve and Fittings Industry, (MSS).
 - a. MSS SP 58, Pipe Hangers and Supports-Materials, Design and Manufacture.
 - b. MSS SP 69, Pipe Hangers and Supports - Selection and Application.
4. Underwriters' Laboratories, Inc., (UL).
 - a. UL 203, Pipe Hanger Equipment for Fire Protection Service.

1.3 QUALITY ASSURANCE

- A. Each type of pipe hanger or support shall be the product of one manufacturer.
- B. Component Supply and Compatibility:
 - 1. Obtain all equipment included in this Section regardless of the component manufacturer from a single pipe hangers and supports manufacturer.
 - 2. The pipe hangers and supports equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
 - 3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the pipe hangers and supports equipment manufacturer.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Detailed drawings showing all hangers and supports for each piping system specified. Shop Drawings shall show location, installation, material, loads or forces, and deflection of all hangers and supports.
 - b. Each pipe system shall be analyzed for all loads and forces on the hangers and supports. Provide calculations of reaction forces to the structure to which they are fastened. Provide confirmation that hanger systems comply with support requirements and codes.
 - c. Submit and coordinate these with Shop Drawings required for all piping systems.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
 - 1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.
- B. Storage and Protection:
 - 1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 - 2. Store materials in covered storage off the ground and prevent condensation.
- C. Acceptance at Site:
 - 1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Hangers and supports shall meet with the following requirements:
1. Standard and fabricated hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and other accessories.
 2. Generally, run piping in groups where practicable and parallel to building wall. Provide minimum clearance of 1-inch between pipe and other work.
 3. Install hangers or supports at all locations where pipe changes direction.
 4. All hangers and supports shall be capable of adjustment after placement of piping.
 5. Different types of hangers or supports shall be kept to a minimum.
 6. All suspended or supported ductile iron pipe shall have a hanger or support adjacent to each hub.
 7. Support vertical piping at each floor and between floors by stays or braces to prevent rattling and vibration.
 8. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.
 9. Maximum support spacing unless otherwise shown or approved for standard weight steel pipe shall be as follows:

Pipe Size (inches)	Maximum Pipe Span ¹ (feet)			
	Steel	Copper	Plastic ²	Cast/Ductile Iron ⁴
3/8 to 3/4	5	6	Cont. ³	-
1	6	6	5	-
1-1/4	6	6	5	-
1-1/2	6	6	5	-
2	10	10	5	-
2-1/2	10	10	5	-
3	10	10	5	-
4	12	12	5	12 feet for pressure pipe
6	12	12	5	
8	12	12	5	
10	12	-	5	
12	12	-	10	
14	12	-	-	
16	12	-	-	10 feet for soil pipe
18	12	-	-	
20	12	-	-	
24	12	-	-	

¹Pipe shall not have pockets formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.

²Span shown is for Schedule 80 CPVC pipe at 100°F. Spans for other plastics, other CPVC pipe Schedules and pipes at higher temperatures shall be shortened in accordance with the pipe manufacturer's recommendations.

³Continuous means pipe shall be in unistrut or similar channel.

⁴Pipe hanger and support selection shall be as shown and in this Section.

10. Maximum support spacing, unless otherwise shown for plastic pipe at ambient temperature, shall be one-half of the values specified for steel pipe.
11. Plastic pipe at temperature greater than 130°F shall be continuously supported in a metal cradle or tray.
12. Where proper hanger or support spacing does not correspond with joist or rib spacing, structural steel channels may be attached to joists or ribs and pipes suspended there from.
13. Prevent contact between dissimilar metals when supporting copper tubing, by use of copper plated, rubber or vinyl coated, or stainless steel hangers or supports.
14. Isolate thin walled stainless steel piping from carbon steel by use of plastic coated hangers or supports or by taping at points of contact with PVC or vinyl.
15. Supports and hangers shall be of a material that is compatible with the fluid being conveyed in such pipe being supported.
16. Anchors for pipe support systems shall be compatible or protected by a coating system which is compatible with the fluid being conveyed in such pipe being supported.

B. Expansion compensation shall be designed for individual exposed piping systems with the following Design Criteria:

1. $\Delta L = L \times \Delta T \times \alpha$
 - a. Where ΔL = pipe length change (inches).
 - b. L = pipe length between anchors (inches).
 - c. $\Delta T = 100$ (F).
 - d. α = coefficient of thermal expansion (inches/inches/F).
2. Expansion compensation shall be designed as an integral part of the piping hanger, support and anchorage system.
3. Expansion compensation shall be achieved via expansion joints specified in Section 40 05 06, Couplers, Adapters, and Specials for Process Piping.

2.2 HANGERS AND SUPPORTS

A. Hangers and supports where shown shall be in accordance with detail drawings. Hangers and supports not shown shall be in accordance with MSS SP 58.

B. Products and Manufacturers: Provide one of the following:

Type	Description	Manufacturers
Adjustable wrought clevis	Hangers, ½ inch through 30 inch Pipe	Figure 260 by Grinnell Figure B3100 or B3102 by B-Line
Carbon Steel Pipe Clamp	Riser Clamps, ½ inch through 30 inch Pipe	Figure 261 by Grinnell. Figure B3373 by B-Line
Cast iron saddle	Pipe Saddles, 1-1/2 inch through 36 inch Pipe	Figure 258 by Grinnell Figure B3095 by B-Line
Cast iron saddle with steel yoke and nuts	Pipe Stanchion Saddle, 2-1/2 inch through 36 inch Pipe	Figure 259 by Grinnell Figure B3090 by B-Line
Cast iron saddle and reducer with nipple	Adjustable Pipe Saddle Support, 2-1/2 inch through 36 inch Pipe	Figure 264 by Grinnell Figure B3093 by B-Line
Fabricated heavy duty steel bracket	Wall Brackets, ½ inch through 36 inch Pipe	Figure 199 by Grinnell Figure B3067 by B-Line
Channel Type Pipe Support	Hot dip galvanized steel conforming to ASTM A 570, Grade 33, 1-5/8 inches by 1-5/8 inches by 12 gauge	Figure PS200 by Grinnell
O.D. Tubing Clamp	Strut mounted clamp	Figure PS1200 by Grinnell Figure B2000 by B-Line
Horizontal pipe support at flange	Flange support. Connecting flange must meet ANSI B16.1 Class 125 and ANSI B16.5 Class 155 standards	Figure B3094 with B3088 base Stand by B-Line

2.3 ACCESSORIES

- A. Hanger rods shall be made from ASTM A 575, with square head nut on top and running thread on bottom end.
- B. Brackets:
 - 1. Brackets for wall mounting shall conform to MSS SP 58 Type 32.

2.4 PAINTING

- A. Clean and prime ferrous metal surfaces in the shop in accordance with the requirements of Section 09 91 00, Painting.
- B. Field painting shall conform to the requirements of Section 09 91 00, Painting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate hangers, supports, and accessories to support piping, valves, and at all concentrated loads.
- B. Locate hangers, supports, and accessories within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.
- C. Locate hanger, supports to prevent vibration or swaying and to provide for expansion and contraction.
 - 1. Temperature differential specified in this Section.
 - 2. Support piping independently so that equipment is not stressed by piping weight or expansion.
 - 3. For Uninsulated Copper Pipe or Tubing: Clamps and supports, electroplated copper finish. Instrumentation tubing shall be supported in steel or aluminum troughs with covers. All tubing layout and connections shall be as approved by the manufacturer of the equipment.
 - 4. Uncoated Hangers, Rods and Supports: Dip in zinc chromate primer before installation.
 - 5. Maximum spacing for horizontal piping:
 - a. Steel 1-Inch and Smaller: Seven feet.
 - b. Steel 1-1/2-Inch and Larger: Ten feet.
 - c. Brass or Copper 3-Inch and Smaller: Seven feet.
 - d. Brass or Copper 4-Inch and Larger: Ten feet.
 - e. Additional supports at:
 - 1) Change in direction.
 - 2) Branch piping and runouts over five feet.
 - 3) Concentrated loads due to valves, strainers or other similar items.
 - f. Maximum support spacing for plastic pipe at ambient temperature shall be one-half the above values.
 - 6. Hanger types for horizontal piping, except as noted and shown:
 - a. Forged steel adjustable clevis type, rod support for all services.
 - b. Slide Bases:
 - 1) Pipe stand, brackets, trapeze or other equivalent structural support.
 - 2) For piping 2-inches or larger.
 - c. For pipe and covering provide:
 - 1) Saddles for rollers or slide bases.
 - 2) Protective shields or saddles for all other types of supports.
 - d. Threaded Steel Rods:
 - 1) Two inch vertical adjustment with two nuts each end for positioning and locking.
 - 2) Size hanger rods according to the schedule below, unless otherwise noted:

Nominal Pipe (Inches)	Rod Diameter (Inches)
2 and less	3/8
2-1/2 to 3-1/2	1/2
4	5/8
6	3/4
8 through 12	7/8
14 through 18	1
20 through 30	1-1/4

- 3) For Double Rod Hangers: One size smaller than above.
- 4) Connection to Structure for Piping to 2-Inches: Concrete inserts, or expansion shields in shear into sides of beams.
- 5) Connection to Structure for Piping 2-1/2-Inch or Larger: Concrete inserts, beam clamps or suitable bridging.

- 7. Vertical Piping:
 - a. Base Support: Base elbow or welded equivalent.
 - 1) Bearing plate on structural support.
 - b. Guides not to exceed:
 - 1) 25 feet for piping to 2-inches.
 - 2) 36 feet for piping 2-1/2-inches or larger.
 - c. Top Support:
 - 1) Special hanger or saddle in horizontal connection.
 - 2) Provisions for expansion.
 - d. Intermediate Supports: Steel pipe clamp at floor.
 - 1) Bolted and welded to pipe.
 - 2) Extension ends bearing on structural steel or bearing plates.
 - e. For Multiple Pipes: Coordinate guides, bearing plates and accessory steel.
- 8. Insulated Piping:
 - a. Horizontal Pipe Shields at Supports:
 - 1) Minimum 120 degree arc.
 - 2) Length equal to diameter of insulation 12-inch minimum.
 - 3) To 6-Inch Pipe Size: No. 18 USSG galvanized steel.
 - b. Vertical Pipe Shields at Guides:
 - 1) Full 360 degree arc, securely banded.
 - 2) Length equal to diameter of insulation, 12-inch minimum.
 - 3) To 6-Inch Pipe Size: No. 18 USSG galvanized steel.

- D. Install items to be embedded before concrete placement.
- E. Fasten embedded items securely to prevent movement during concrete placement.
- F. Anchor Systems: Shall be in accordance with Section 05 05 33, Anchor Systems, and the requirements of this Section.

- G. Install hangers and support units on piping systems in accordance with manufacturer's recommendations.
- H. Adjust hangers and supports and place grout for concrete supports to bring pipelines to specified elevations.
- I. Bring all pipe systems up to operating pressures and temperatures. Cycle systems to duplicate operating conditions. Correct all support malfunctions.

++ END OF SECTION ++

SECTION 40 05 08

WALL PIPES, FLOOR PIPES, AND PIPE SLEEVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all floor pipes, pipe sleeves, wall pipes, other wall pieces, and escutcheons to complete the Work.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate with the installation of floor pipes, pipe sleeves, wall pipes, other wall pieces and escutcheons that must be installed with or within formwork, walls, partitions, ceilings and panels.

C. Related Sections:

1. Section 03 00 05, Concrete.
2. Section 07 92 00, Joint Sealants.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American National Standards Institute, (ANSI).
 - a. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
 - b. ANSI B16.4, Gray-Iron Threaded Fittings.
2. American Water Works Association, (AWWA).
 - a. AWWA C104 (ANSI A21.4), Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - b. AWWA C110 (ANSI A21.10), Ductile-Iron and Gray-Iron Fittings, for Water.
 - c. AWWA C111 (ANSI A21.11), Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - d. AWWA C115 (ANSI A21.15), Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - e. AWWA C151 (ANSI A21.51), Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - f. AWWA C200, Steel Water Pipe 6-Inches and Larger.

1.3 QUALITY ASSURANCE

- A. Component Supply and Compatibility:
 - 1. Obtain all equipment included in this Section regardless of the component manufacturer from a single wall pipes, floor pipes and pipe sleeves manufacturer.
 - 2. The wall pipes, floor pipes and pipe sleeves manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
 - 3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the wall pipes, floor pipes and pipe sleeves manufacturer.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Detailed drawings and data on all wall and floor pipe, and pipe sleeves. Submit and coordinate these with Shop Drawings required for all piping systems.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements of Section 40 05 05, Exposed Piping Installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Mechanical Seals: Provide link type mechanical seals suitable for 20 psi working pressure, corrosive service and accessible from one side, with glass-reinforced nylon pressure plate and stainless steel bolts and nuts.
 - 1. Products and Manufacturers: Provide one of the following:
 - a. Link-Seal, as manufactured by Thunderline Corporation.
 - b. Or equal.

- E. Floor, Wall and Ceiling Plates:
 - 1. Bare pipes passing through floors, walls and ceilings in finished rooms: Provide escutcheon plates of cast brass or cast-iron nickel plated, clevis or split ring and hinged with set screws.
 - 2. Provide plated escutcheon plates of 18-gauge steel for insulated pipes passing through walls and ceilings in finished rooms.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mechanical Seals: Install as shown and in accordance with approved Shop Drawings.
- B. Install floor, wall and ceiling plates in accordance with the manufacturer's recommendations and approved Shop Drawings.

++ END OF SECTION ++

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SECTION 40 05 19

DUCTILE IRON PROCESS PIPE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish ductile iron pipe and fittings.
2. Extent of piping is shown on the Drawings. Piping schedules in Section 40 05 05, Exposed Piping Installation, specify pipe service, diameter, material, lining, coating, pressure rating, joint type, and testing required.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before ductile iron pipe Work.

C. Related Sections:

1. Section 09 91 00, Painting.
2. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series.
2. ANSI B18.2.2, Square and Hex Nuts. (Inch Series).
3. ASTM A193, Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service.
4. ASTM A194, Specification for Carbon Steel and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
5. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
6. ASTM A354, Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.
7. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
8. ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.
9. ASTM C283, Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
10. ASTM D714, Test Method for Evaluating Degree of Blistering of Paints.
11. ASTM D792, Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
12. ASTM D5162, Discontinuity (Holiday) Testing of Non-Conductive Protective Coating on Metallic Substrates.

13. ASTM E96, Test Methods for Water Vapor Transmission of Materials.
14. ASTM G14, Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).
15. ASTM G62, Test Methods for Holiday Detection in Pipeline Coatings.
16. ASTM G95, Test Methods for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).
17. ANSI/AWWA C104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
18. ANSI/AWWA C110, Ductile Iron and Gray Iron Fittings for Water.
19. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
20. ANSI/AWWA C115, Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.
21. ANSI/AWWA C116, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings for Water Service.
22. ANSI/AWWA C151, Ductile Iron Pipe, Centrifugally Cast, for Water.
23. ANSI/AWWA C153, Ductile Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch for Water Service.
24. ANSI/AWWA C606, Grooved and Shouldered Type Joints.
25. European Standard (EN), EN 598: Ductile Iron Pipe, Fittings, Accessories and Their Joints for Sewerage Applications.
26. MSS-SP 60, Connecting Flange Joint Between Tapping Sleeves and Tapping Valves.
27. NACE RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
28. NAPF 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
29. NSF/ANSI 61, Drinking Water System Components - Health Effects.
30. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
31. SSPC Painting Manual, Volume 1, Para. XIV.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:
 - a. Manufacturer shall have a minimum of five years successful experience producing ductile iron pipe and fittings and shall be able to show evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.
 - b. Lining and coating products shall be manufactured by a firm with a minimum of five years successful experience in protecting pipelines exposed to the specified service conditions , and shall be able to show evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.
 - c. When not applied by the manufacturer, lining and coating

Subcontractor shall have a minimum of five years successful experience in the application of the specified linings and coatings for similar applications for the specified service, and shall be able to show evidence of at least five installations in satisfactory operation in the United States.

B. Supply and Compatibility:

1. Unless otherwise approved, obtain all pipe, fittings, and appurtenances included in this Section from a single ductile iron pipe manufacturer.
2. Ductile iron pipe manufacturer shall review and approve or prepare all Shop Drawings and other submittals for pipe, fittings, and appurtenances furnished under this Section.
3. Pipe, fittings, and appurtenances shall be suitable for the specified service and shall be integrated into overall piping system by ductile iron pipe manufacturer.
4. Ductile iron pipe manufacturer shall be responsible for all products and all factory-applied linings and coatings, whether installed at pipe manufacturer's facility or at manufacturer's Supplier's facility.

C. Regulatory Requirements:

1. Pipe and fittings, including linings and coatings, that will convey potable water or water that will be treated to become potable, shall be certified by an accredited organization in accordance with NSF/ANSI 61 as being suitable for contact with potable water, and shall comply with requirements of authorities having jurisdiction at Site.

1.4 SUBMITTALS

A. Action Submittals: Submit the following with Shop Drawings required under Section 40 05 05, Exposed Piping Installation:

1. Shop Drawings:
 - a. Detailed drawings and data for pipe, fittings, gaskets, appurtenances, linings, and coatings.
2. Product Data:
 - a. Surface preparation and application reports and procedures as required for lining and coating of pipe and fittings. Ductile iron pipe and fitting manufacturer and manufacturer and applicator of lining and coating, as specified, shall mutually determine recommended surface preparation and application methods, and provide written verification of mutually selected method in the submittals.
3. Samples:
 - a. Submit Sample of pipe and fitting with each type of lining, for use at the Site to verify continuity, surface gloss, and color, as applicable, via visual inspection.
4. Test Procedures: For linings and coatings in pipe and fittings.

- B. Informational Submittals: Submit the following:
1. Certificates:
 - a. Submit certificate signed by manufacturer of each product that product conforms to applicable referenced standards and the Contract Documents.
 - b. Submit certificate signed by applicator of the linings and coatings stating that product to be applied conforms to applicable referenced standards and that the applicator shall conform to the Contract Documents.
 2. Source Quality Control Submittals:
 - a. Submit results of specified shop tests for pipe, fittings, linings, and coatings.
 - b. Lining and coating test coupons.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 40 05 05, Exposed Piping Installation.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. General:
1. Piping systems shall be suitable for their intended use.
 2. Joints shall be as specified in Section 40 05 05, Exposed Piping Installation. If not specified, provide flanged joints for exposed piping and push-on or mechanical joints for buried piping. Provide couplings on pipe with plain or grooved ends where shown or where approved by ENGINEER.
- B. Ductile Iron Pipe, Joints, and Fittings:
1. Flanged Pipe: Fabricate in accordance with ANSI/AWWA C115.
 - a. Pressure Rating: As specified in piping schedule in Section 40 05 05, Exposed Piping Installation. If not otherwise specified, use Special Thickness Class 53 for three-inch to 54-inch diameter pipe and Pressure Class 350 for 60-inch and 64-inch diameter pipe.
 2. Pipe Joints:
 - a. Flanged Joints: Conform to ANSI/AWWA C110 and ANSI/AWWA C111 capable of meeting the pressure rating or special thickness class, and test pressure specified in piping schedule in Section 40 05 05, Exposed Piping Installation.
 - 1) Gaskets: Unless otherwise specified, gaskets shall be at least 1/8-inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for the service conditions specified, specifically designed for use with ductile iron pipe and fittings.

- 2) Bolts: Comply with ANSI B18.2.1.
 - a) Exposed: ASTM A307, Grade B.
 - b) Buried or Submerged: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.
- 3) Nuts: Comply with ANSI B18.2.2.
 - a) Exposed: ASTM A563, Grade A, Heavy hex.
 - b) Buried or Submerged: ASTM A194, Grade B8M, Heavy hex, Type 316 stainless steel.
4. Flanged and Push-On Joint Fittings: Comply with ANSI/AWWA C110 and ANSI/AWWA C111.
 - a. Material: Ductile iron.
 - b. Pressure rating, gaskets, bolts, and nuts shall be as specified for flanged joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of the connected pipe.

C. Lining, General:

1. Typical Service Conditions:
 - a. Surface Preparation: Prepare surface in accordance with recommended method
2. Surface Preparation:
 - a. Initial Surface Inspection: Surface to be lined shall be inspected by pipe and fitting manufacturer and applicator, if applicator is other than pipe and fitting manufacturer. Inspecting parties shall inspect surface to be coated and mutually determine recommended surface preparation method.
 - b. Surface Preparation: Prepare surface in accordance with recommended method.
 - c. Finished Surface Inspection: Lining applicator shall inspect finished surface prior to application to determine acceptability. If surface is unacceptable, repeat surface preparation as necessary.

D. Cement-mortar Lining:

1. Where specified in piping schedules included with Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation, pipe and fittings shall be lined with bituminous seal coated cement-mortar lining in accordance with ANSI/AWWA C104.

E. Specials:

1. Transition Pieces:
 - a. Provide suitable transition pieces (adapters) for connecting to existing piping.
 - b. Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.
2. Taps:
 - a. Provide taps where shown or required for small-diameter piping or

- instrumentation connections.
 - b. Provide corporation stops where shown or required.
 - c. Where pipe wall thickness or tap diameter will not allow engagement of full threads, provide tapping saddle with outlet joints conforming to requirements of Paragraph 2.1.B.3.a of this Section for four-inch through 12-inch diameter pipe, and Paragraph 2.1.B.3.b. for 14-inch through 54-inch diameter pipe.
 - d. For flanged connections on tapping saddle outlet branch, counterbore flange in accordance with MSS SP-60 dimensions. Inside diameter of outlet shall be 1/4-inch greater than nominal diameter.
3. Tangential Outlets:
- a. Provide tangential outlet fittings where shown or indicated.
 - b. Weld-on fittings are acceptable.
 - c. Flanged and grooved end joints are not allowed.

2.2 MARKING FOR IDENTIFICATION

- A. In addition to identification markings specified in Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify push-on joint and mechanical joint pipe with:
- 1. Name or trademark of manufacturer.
 - 2. Weight, class or nominal thickness, and casting period.
 - 3. Country where cast.
 - 4. Year the pipe was produced.
 - 5. Letters "DI" or "Ductile" shall be cast or metal stamped
- B. In addition to identification markings specified in Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify flanged pipe with:
- 1. Flange manufacturer's mark, size, and letters "DI" cast or stamped on the flanges.
 - 2. Fabricator's mark if other than flange manufacturer.
 - 3. Length and weight.
- C. In addition to identification markings specified in Exposed Piping Installation, also stamp, mark, and identify fittings with:
- 1. Manufacturer's identification.
 - 2. Pressure rating.
 - 3. Nominal diameters of openings.
 - 4. Country where cast.
 - 5. Number of degrees or fraction of the circle on bends.
 - 6. Letters "DI" or "Ductile" cast on them.

2.3 EXTERIOR SURFACE PREPARATION AND COATINGS

- A. General Coating Requirements:
- 1. Coating types are specified in piping schedules in Section 40 05 05, Exposed

Piping Installation.

B. Exposed Pipe and Fittings:

1. Surface Preparation:
 - a. Initial Surface Inspection: Pipe and fitting manufacturer and coating applicator shall inspect surface to be coated and mutually determine recommended NAPF 500-03 surface preparation method.
 - b. Surface Preparation: Prepare surface in accordance with recommended NAPF 500-03 method.
 - c. Finished Surface Inspection: Prepared surfaces shall be inspected by coating applicator prior to application to determine acceptability of finished surface. If surface is unacceptable, repeat surface preparation and re-application as necessary.
2. After recommended surface preparation, prime coat exterior ferrous metal surfaces of pipe and fittings in the shop in accordance with Section 09 91 00, Painting.
3. Field painting shall comply with Section 09 91 00, Painting.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Inspect piping to assure that piping is free from defects in material and workmanship. Verify compatibility of pipe, fittings, gaskets, linings, and coatings.

3.2 INSTALLATION AND FIELD QUALITY CONTROL

- A. For exposed piping installation and testing, refer to Section 40 05 05, Exposed Piping Installation.

++ END OF SECTION ++

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SECTION 40 05 31

THERMOPLASTIC PROCESS PIPE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install thermoplastic piping and fittings.
2. Extent of piping is shown and shall be in accordance with piping schedules in Section 40 05 05, Exposed Piping Installation.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before thermoplastic piping Work.

C. Related Sections:

1. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. AASHTO, Standard Specifications for Highway Bridges.
2. ASTM D1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
3. ASTM D1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
4. ASTM D2464, Specification for Threaded Poly (Vinyl Chlorinated) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D2466, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
6. ASTM D2467, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7. ASTM D2513, Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
8. ASTM D2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
9. ASTM D2665, Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
10. ASTM D683, Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

11. ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM D3035, Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
13. ASTM D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
14. ASTM D3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
15. ASTM D3222, Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
16. ASTM D3261, Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
17. ASTM D3311, Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns.
18. ASTM D3350, Specification for Polyethylene Plastic Pipe and Fittings Materials.
19. ASTM D4101, Specification for Polypropylene Injection and Extrusion Materials.
20. ASTM F437, Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM F438, Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM F439, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
23. ASTM F441/F441M, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
24. ASTM F442/F442M, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
25. ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
26. ASTM F656, Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
27. ASTM F679, Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
28. ASTM F714, Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
29. ASTM F1055, Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
30. ASTM F1336, Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
31. ASTM F1674, Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
32. ASTM F1760, Specification for Coextruded Poly (Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content.

33. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.-12 In. (100 mm-300 mm), for Water Transmission and Distribution
34. AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
35. AWWA C905, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In.-48 In. (350 mm-1,200 mm).
36. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.
37. AWWA C907, Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm).
38. NSF 14, Plastic Piping Systems Components and Related Material.
39. ANSI/NSF 61, Drinking Water System Components - Health Effects.
40. Standards of U.S. Food and Drug Administration.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. **Manufacturer:** Shall have a minimum of five years experience producing thermoplastic pipe and fittings substantively similar to the materials specified, and shall be able to submit documentation of satisfactory service in at least five completed installations in operation for at least five years each.
2. **Installer:**
 - a. Engage a single pipe installer who shall be responsible for all thermoplastic pipe Work, and who shall employ only tradesmen with specific skills and experience in the type of Work required.
 - b. Installer shall have a minimum of five years experience installing thermoplastic pipe and fittings substantively similar to the materials specified and substantively similar to or larger than the scope of thermoplastic piping Work on the Project, and shall be able to submit documentation of satisfactory experience in at least five completed installations in operation for at least five years each.

B. Component Supply and Compatibility:

1. Obtain all materials included in this Section, regardless of component Supplier, from a single thermoplastic pipe Supplier. All pipe of each material type shall be furnished by the same manufacturer.
2. Thermoplastic pipe Supplier shall review and approve to prepare all Shop Drawings and other submittals for all materials furnished under this Section.
3. Materials shall be suitable for specified service conditions and shall be integrated into overall assembly by thermoplastic pipe Supplier.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Submit piping layout Shop Drawings in accordance with Section 40 05 05, Exposed Piping Installation.
 - 2. Product Data:
 - a. Submit product data on pipe, fittings, gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.

- B. Informational Submittals: Submit the following:
 - 1. Certificates:
 - a. Submit manufacturer's certificate of compliance standards referenced in this Section.
 - 2. Source Quality Control Submittals:
 - a. When requested by ENGINEER, submit results of source quality control tests.
 - 3. Qualifications Statements:
 - a. Submit qualifications of manufacturer when requested by ENGINEER.
 - b. Submit qualifications of installer when requested by ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 40 05 05, Exposed Piping Installation.

PART 2 – PRODUCTS

2.1 SERVICE CONDITIONS

- A. General:
 - 1. Pipe materials shall be suitable for services intended. Refer to piping schedules in Section 40 05 05, Exposed Piping Installation.
 - 2. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, and other defects. Unless otherwise shown or indicated, pipe shall be uniform in color, opacity, density, and other physical properties.
 - 3. Comply with NSF 14.
 - 4. Buried pipe shall be capable of withstanding external live load, including impact, equal to AASHTO H-20 loading, with cover shown or indicated on the Drawings.
 - 5. Pipe, fittings, and appurtenances in contact with potable water or water that will be treated to become potable shall be listed in ANSI/NSF 61 as being suitable for contact with potable water, and shall comply with requirements of the authorities having jurisdiction at the Site.

2.2 POLYVINYL CHLORIDE (PVC) PIPING

- A. PVC Pipe – General Applications: Unless otherwise shown or indicated, PVC pipe shall comply with the following:
1. Manufacturers: Provide products of one of the following:
 - a. Ipex, Inc.
 - b. Spears Manufacturing Company.
 - c. Or equal.
 2. Material: Unless otherwise specified, comply with the following:
 - a. Type and Grade: Type 1, Grade 1.
 - b. Wall Thickness: Schedule 80 complying with ASTM D1784 and ASTM D1785, and US Product Service PS 21-70 as having same outside diameter dimension as cast-iron pipe.
 - c. Temperature Rating: Rated for temperature to 140 degrees F.
 - d. Color: Gray.
 3. Fittings: Type, grade, schedule, and color of fitting shall match the associated pipe.
 - a. Solvent Weld: Comply with ASTM D2467.
 - b. Flanged: Provide flanged fittings with neoprene gaskets
 4. Joints:
 - a. Solvent Weld: Use primer and solvent cement recommended by PVC pipe manufacturer for the application. Primer shall be in accordance with ASTM F656, and solvent cement shall be in accordance with ASTM D2564.
 - b. Threaded: Use 100 percent virgin polytetrafluoroethylene (Teflon or PTFE) tape for threaded fittings. Pipe shall not be threaded.
 - c. Flanged: Provide with backup flange minimum 1/8-inch thick. Backup flanges and connecting bolts shall be Type 304 stainless steel.
- B. PVC Drain, Waste, and Vent (PVC-DWV) Pipe.
1. Manufacturers: Provide products of one of the following:
 - a. Chemtrol, manufactured by Nibco, Inc.
 - b. Spears Manufacturing Company.
 - c. Or equal.
 2. Material: In accordance with ASTM D1784. Unless otherwise shown or indicated, PVC-DWV pipe shall be:
 - a. Type and Grade: Type 1, Grade 1.
 - b. Wall Thickness: Schedule 40.
 - c. Color: White.
 3. Fittings: Manufactured in accordance with ASTM D2665 and ASTM D3311.
 - a. Solvent weld.
 - b. Spigot.
 4. Joints:
 - a. Solvent weld.
 - b. Threaded.

- C. Clear PVC Pipe (ARV Drain, Viewing Segment) – General Applications: Unless otherwise shown or indicated, PVC pipe shall comply with the following:
1. Manufacturers: Provide products of one of the following:
 - a. Ipex, Inc.
 - b. Spears Manufacturing Company.
 - c. Or equal.
 2. Material: Unless otherwise specified, comply with the following:
 - a. Type and Grade: Type 1, Grade 1.
 - b. Wall Thickness: Schedule 80 complying with ASTM D1784 and ASTM D1785, and US Product Service PS 21-70 as having same outside diameter dimension as cast-iron pipe.
 - c. Temperature Rating: Rated for temperature to 140 degrees F.
 - d. Color: Clear, Clear PVC shall comply with ASTM D1784 as Cell Classification of 12454-B.
 3. Fittings: Type, grade, schedule, and color of fitting shall match the associated pipe.
 - a. Solvent Weld: Comply with ASTM D2467.
 - b. Flanged: Provide flanged fittings with neoprene gaskets
 4. Joints:
 - a. Solvent Weld: Use primer and solvent cement recommended by PVC pipe manufacturer for the application. Primer shall be in accordance with ASTM F656, and solvent cement shall be in accordance with ASTM D2564.
 - b. Threaded: Use 100 percent virgin polytetrafluoroethylene (Teflon or PTFE) tape for threaded fittings. Pipe shall not be threaded.
 - c. Flanged: Provide with backup flange minimum 1/8-inch thick. Backup flanges and connecting bolts shall be Type 304 stainless steel.

2.3 IDENTIFICATION

- A. Pipe material identification requirements are in Section 40 05 05, Exposed Piping Installation.

2.8 SOURCE QUALITY CONTROL

- A. Shop Tests:
1. Pipe manufacturer shall maintain continuous quality control program.
 2. Where applicable and when requested by ENGINEER, submit results of source quality control tests specified in reference standards.
 3. CPVC plastic molding materials used for manufacturing pipe and fittings under this Section shall be tested for compliance with ASTM D1784.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect pipe materials for defects in material and workmanship. Verify compatibility of pipe and fittings.

3.2 INSTALLATION

- A. For exposed piping installation, refer to Section 40 05 05, Exposed Piping Installation.

++ END OF SECTION ++

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SECTION 40 05 53

PROCESS VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install process valves, four-inch diameter and larger, and appurtenances, complete and operational.
2. Valves for digester gas and air have been specifically identified. All other valves are for liquid service.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before process valves Work.

C. Related Sections:

1. Section 05 05 33, Anchor Systems.
2. Section 09 91 00, Painting.
3. Section 40 05 05, Exposed Piping Installation.

D. The following index of this Section is included for convenience:

Article Title

Part 1 - General

- 1.1 Description
- 1.2 References
- 1.3 Quality Assurance
- 1.4 Submittals
- 1.5 Delivery, Storage and Handling

Part 2 - Products

- 2.1 General
- 2.2 Rotary Pump Control Valves
- 2.3 Butterfly Valves
- 2.4 Air Release Valves
- 2.5 Appurtenances for Exposed Metallic Valves
- 2.6 Anchorages and Mounting Hardware
- 2.7 Tools, Lubricants, and Spare Parts

2.8 Painting of Exposed Valves, and Appurtenances

Part 3 - Execution

- 3.1 Inspection
- 3.2 Installation
- 3.3 Field Quality Control
- 3.4 Supplements

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American Bearing Manufacturers Association (ABMA).
2. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
3. ANSI B16.34, Valves-Flanged, Threaded and Welding end. (ASME B16.34).
4. ANSI/NSF 61 Drinking Water Components – Health Effects.
5. API STD 594, Check Valves, Flanged Lug, Wafer and Butt-Welding.
6. API STD 598, Valve Inspection and Testing.
7. API STD 609, Butterfly Valves: Double Flanged, Lug-Type and Wafer-Type.
8. ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
9. ASTM A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
10. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both.
11. ASTM A240/A240M, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
12. ASTM A276, Specification for Stainless Steel Bars and Shapes.
13. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
14. ASTM A351/A351M, Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts.
15. ASTM A380, Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems.
16. ASTM A536, Specification for Ductile Iron Castings.
17. ASTM A564/A564M, Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
18. ASTM A743/A743 M, Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
21. ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
22. ASTM B98/B98M, Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

24. ASTM B138/B138M, Specification for Manganese Bronze Rod, Bar and Shapes.
25. ASTM B265, Specification for Titanium and Titanium Alloy Strip, Sheet and Plate.
26. ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.
27. ASTM D429, Test Methods for Rubber Property - Adhesion to Rigid Substrates.
28. AWWA C500, Metal-Seated Gate Valves for Water Supply Service.
29. AWWA C501, Cast-Iron Sluice Gates.
30. AWWA C502, Dry-Barrel Fire Hydrants.
31. AWWA C504, Rubber-Seated Butterfly Valves.
32. AWWA C507, Ball Valves, 6-inch through 48-inch.
33. AWWA C508, Swing-Check Valves for Waterworks Service, 2-inch through 24-inch NPS.
34. AWWA C509, Resilient-Seated Gate Valves for Water Supply Service.
35. AWWA C540, Power-Actuating Devices for Valve and Slide Gates.
36. AWWA C550, Protective Interior Coatings for Valves and Hydrants.
37. AWWA Manual M49, Butterfly Valves: Torque, Head Loss, and Cavitation Analysis.
38. FS TT-C-494, Coating Compound, Bituminous, Solvent Type, Acid-Resistant.
39. NEMA MG 1, Motors and Generators.
40. ANSI/NSF 372, Drinking Water System Components – Lead Content.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Manufacturer shall have minimum of five years of experience producing substantially similar materials and equipment to that required and be able to provide evidence of at least five installations in satisfactory operation for at least five years.

B. Component Supply and Compatibility:

1. Obtain each type of equipment and appurtenances included in this Section, regardless of the component manufacturer, from a single manufacturer of the type of process valve. For each type of valve, do not furnish valves of more than one manufacturer.
2. Supplier of each type of equipment specified shall review and approve or prepare all Shop Drawings and other submittals for all components associated with the type of process valve Supplier is furnishing.
3. Components shall be suitable for use in the specified service conditions. Components shall be integrated into the overall assembly by the process valve manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Installation drawings showing orientation of valve in both plan and elevation view. Drawings shall clearly identify valve and its appurtenances, including controls, actuators, valve stems, and other components. Show dimensions of valves and appurtenances in relation to piping and structural and architectural components, where applicable.
 - b. Controls for and control characteristics of modulating valves.
 - c. Power and control wiring diagrams, including terminals numbers for electric-motor actuators.
 - d. Calculations for sizing of electric actuators.
 - e. Calculations for sizing of operating mechanism with extension stems.
 - f. Calculations for sizing of gear actuators.
2. Product Data:
 - a. Product data sheets.
 - b. Complete catalog information, including dimensions, weight, specifications, and identification of materials of construction of all parts.
 - c. Corrosion resistance information to confirm suitability of valve materials for the application. Furnish information on chemical resistance of elastomers from elastomer manufacturer.
 - d. Cv values and hydraulic headloss curves.
3. Testing Plans:
 - a. Submit plan for shop testing of each valve for which shop testing is specified, including testing plan's and test facility's limitations proposed.

B. Informational Submittals: Submit the following:

1. Certificates:
 - a. Certificates of compliance with referenced standards, where applicable, including those of AWWA, NSF, and others required by ENGINEER.
2. Manufacturer Instructions:
 - a. Submit manufacturer's instructions for handling, storing, and installing valves and appurtenances. Provide templates and setting drawings for valves and appurtenances that require anchor bolts or similar anchorages.
4. Source Quality Control Submittals:
 - a. Submit copies of shop test results and inspection data, certified by manufacturer.
5. Field Quality Control Submittals:
 - a. Submit results of field tests required.

6. Supplier's Reports:
 - a. When requested by ENGINEER, submit written report of results of each visit to Site by Supplier's serviceman, including purpose and time of visit, tasks performed and results obtained.
 7. Qualifications Statements:
 - a. When requested by ENGINEER, submit manufacturer's qualifications demonstrating compliance with the Specifications, including list of existing installations with contact names and telephone number(s) for each.
- C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data:
 - a. Furnish operation and maintenance manuals in accordance with Section 01 78 23, Operations and Maintenance Data.
 - b. Furnish in operations and maintenance manuals complete nameplate data for each valve and electric actuator.
- D. Maintenance Material Submittals: Submit the following:
1. Spare Parts, Extra Stock Materials, and Tools:
 - a. Spare Parts and Extra Stock Materials: Furnish as specified for each valve type.
 - b. Tools: Furnish two sets of special tools (excluding metric tools, if applicable) for each size and type of valve furnished.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
1. Deliver materials and equipment to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in concrete in ample time to prevent delaying the Work.
 2. Inspect boxes, crates, and packages upon delivery to Site and notify ENGINEER in writing of loss or damage to materials and equipment. Promptly remedy loss and damage to new condition in accordance with manufacturer's instructions.
 3. Conform to Section 01 65 00, Product Delivery Requirements.
- B. Storage and Protection:
1. Keep products off ground using pallets, platforms, or other supports. Store equipment in covered storage and prevent condensation and damage by extreme temperatures. Store in accordance with manufacturer's recommendations. Protect steel, packaged materials, and electronics from corrosion and deterioration.
 2. Conform to Section 01 66 00, Product Storage and Handling Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Valves, General:

1. Provide each valve with manufacturer's name and rated pressure cast in raised letters on valve body.
2. Provide valves with brass or Type 316 stainless steel nameplate attached with Type 316 stainless steel screws. Nameplates shall have engraved letters displaying the following minimum information:
 - a. Valve size.
 - b. Pressure and temperature ratings.
 - c. Application (other than water and wastewater).
 - d. Date of manufacture.
 - e. Manufacturer's name.
3. Provide valves to turn clockwise to close, unless otherwise specified.
4. Provide valves with permanent markings for direction to open.
5. Manually operated valves, with or without extension stems, shall require not more than 40-pound pull on manual operator to open or close valve against specified criteria. Gear actuator and valve components shall be able to withstand minimum pull of 200 pounds on manual operator and input torque of 300-foot pounds to actuator nut. Manual operators include handwheel, chainwheel, crank, lever, and T-handle wrench.

B. Valve Materials:

1. Valve materials shall be suitable for the associated valve's service or application, as shown.
2. Protect wetted parts from galvanic corrosion caused by contact of different metals.
3. Wetted components and wetted surfaces of valves used with potable water or water that will be treated to become potable shall conform to ANSI/NSF 61 and ANSI/NSF 372.
4. Clean and descale fabricated stainless steel items in accordance with ASTM A380 and the following:
 - a. Passivate all stainless steel welded fabricated items after manufacture by immersing in pickling solution of six percent nitric acid and three percent hydrofluoric acid. Temperature and detention time shall be sufficient for removing oxidation and ferrous contamination without etching surface. Perform complete neutralizing operation by immersing in trisodium phosphate rinse followed by clean water wash.
 - b. Scrub welds with same pickling solution or pickling paste and clean with stainless steel wire brushes or by grinding with non-metallic abrasive tools to remove weld discoloration, and then neutralize and wash clean.

C. Valve Joints:

1. Exposed Valves: Unless otherwise specified, provide with flanged ends conforming to ANSI B16.1. Pressure class of flanges shall be equal to or greater than specified pressure rating of the associated valve.
2. For stainless steel bolting, except where nitrided nuts are required, use graphite-free anti-seize compound to prevent galling. Strength of joint shall not be affected by using anti-seize compound.

2.2 ROTOARY PUMP CONTROL VALVES

A. Manufacturers: Provide products of one of the following:

1. GA Industries.
2. Or equal.

B. General:

1. Provide valves conforming to AWWA C507 Ball Valves for pump control applications and as specified herein. Valves shall consist of a main valve assembly and electro-hydraulic controls, completely assembled, tested and ready for field installation and wiring.
2. Sizes: As shown on Valve Schedule.
3. Rated Working Pressure: 150 psig.
4. Maximum Fluid Temperature: 180 degrees F.
5. Valve body shall have full, circular, unobstructed waterway and be trunnion-mounted, resilient seated. Stub Shafted valves will not be accepted.

C. Materials of Construction: Materials of construction shall conform to AWWA C507 and as follows:

1. Body and Cover: Cast iron per ASTM A126 Class B with flanges faced and drilled to ANSI B16.1 Class 125. All internal parts shall be removable and serviceable without removing the valve body from the line. A flanged access cover shall be provided to permit resilient seat inspection, adjustment or replacement without valve disassembly or removal of inlet or outlet piping. The body and cover shall have replaceable bronze bearings to support the rotor (Ball) and hydraulic forces.
2. Seating Surface on Ball: Type 316 Stainless Steel on the pump side.
3. Ball: Ductile iron per ASTM A536 Gr 65-45-12 with two integrally cast, bronze bushed trunnions on the axis of rotation. The upper and lower trunnions shall be sealed by means of a removable O-ring seal cartridge. There shall be a single replaceable, hydraulically actuated rotor seat of Ultra High Molecular Weight Polyethylene (UHMWPE) or other suitable material, providing drop tight shutoff.
4. Shaft: Type 316 stainless steel.
5. Drive Mechanism: The drive mechanism shall be securely attached to the valve and keyed to the rotor shaft. Valves that incorporate pins to connect the drive shaft to the rotary ball will not be accepted. The drive mechanism shall have a ductile iron housing and an aluminum bronze crosshead

operating in a machined track. The mechanism shall convert the linear cylinder operator movement to a characterized rotation of the valve such that when closing, no less than 80% of the flow area is gradually cut off during the first 50% of the cylinder stroke. The remaining portion of the flow area shall be gradually reduced during the final 50% of the stroke.

6. Operator: The valve shall be operated by water fitted hydraulic cylinder meeting requirements of AWWA C507 and use water pressure obtained from the line. Cylinder tubes shall be stainless steel, honed to a 20 micro-inch finish with steel or ductile iron heads and a cast iron, steel or ductile iron piston, protected against corrosion by electro-plating, and a chrome plated stainless steel rod. Cylinder shall be equipped with a wiper ring to clean the piston rod before it enters the cylinder. Cylinder seals shall be Buna-N or other suitable material compatible with the fluid. Cylinder shall be sized to positively close the valve against full pump shutoff using the specified minimum water pressure. The cylinder shall be rigidly attached to the drive mechanism and shall not rotate or pivot. A device shall be provided to allow manual valve closure in the absence of hydraulic power.
7. Vent and drain connection for operation of the valve shall be provided.
8. Internal and external bolting and other hardware, including pins, set screws, studs, bolts, nuts, and washers shall be Type 316 stainless steel.

D. Controls:

1. Controls shall consist of a two-position four-way normal solenoid pilot with manual operator, independently adjustable normal opening and closing speed controls, emergency solenoid with separate, adjustable closing speed control, wye-strainer and isolating valves. Provide a limit switch for open and closed position, with a visual position indicator and a minimum of four sets of SPDT contacts mounted on the valve. Devices shall be furnished for 120VAC operation. Enclosures shall be NEMA 4 or 4X.
2. All controls and control piping shall be non-corrosive and suitable for the working pressure and electrical conditions.
3. Each valve shall be furnished with a high discharge pressure switch. Pressure switches shall be piston actuated with adjustable differential. Sealed piston devices shall be provided to filter the piston assembly. Range shall be as required for the application. Range adjustment shall be accessible from the outside of the switch housing. Pressure switch housing and pistons shall be stainless steel. Diaphragms and o-ring seals shall be Viton. Retaining rings shall be Teflon. Switches shall have SPDT contact outputs which shall provide one N.O. and one N.C. contact rated 10A continuous at 120VAC. Switch housings shall be UL listed for NEMA 4, 4X, and 13 applications,

E. Testing:

1. Test each valve in manufacturer's shop in accordance with AWWA C507.

F. Interior Coating:

1. Valves shall be coated inside. Steel, cast-iron and ductile iron surfaces, except machined surfaces, shall be epoxy coated in accordance with AWWA C550.

2.3 BUTTERFLY VALVES

- A. Manufacturers: Provide products of one of the following:
1. DeZurik.
 2. Henry Pratt Company.
 3. Or equal.
- B. General:
1. Provide butterfly valves conforming to AWWA C504 and as specified herein.
 2. Sizes:
 - a. Flanged: Four-inch through 72-inch diameter.
 3. Rated Working Pressure: 150 psig, Class 150B.
 4. Maximum Fluid Temperature: 150 degrees F.
 5. Valves shall provide drip-tight bi-directional shutoff at rated pressures.
 6. Mount valve seats in valve body. Rubber seats for 24-inch diameter and larger valves shall be replaceable in the field.
 7. Valves shall be capable of being maintained in open or partially open position for manual operation, and for automatic operation. When valve disc is maintained, there shall be no chatter or vibration of disc or operating mechanism.
 8. Valve packing shall be replaceable without dismantling valve.
 9. Disc shall provide uninterrupted 360-degree seat seal.
- C. Materials of Construction: materials of construction shall conform to AWWA C504 and shall be as follows:
1. Body: Cast-iron, ductile iron, or alloy cast-iron.
 2. Shaft: Type 316 stainless steel.
 3. Discs:
 - a. Valves Smaller than 30-inch Diameter: Cast-iron.
 - b. Valves 30-inch Diameter and Larger: Ductile iron.
 4. Seats: Buna-N or other synthetic rubber suitable for the application.
 5. Seating Surfaces: Type 316 stainless steel.
 6. Bearings:
 - a. Valves Smaller than 24-inch Diameter: Nylon.
 - b. Valves 24-inch Diameter and Larger: Fiberglass with Teflon lining.
 7. Shaft Seals: Externally adjustable, material same as for seats. For services that are either buried or submerged, self-adjusting V-type chevron, material same as for seats.
 8. Tapered Pins for Attachment of Shaft to Disc: Type 316 stainless steel.
 9. Internal and external bolting and other hardware; including pins, set screws, studs, bolts, nuts, and washers shall be Type 316 stainless steel.

- D. Interior Coating:
1. Valves shall be coated inside. Steel, cast-iron, and ductile iron surfaces, except machined surfaces, shall be epoxy-coated in accordance with AWWA C550.
- E. Testing:
1. Test each valve in the manufacturer's shop in accordance with AWWA C504.
- F. Gear Actuators for Manual Valves:
1. Provide gear actuators conforming to AWWA C540.
 2. Gear actuators for valves 20-inch diameter and smaller shall be constructed for 150 psi differential pressure and 16 feet per second port velocity.

2.4 AIR RELEASE VALVES

- A. Manufacturers: Provide products of one of the following:
1. Val-Matic.
 2. GA Industries.
 3. Or equal.
- B. General:
1. Provide air release valves intended for well and clean water vertical turbine pump service and manufactured and tested in accordance with AWWA C512 and as specified herein.
 2. Sizes:
 - a. Flanged: See valve schedule.
 - b. Valves 4-inch and larger shall have bolted flange inlets equal to the valve size. Flanges shall be in accordance with ANSI B16.1 for Class 125 iron flanges.
 - c. The valves shall have two additional NPT connections for the addition of air release valves, gauges, testing, and draining.
 3. Rated Working Pressure: 150 psig.
 4. Design:
 - a. Air release valves shall be fully automatic float operated valves designed to exhaust air which is present in the pump column on pump startup and allow air to re-enter the column on pump shutdown or should a negative pressure occur. A dual port throttling device shall provide adjustable control of the exhaust rate and allow free flow into the valve through a separate inlet port. A regulated exhaust device shall allow free air flow in and out of the valve, close upon rapid air exchange, and control the air exhaust rate to reduce pressure surges.

- b. The valve body shall provide a through flow area equal to the nominal valve size. A bolted cover with allow screws and flat gasket shall be provided to allow for maintenance and repair.
 - c. Floats shall be unconditionally guaranteed against failure including pressure surges.
 - d. The resilient seat shall provide drop tight shut off to the full valve pressure rating.
 - e. Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 when specified.
5. Materials:
- a. Body and Cover: Cast Iron.
 - b. Float, Guide Shaft and Bushings: Stainless Steel.
 - c. Disc and Seat: Bronze.

2.5 APPURTENANCES FOR EXPOSED METALLIC VALVES

A. General:

- 1. For valves located less than five feet above operating floor, provide levers on four-inch diameter quarter-turn valves, and provide handwheels on all other valves, unless otherwise shown or specified.
- 2. For valves located five feet or more above operating floor, provide chain operators.
- 3. Where indicated, provide extension stems and floorstands.

B. Handwheels:

- 1. Conform to applicable AWWA standards.
- 2. Material of Construction: Ductile iron, or cast aluminum.
- 3. Arrow indicating direction of opening and word "OPEN" shall be cast on trim of handwheel.
- 4. Maximum Handwheel Diameter: 2.5 feet.

C. Chain Operators:

- 1. Chains shall extend to three feet above operating floor.
- 2. Provide 1/2-inch stainless steel hook bolt to keep chain out of walking area.
 - a. Chain: Type 316L stainless steel.
 - b. Chainwheel: Recessed groove type made out of Type 316 stainless steel.
 - c. Guards and Guides: Type 316L stainless steel.
- 4. Chain Construction:
 - a. Chain shall be of welded link type with smooth finish. Chain that is crimped or has links with exposed ends is unacceptable.
- 5. Provide geared operators where required to position chainwheels in vertical position.

- D. Crank Operator:
 - 1. Crank operator shall be removable and fitted with rotating handle.
 - 2. Maximum Radius of Crank: 15 inches.
 - 3. Materials:
 - a. Crank: Cast-iron or ductile iron.
 - b. Handle: Type 304 stainless steel.
 - c. Hardware: Type 304 stainless steel.

2.6 TOOLS, LUBRICANTS, AND SPARE PARTS

- A. Lubricants: For valves, actuators, and appurtenances requiring lubricants, provide suitable lubricants for initial operation and for first year of use following Substantial Completion. Lubricants for equipment associated with conveying potable water or water that will be treated to become potable shall be food-grade and ANSI/NSF 61-listed.
- B. Tools, spare parts, and maintenance materials shall conform with Section 01 78 43, Spare Parts and Extra Materials.

2.7 PAINTING OF EXPOSED VALVES, AND APPURTENANCES

- A. Exterior steel, cast-iron, and ductile iron surfaces, except machined surfaces of exposed valves and appurtenances, shall be finish painted in manufacturer's shop. Surface preparation, priming, finish painting, and field touch-up painting shall conform to Section 09 91 00, Painting.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions under which materials and equipment are to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Install valves and appurtenances in accordance with:
 - a. Supplier's instructions and the Contract Documents.
 - b. Requirements of applicable AWWA standards.
 - c. Applicable requirements of Section 40 05 05, Exposed Piping Installation.
 - 2. Install valves plumb and level. Install all valves to be free from distortion and strain caused by misaligned piping, equipment, and other causes.

3. Position swing check valves and butterfly valves so that, when valve is fully open, valve disc does not conflict with piping system elements upstream and downstream of valve.

B. Exposed Valves:

1. Provide supports for large or heavy valves and appurtenances as shown or required to prevent strain on adjoining piping.
2. Operators:
 - a. Install valves so that operating hand wheels or levers can be conveniently turned from operating floor without interfering with access to other valves, piping, structure, and equipment, and as approved by ENGINEER.
 - b. Avoid placing operators at angles to floors or walls.
 - c. Orient chain operators out of way of walking areas.
 - d. Install valves so that indicator arrows are visible from floor level.
 - e. For motor-operated valves located lower than five feet above operating floor, orient motor actuator to allow convenient access to pushbuttons and hand wheel.
3. Floor Stands and Stems:
 - a. Install floor stands as shown and as recommended by manufacturer.
 - b. Provide lateral restraints for extension bonnets and extension stems as shown and as recommended by manufacturer.
 - c. Provide sleeves where operating stems pass through floor. Extend sleeves two inches above floor.

3.3 FIELD QUALITY CONTROL

A. Field Tests:

1. Adjust all parts and components as required to provide correct operation of valves.
2. Conduct functional field test on each valve in presence of ENGINEER to demonstrate that each valve operates correctly.
3. Verify satisfactory operation and controls of motor operated valves.
4. Demonstrate satisfactory opening and closing of valves at specified criteria requiring not more than 40 pounds effort on manual actuators.
5. Test ten percent of valves of each type by applying 200 pounds effort on manual operators. There shall be no damage to gear actuator or valve.

B. Supplier's Services:

1. Provide services of qualified factory-trained service technicians to check and approve installation of the following types of valves:
 - a. Rotary Pump Control Valves.
2. Supplier's serviceman shall perform the following:
 - a. Instruct CONTRACTOR in installing equipment.
 - b. Supervise installation of equipment.

- c. Inspect and adjust equipment after installation and ensure proper operation.
 - d. Instruct OWNER's personnel in operating and maintaining the equipment.
3. Manufacturer's representative shall make a minimum of 1 visit, with a minimum of 8 hours onsite for each visit. First visit shall be for unloading supervision (if specified) and instruction of CONTRACTOR in installing equipment; second visit shall be for assistance in installing equipment; third visit shall be for checking completed installation and start-up of system; fourth visit shall be to instruct operations and maintenance personnel. Representative shall revisit the Site as often as necessary until installation is acceptable.
 4. Training: Furnish services of Supplier's qualified factory trained specialists to instruct OWNER's operations and maintenance personnel in recommended operation and maintenance of equipment. Training requirements, duration of instruction and qualifications shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
 5. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

3.4 SUPPLEMENTS

- A. The supplements listed below, following "End of Section" designation, are a part of this Specification Section:
 1. Table 40 05 53-A, Schedule of Valves

+ + END OF SECTION + +

TABLE 40 05 53-A, SCHEDULE OF VALVES WITH ELECTRIC ACTUATORS

Valve Number	Location	Service	Valve Size (in)	Operator	Specification Paragraph	Remarks
ARV-1		FW	4	--	2.4	--
BFV-1		FW	20	Manual	2.3	Provide Hand Wheel Operator
BFV-2		FW	20	Manual	2.3	Provide Hand Wheel Operator
RPCV-1		FW	14	Hydraulic Cylinder	2.2	Provide ANSI Class 125 Flanges
RPCV-2		FW	14	Hydraulic Cylinder	2.2	Provide ANSI Class 125 Flanges
RPCV-3		FW	14	Hydraulic Cylinder	2.2	Provide ANSI Class 125 Flanges

The following abbreviations are used in Table 40 05 53-A.

A. Valve Type Abbreviations

Valve Type	Abbrev		Valve Type	Abbrev.
Metal-seated Gate Valve	GV-MS		Swing Check Valve	SCV
Resilient-seated Gate Valve	GV-RS		Automatic Pressure-reducing Valve	PRV
Eccentric Plug Valve	PV		Automatic Pressure-sustaining Valve	PSV
Eccentric Plug Valve (digester gas service)	PV-DI		Automatic Electric Check Valve	ECV
Rotary Pump Control Valve	RPCV		Check Valve (air service)	CV-AS
Butterfly Valve	BV		Check Valve (digester gas service)	CV-DI
Butterfly Valve (air service, open-close applications)	BV-AS		Telescopic Valve	TEL
High-performance Butterfly Valve (air service, modulating)	HBV-AS		Mud Valve	MUD
Butterfly Valve (digester gas service, open-close applications)	BV-DI		Fire Hydrant	HYD
High-performance Butterfly Valve (digester gas service, modulating)	HBV-DI			

B. Service Abbreviations

Service	Abbrev		Service	Abbrev.
Sanitary Sewer	SAN		Wastewater	WW
Storm Sewer	ST		Overflow	OF
Combined Sewer	CS		Centrate	CEN
Sanitary Force Main	SFM		Filtrate	FILT
Raw Water	RW		Scum	SCUM
Potable Water	PW		Primary Sludge	PS
City Water	CW		Return Activated Sludge	RAS
Non-Potable Water	NPW		Waste Activate Sludge	WAS
Plant Effluent Water	PEW		Thickened Sludge	TS
Spray Water	SPW		Mixed Sludge	MS
Backwash Water	BW		Digested Sludge	DS
Hot Water Supply	HWS		Chlorine Solution	CLS
Hot Water Return	HWR		Sodium Hydroxide	NAOH
Influent	INF		Sodium Hypochlorite	NAOCL
Effluent	EFF		Polymer Solution	POLYS
Drain	DR		Alum	AL
Process Air	PA		Hydraulic Fluid	HF
Instrument Air	IA		Fuel Oil	FO
Digester Gas	DIG		Lube Oil	LO
Chlorine Gas	CLG		Finished Water	FW

SECTION 43 21 40

VERTICAL TURBINE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, tools and equipment required to furnish and install vertical turbine pumps complete and operational with motors, accessories, and services as shown and as specified.
- B. Coordination:
1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the vertical turbine pump Work.
- C. Related Sections:
1. Section 03 00 05, Concrete
 2. Section 05 05 33, Anchor Systems.
 3. Section 09 91 00, Painting.
 4. Division 26, Electrical
 5. Division 40, Applicable Sections on Instrumentation and Controls.
 6. Division 40, Applicable Sections on Piping, Valves and Appurtenances.

1.2 REFERENCES

- A. Standards referenced in this Section are listed below:
1. American Bearing Manufacturers Association, (ABMA).
 2. American National Standards Institute, (ANSI).
 - a. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
 3. American Society for Testing and Materials, (ASTM).
 - a. ASTM A 48/A 48M, Specification for Gray Iron Castings.
 - b. ASTM A 582/A 582M, Specification for Free-Machining Stainless Steel Bars.
 4. American Water Works Association, (AWWA).
 5. Hydraulics Institute, (HI).
 6. Institute of Electrical and Electronics Engineers, (IEEE).
 7. National Electrical Code, (NEC).
 8. National Electrical Manufacturers' Association, (NEMA).
 9. National Sanitation Foundation, (NSF).
 10. The Society for Protective Coatings, (SSPC).
 - a. SSPC SP 10, Near-White Blast Cleaning.
 11. Local and state building codes and ordinances.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Manufacturer shall have a minimum of five years experience producing substantially similar equipment and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.

B. Component Supply and Compatibility:

1. Obtain all equipment included in this Section regardless of the component manufacturer from a single pump manufacturer.
2. The pump equipment manufacturer is to review and approve or is to prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the vertical turbine pump equipment manufacturer.

1.4 SUBMITTALS

A. Shop Drawings: Submit the following:

1. Shop Drawings Showing: Fabrication, assembly, installation, and wiring diagrams.
2. Descriptive literature including cross-sectional views of the pumps indicating the materials of construction and preliminary dimension prints of pumps and motors.
3. Performance curves for the complete pump assemblies showing the relationship between head and capacity, efficiency, brake and motor horsepower, and NPSH from shut-off head to the minimum operating head specified. Curves shall be corrected for pump losses and shaft friction horsepower losses. Pump losses shall include column and discharge head losses.
4. Impeller type.
5. Bowl and shaft WR square.
6. Maximum down thrust at design points and shutoff, and maximum up thrust.
7. Weight of pumps and motors (including all components).
8. Motor manufacturer, type, enclosure, phase, voltage, rated horsepower, full load and locked rotor amperage, temperature rating, and expected minimum life under design conditions, minimum efficiency at 1/2, 3/4 and full load, and descriptive literature including description of motor insulation, for each type of motor to be furnished.
9. A list of deviations from the Contract Documents.
10. Names and addresses of the nearest factory authorized service organization.
11. Ten copies of certified shop tests.
12. Copy of paint certification.

- B. Operation and Maintenance Manuals:
 - 1. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.
 - 2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operation and Maintenance Data.
- C. Certificates:
 - 1. Submit certificate stating that Vertical Turbine Pump Manufacturer has coordinated with VFD Manufacturer to insure that VFD will function properly with driven piece of equipment.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
 - 1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.
- B. Storage and Protection:
 - 1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
- C. Acceptance at Site:
 - 1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 EQUIPMENT PERFORMANCE

- A. General:
 - 1. Pumps shall be vertical turbine type, and designed for the performance and design requirements as required, at maximum speed unless otherwise noted. Pumps shall be suitable for pumping of finished potable water.
- B. Design Criteria:
 - 1. Pumps shall be specially designed, constructed, and installed for the service specified and shall comply with the following minimum conditions:

Design Conditions	Pump ID			
	Pump No. 1	Pump No. 3	Pump No. 5	Pump No. 6
ID:				
Design Flow, (gpm):	8,750	5,600	7,700	8,750
*Design TDH, (ft.):	145	375	372	145
Shutoff Head, (ft.):	310	630	640	303
Minimum Bowl Efficiency at Design, (percent):	84.5	82.0	83.0	84.5
Motor, (Hp):	450	700	900	450
Maximum Operating Speed, (rpm):	1,200	1,200	1,200	1,200
Pump Column Diameter, (in.):	20	20	20	20
Discharge Size, (in.):	20	20	20	20
Low flow at 2 nd Design Point, (gpm):	4,000	4,000	4,000	4,000
TDH at 2 nd Design Point, (ft.):	250	480	480	250
**Approximate Pump Discharge Center-line Elevation, (ft.):	523.17	523.17	526.17	526.17
Liquid Pumped:	Finished Water	Finished Water	Finished Water	Finished Water
Temperature, (°F):	50-75	50-75	50-75	50-75
Drive Type***:	Motor	Motor	Variable Frequency Drive	Variable Frequency Drive
Motor: Volts/Phase/Hertz	2,300/3/60	2,300/3/60	2,300/3/60	2,300/3/60
Pump Basis of Design Manufacturer/Model	Goulds/ 20 GHC 3 Stage	Floway/ 24 MKM/N 4 stage	Floway/ 24 MKM/N 4 stage	Goulds/ 20 GHC 3 Stage
Pump Type:	CAN	VTP	VTP	CAN

* Does not includes entrance, pump, column, and discharge head losses.

** CONTRACTOR shall field verify existing pump discharge center-line elevation.

*** VFD's shall be programmed and configured by VFD Manufacturer together with the pump manufacturer and pump control valve manufacturer.

2.2 MANUFACTURERS

- A. Manufacturer (Pump No. 1 and No. 6):
 - 1. Goulds
 - 2. Or Equal

- B. Manufacturer (Pump No. 3 and No 5):
 - 1. Floway
 - 2. Or Equal

2.3 DETAILS OF CONSTRUCTION (PUMP NO. 1 AND NO. 6)

- A. Pump Materials and Construction:
 - 1. Pump Bowl Assembly:
 - a. The pump bowls shall be lined with fusion bonded epoxy lined type to reduce friction. The waterway and diffusion vanes shall be smooth and free from nodules, bumps and dips, and shall be cast of high quality free of blow holes, sand holes and other detrimental defects. The bowls shall be accurately machined and fitted with a suction bell with integral cast ribs supporting the suction bearing. The bearings shall be sleeve type and are to be lubricated by the product being pumped. The bearings are to be located above and below each impeller. The suction bearing shall be permanently packed with food grade grease, and shall have a length not less than 2 times the shaft diameter. The bowls are to be flanged with machined rabbet fit connections
 - b. Fit the bowls and suction bell with renewable wear ring(s) adjacent to the impeller skirts. Wear ring clearances shall not exceed 0.002-inch clearance per inch of diameter.
 - c. The impellers shall be cast in one piece of the enclosed type. The impellers shall be statically and dynamically balanced. Unless otherwise stipulated, if the bowl diameter is smaller than 22-inch diameter the impeller shall be securely fastened to the shaft with taper split bushings (collets). Impellers with bowl diameters larger than 22" shall be double keyed. Impellers shall be adjusted vertically by external means and shall have sufficient axial clearance for reliable service in accordance with the specified operating conditions.
 - 2. Pump Column Assembly:
 - a. The column pipe shall be flanged with rabbeted fits to ensure proper alignment. It shall be constructed of material conforming to ASTM A53 Gr. B steel. The weight of the column pipe shall be no less than that stated in ANSI/AWWA Specification E101. The column size shall be such that friction loss will not exceed 5' per 100', based on the rated capacity of the pump. Column length shall not exceed 10' for 1800 RPM and 5' lengths for pumps running at 3,600 RPM. The top and bottom section shall not exceed 5'.
 - b. The column line shaft shall be turned and ground. They shall be furnished in interchangeable sections not over 10 feet in length. The

butting faces shall be machined square to the axis of the shaft with maximum permissible misalignment of the thread axis with the shaft axis 0.002 in 6". The size of the shaft shall be no less than that determined by ANSI/AWWA-E101 Specifications, Section 5.5 and shall be such that elongation due to hydraulic thrust will not exceed the axial clearance of the impellers in the pump bowls. Maximum run out shall not exceed 0.005" in 10 feet. The line shafts shall be provided with 304 stainless steel sleeves at the location of each line shaft bearing. The line shaft bearings shall be sleeve type. Line shaft bearing spacing shall be such that shaft first critical frequency shall be safely above or below the operating frequency.

- c. Threaded shaft couplings are to be supplied for shafts less than 2-3/4" diameter and shall be sized per ANSI/AWWA E101 section A-4.1.4. They shall utilize left-hand threads to tighten during operation.
 - d. Bearing retainers shall be of the drop-in type, held in place by compression of the butted ends of the column pipe.
3. Discharge Head:
- a. The discharge head shall be fabricated of carbon steel materials using ASTM A181 flanges, ASTM A53 Grade B body pipe and ASTM A516 steel plate with suction and discharge flanges in-line with each other and located 180 apart. Discharge head design shall be capable of containing maximum pressure developed by pump plus suction pressure. The suction flange shall be 150# ANSI raised face with bolt holes straddling suction centerline. The discharge flange shall be 150# ANSI raised face with bolt holes straddling the vertical centerline. A 1/4" NPT pressure gauge connection shall be supplied on the top centerline of the suction and discharge outlets. A 3/4" NPT barrel vent tap shall be located on the outer casing of the discharge head. The top of the discharge head shall be machined to accept a standard NEMA P base driver and have a diameter equal to the driver base diameter. The base flange shall be machined, drilled and gasketed to provide a pressure containing seal to the top of the suction barrel. The head shaft shall be connected to the top line shaft beneath the motor to facilitate ease of assembly and maintenance. All couplings and other moving or rotating parts shall be covered on all sides by an OSHA approved coupling guard. Coupling guards shall be fabricated from 16 USS gage or thicker galvanized or aluminum-clad steel or from 1/2 inch mesh expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. The pump shall be furnished with a stainless steel nameplate securely mounted to the discharge head. At a minimum it shall contain information providing (design flow, design TDH, HP, RPM, bowl model number, number of stages, manufacturer serial number, pump type, impeller setting dimension).
 - b. A rigid flanged adjustable "spacer" type coupling shall be provided to couple the motor shaft to the pump shaft. The spacer shall be of sufficient length to allow the mechanical seal to be removed without

disturbing the motor. This coupling shall allow for the vertical adjustment of the shaft mounted impellers.

- c. The discharge head shall be fitted with a mechanical seal. The seal shall be of the split type, easily replaceable and have its face continuously flushed with the product being pumped. The seal shall be equivalent to the Chesterton 442.
4. Barrels:
 - a. For barrel (can type) pumps, each pump barrel shall be of the ANSI/HI-9.8 Length design and size recommended by the manufacturer and shall conform to Hydraulic Institute Standards. Barrel inlet nozzle and flange shall be located and sized properly per ANSI/HI9.8 Standard. Pump barrel (can) must be designed in such a manner as to prevent submerged vortices from being developed. The barrel's square top mounting plate shall be of sufficient thickness to drill and tap for ANSI rated flange bolting to match the base flange of the discharge head. The top mounting plate of the barrel shall be properly machined and be gasketed or "O" ringed for zero leakage connection to the discharge head. The pressure rating of the barrel shall be capable of containing the maximum suction pressure. The pumping system shall be designed to be supported from the base of the can.
 - b. The suction barrel shall be fitted with 2 direction vanes to reduce hydraulic swirling. They should be welded to the inside of the barrel in line with the suction centerline and located 180 degrees apart.
 - c. The bottom of the barrel shall contain 2 direction vanes welded in a cross patten perpendicular to one another to help minimize hydraulic swirling.
 5. Materials of Construction:
 - a. Pump Bowls: Cast Iron (ASTM A48 c130, Enamel Lined).
 - b. Impellers: 952 Bronze – (ASTM B584-90b Alloy 952).
 - c. Bowl Assembly Shaft – 416 Stainless Steel (ASTM A582088a Type 416).
 - d. Bowl Bearings: Bronze – (ASTM B505-91 Alloy 932).
 - e. Bowl Bolting: 304 Stainless Steel (ASTM f593 Gr CW1).
 - f. Bowl Wear Rings: Bronze – (ASTM B148-89a Alloy 954).
 - g. Column Pipe Thickness: Schedule 40.
 - h. Column Bolting: 304 Stainless Steel (ASTM f593 Gr CW1).
 - i. Line Shaft: 416 Stainless Steel (ASTM A582-88a).
 - j. Line Shaft Couplings: 416 Stainless Steel (ASTM A582-88a).
 - k. Line Shaft Sleeves: 304 Stainless Steel.
 - l. Line Shaft Bearings: Styrene Butadiene Rubber (SBR).
 - m. Bearing Retainers: Ductile Iron – (ASTM A536-84 Gr 60-40-18).
 - n. Discharge Head: Fabricated Steel – (A516-Gr 70 plt, A105 flg, A53-Gr B pipe).
 - o. Name Plate: Stainless Steel.

B. Motor Type: As required to drive the pump specified above. Motors shall meet

the requirements of Section 26 29 01, Motors. Motor shall be VFD rated for Pump No. 6 and meet the requirements of NEMA MG-1, Part 31.

2.4 DETAILS OF CONSTRUCTION (PUMP NO. 3 AND NO. 5)

A. Pump Materials and Construction:

1. **Pump Bowl Assembly:** The bowls shall be flanged type constructed of close grained cast iron conform to ASTM A48, class 30. They shall be free from sand holes, blowholes, or other faults and must be accurately machined and fitted to close tolerances. They shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated flow or 1.5 times shut-off head, whichever is greater. The intermediate bowls shall have enamel or epoxy lined waterways for maximum efficiency and wear protection. All the bowls shall be fitted with sleeve type bearings of bronze alloy C89835.
2. **Impellers:** The impellers shall be constructed from ASTM B584 Silicon Bronze and shall be the enclosed type. They shall be free from defects and must be accurately cast, machined and filed for optimum performance and minimum vibration. Impellers shall be balanced to grade G6.3 of ISO 1940 as minimum. They shall be securely fastened to the bowl shaft with taper locks of 416 stainless steel or key and split thrust ring of stainless steel.
3. **Suction:** The suction bowl or suction bell shall be provided with a non-soluble grease packed bronze bearing. A bronze sand collar shall be provided to protect this bearing from abrasives in the pumping fluid. The bearing housing shall have sufficient opening at the bottom for easy removal of the bearing.
4. **Shaft:** The bowl shaft shall be constructed from ASTM 582 type 416 stainless steel. It shall be precision ground and polished with surface finish better than 40 RMS.
5. **Column Assembly:**
 - a. **Column Pipe:** The column pipe shall be furnished in sections not exceeding a nominal length of 10 ft. and shall be connected by flanges. The length of the top and bottom sections shall not be more than 5 ft. The pipes shall be of ASTM A53 grade B steel pipe and the weight shall be not less than schedule 30. The end of the pipe shall be with 8 threads per inch with 3/16-in taper per foot thread and faced parallel to butt against the centering spiders of ASTM B584 Silicon Bronze to form accurate alignment. All column flange faces shall be parallel and machined for rabbet fit to permit accurate alignment. The inside diameter of the pipe shall be such that the head losses shall not be more than 5 feet per 100 feet of pipe or the flow velocity not to exceed 3 ft/sec based on rated flow of the pump.
 - b. **Lineshaft:** The lineshaft shall be of ASTM A582 type 416 stainless steel ground and polished with surface finish not to exceed 40 RMS. They shall be furnished in interchangeable section not over ten feet in length, and shall be coupled with threaded stainless steel couplings (up to 2-15/16" diameter) machined from solid steel bar. It shall have left-hand thread to tighten during pump operation. The diameter of the shaft and

- coupling shall be designed in according with AWWA E101 Standard.
- c. Bearing: Bearing shall be fluted rubber retained in the centering spider by a shoulder on each end of the bearing.
6. Discharge Head Assembly:
- a. Discharge Head: It shall be of the high profile type to all shaft coupled above stuffing box and provided for mounting the driver and support the column and bowl assemblies. It shall be of high-grade cast iron, ASTM A48 Class 30. The above ground outlet shall be flanged to match ANSI Class 125 (for cast iron). It shall have a 1/2-inch NPT connection for a pressure gauge.
 - b. Stuffing Box: The stuffing box shall be cast iron and be fitted with a mechanical seal. The seal shall be of the split type, easily replaceable and have its face continuously flushed with the product being pumped. The seal shall be equivalent to the Chesterton 442.
- B. Motor Type: As required to drive the pump specified above. Motors shall meet the requirements of Section 26 29 01, Motors. Motor shall be VFD rated for Pump No. 5 and meet the requirements of NEMA MG-1, Part 31.

2.5 SURFACE PREPARATION AND SHOP PAINTING

- A. Pumps, motor, drive and appurtenances shall receive shop primer and shop finish coating conforming to requirements of Section 09 91 00, Painting.
- B. Surface preparation and painting shall conform to the requirements of Section 09 91 00, Painting. The interior surfaces of the pump, suction bell and discharge column pipes, and the interior surfaces of the pump head and suction barrel shall be cleaned with a Near White Metal Sandblast (SSPC SP 10), shall receive two coats of a NSF 61 approved coating with a minimum dry film thickness of 8 mils applied in accordance with the paint manufacturers printed instructions.
- C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.
- D. CONTRACTOR shall certify, in writing, that the shop primer and shop finish coating system conforms to the requirements of Section 09 91 00, Painting.

2.6 SOURCE QUALITY CONTROL

- A. Shop Tests:
 - 1. Pump columns and discharge heads shall be hydrostatically tested to twice the discharge head or one and a half times the shutoff head, whichever is greater.
 - 2. Running Test: Pump assembly shall be operated from zero to maximum capacity as shown on the approved curve. Results of the test shall be shown in a plot of test curves showing head, flow, horsepower, overall efficiency and

current. Readings shall be taken at a minimum of five evenly spaced capacity points including shutoff, design point and minimum head for which pump is designed to operate. Where variable speed units are specified, curves shall have at least five speeds plotted between maximum and minimum rpm.

3. All tests shall be witnessed by a Registered Professional Engineer, who may be an employee of the manufacturer. The Registered Professional Engineer shall sign and seal all copies of test curves and shall certify that hydrostatic tests were performed. The State of registration, registration number and the name on the seal shall be clearly legible. Conduct tests in conformance with the methods described in Section A6 of AWWA E101. The serial numbers of the pumps shall be on the test curves and hydrostatic tests.
4. Pumps shall not be shipped until the ENGINEER has approved the test reports.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in complete accordance with manufacturer's instructions and recommendations and the approved Shop Drawings.
- B. Pumping units shall be installed on concrete bases and grouted as shown.
- C. Installation shall include furnishing and applying an initial supply of grease and oil, recommended by the manufacturer.
- D. Support piping independent of pump.
- E. Check and align pump, motor and shafting.

3.2 START-UP AND TEST

- A. CONTRACTOR shall verify that structures, pipes and equipment are compatible.
- B. Make adjustments required to place system in proper operating condition.
- C. Field Vibration Tests:
 1. Vibration measurements shall be made at the upper motor bearing of pump while operating over its speed range. Measurements shall be made in each of two orthogonal horizontal directions one of which shall be in the plane of the greatest vibration and in the vertical (pump axial) direction. Measured levels in the horizontal direction of the operating pump shall not exceed those in the Hydraulic Institute Standards, latest edition.
 2. CONTRACTOR shall provide the services of an Engineer to conduct the vibration tests after the installation has been completed. The Engineer shall be recognized as an expert in the field of vibration analysis and control and shall have qualifications acceptable to ENGINEER.

3. Submit certified report of successful vibration tests for approval.
- D. Submit report of test results.
 - E. Testing, checkout and start-up of the equipment shall be performed under the technical direction of the manufacturer's factory-trained representative. The drive system shall not be energized without authorization from the manufacturer's representative.

3.3 MANUFACTURER'S SERVICES

- A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of 4 visits to the site per pump with a minimum 4 hours on-site for each visit. The first visit shall be for assistance in the installation of equipment. Subsequent visits shall be for checking the completed installation, start-up and training of the system. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to the requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.
- B. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the OWNER.

++ END OF SECTION ++

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SECTION 46 43 73

TUBE SETTLERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide, as shown and specified, a complete installation of the following at the North Sedimentation Basin and South Sedimentation Basin.
 - a. Tube settler modules.
 - b. Protective surface grating.
- B. Responsibility: To ensure that all the equipment is properly coordinated, the CONTRACTOR shall obtain all the equipment specified herein from a single manufacturer. However, the CONTRACTOR shall retain ultimate responsibility under this Contract for equipment coordination, installation, operation and guarantee.
- C. Coordination:
1. Review installation procedures under other sections and coordinate with the Work which is related to this section.
- D. Related Work Specified Elsewhere:
1. Section 09 91 00, Painting.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM D 256, Impact Resistance of Plastics.
 2. ASTM D 570, Water Absorption of Plastics.
 3. ASTM D 638, Tensile Properties of Plastics.
 4. ASTM D 696, Coefficient of Linear Thermal Expansion of Plastics.
 5. ASTM D 790, Flexural Properties of Plastics.
 6. ASTM D 2583, Indentation Hardness of Plastics (Barcol).
 7. Standards of the Reinforced Plastic/Composites Institute.
 8. National Bureau of Standards, PS 15-69.
 9. ANSI/NSF-61.
- B. Tube settler manufacturer shall have a minimum of ten years of continuous experience in the manufacture of tube settlers with a minimum of fifty United States

installations in service for a minimum of five years. At least ten installations shall include the protective surface grating.

1.3 SUBMITTALS

A. Shop Drawings and Product Data:

1. Submit Shop Drawings showing the following:
 - a. Submit detailed drawings showing the configuration of the tube settler modules and the manner in which they will be installed. The installation drawings shall include detailed instructions to the installer regarding any field trimming or other modifications to fit the modules to the sedimentation basins.
 - b. Layout drawings and materials of construction for protective surface grating.
 - c. Manufacturer's installation and recommended startup procedure.
 - d. Load testing method and results.
 - e. Manufacturer's guarantee for the minimum terms of the correction period in Section 00 73 01, SC-13.07.C.

B. Operation and Maintenance Data:

1. Comply with the requirements of Section 01 78 23.
2. Provide detailed tube settlers cleaning instructions.

C. Provide current certificate that tube settler modules and grating are tested and certified by ANSI/NSF to ANSI/NSF Standard 61 Drinking Water System Components.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. Description: Provide tube settler modules and protective surface grating at North Clarifier and South Clarifier.

1. Characteristics of the existing basins are as follows:

Design Basis for the Tube Settler System Performance

	<u>North Basin</u>	<u>South Basin</u>
Max hydraulic flow rate	6 mgd	6 mgd
Loading rate at maximum flow	2.0 gal/min/sq. ft.	2.0 gal/min/sq. ft.
Minimum surface area	2000 sq. ft	2000 sq. ft.

<u>Clarifier Dimensions</u>	<u>North Basin</u>	<u>South Basin</u>
Width, ft.	65	65
Length, ft.	65	65
Side Water Depth, ft.	15.5	15.5

2. Field verify dimensions of each clarifier prior to providing product submittals. Basin dimensions may vary slightly from dimensions specified above. No extra compensation will be paid for minor variations from specified dimensions.
3. Tube settler modules shall be designed to maintain structural integrity under a loading of 15 pounds per sq. ft. which includes module dead weight plus a uniformly distributed solids load of 10 pounds per sq. ft. while supporting a movable live load of 250 pounds concentrated over a one sq. ft. area.
4. The system of tube settler modules shall be designed to maintain structural integrity under a loading of 15 pounds per sq. ft. which includes module dead weight plus a uniformly distributed solids load of 10 pounds per sq. ft. while supporting a movable live load of 500 pounds concentrated over a one sq. ft. area.

2.2 TUBE SETTLER MODULES

A. General:

1. The area of new tube settlers shall be equivalent to the area of tube settlers being replaced.
2. Tube settlers shall be composed of a multiplicity of uni-directional tube-like channels at least four square inches in cross-sectional area sloped from the horizontal. Tube settlers shall provide natural drainage of suspended solids. Modules shall be designed and arranged to provide the lowest practical Reynolds number for conditions of laminar flow.
3. Effective settling height of the tubes shall be at least 24 inches, with a length of no more than 28 inches, inclined at 60 degrees from the horizontal.
4. Tube settler modules shall be factory fabricated to the greatest extent possible to minimize field cutting.

B. Materials:

1. Materials used in tube settler module construction shall be inert and resistant to deterioration from naturally present chemical constituents in the water supply

and from the proposed dosage rates of treatment chemicals added in the water treatment process and suitable for pH range of 4.5 to 9.0. Surface properties of the materials of construction shall prevent the accumulation of deposits to the extent that the intended function of the tube settler modules would be seriously impaired as measured by total plant performance.

2. Tube settler modules shall be built-up from evenly spaced sheets of rigid polyvinyl chloride (PVC) bonded together to form a durable structure. The PVC sheets shall be evenly spaced so that they form tube-like channels running from the bottom of the module to the top, inclined at 60 degrees from the horizontal. The tubes shall be molded of high-impact PVC with a minimum finished thickness of 20 mils plus/minus .002 inches. The PVC sheet shall be primed and rigid and contain UV stabilizers. It shall have a polished surface to minimize adherence of solids, and shall conform to commercial standards ANSI/ASTM D 1784-78; 12454B. Tubes constructed of ABS plastic shall not be allowed.
3. Solvent welding process shall provide a continuous bond between the various components of the module assembly. Finished bonds shall provide a rigid structure capable of resisting rupture under normal conditions of handling during installation and operation of the modules.
4. All fasteners and ties used in the installation of the tube settler modules shall be Type 304 Stainless Steel.
5. The material of construction shall be flame resistant, self extinguishing rigid PVC. Virgin material shall be used. Tube settler modules shall be blue or White in color. Tube settler modules must be tested and certified by ANSI/NSF to ANSI/NSF Standard 61. Current certification must be indelibly marked on sheets of modules.

2.3 PROTECTIVE SURFACE GRATING

A. General

1. The protective surface grating shall provide a protective surface on top of the tube settler media to minimize hydraulic impact and provide operator access. The grating system shall be designed and provided by the tube settler manufacturer and shall be an integral component and regularly available option as part of their system. The protective surface grating shall be installed directly on top of the tubes without additional support structures.
2. Grating shall comprise of multiple square mesh of 2 in. x 2 in. openings, molded together to provide a strong and lightweight panel. The height of the grating shall be a maximum of 1-1/4 inch.
3. The grating system shall be designed to prevent damage to the tube settler media, and allow for ease of placement and removal.
4. Protective surface grating shall be designed to maintain structural integrity under a loading of 15 pounds per sq. ft. which includes module dead weight plus a uniformly distributed solids load of 10 pounds per sq. ft. while supporting a movable live load of 250 pounds concentrated over a one sq. ft. area

B. Materials:

1. Materials used in protective surface grating construction shall be inert and resistant to deterioration from naturally present chemical constituents in the water supply and from the proposed dosage rates of treatment chemicals added in the water treatment process and suitable for pH range of 4.5 to 9.0.
2. Protective surface grating modules shall be constructed of HDPE or fiberglass and contain UV stabilizers.
3. The material of construction must be tested and certified by ANSI/NSF to ANSI/NSF Standard 61.

C. Installation:

1. Install surface grating in accordance with the manufacturer's instructions.
2. Grating shall be installed in panels side-by-side and placed on top of the tube settler media as shown on the plans and drawings for the project. Each panel shall be snapped together with the adjacent panel with locks provided at the edges of each panel.

2.5 MANUFACTURERS

A. Manufacturers:

1. Provide tube settlers and protective surface grating as manufactured by:
 - a. Brentwood Industries.
 - b. Enviropax

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE & HANDLING

A. Delivery

1. Tube modules shall be shipped and delivered to job site on pallets.

B. Storage

1. All material and equipment shall be shipped, stored, handled, and installed in such a manner as to not degrade quality or serviceability.
2. The tube settling modules shall not be stacked more than four high (8 ft.) (one over the other).
3. All modules shall be stacked such that the PVC sheet planes are in a vertical position (similar to the manner of their placement inside the tank).
4. A light colored cover shall cover all modules required to be stored in the open beyond two months. Ideally these covers should be double sided such as a white on black. The white side, facing out, is used to reflect light away. Clear covers are prohibited. Black is not recommended. Black will absorb heat and if the cover comes in direct contact with the media, this heat can be quickly transferred to the media.

5. Covers cannot be wrapped tightly around the media. There should be at least a 6" air gap between the cover and top of media. The ends of the cover should be securely anchored on all sides with at least a 12" air gap at the bottom. These covers should provide shading while allowing air to pass through to prevent heat from building up.
6. Modules should be checked at least once a week. It is very possible that the covers can become loose over time due to wind or rain. A check of the stored area should be done to make any minor repairs to the cover or to restack any modules that could have fallen.

C. Handling

1. Tube modules shall remain on shipping pallets until ready to install.
2. Any abusive handling of the modules shall not be permitted. Workmen shall be careful in placing the tube modules and avoid any damage to the corners and tube edges.
3. Personnel shall not stand or walk directly on top of the modules.
4. Media modules may get brittle at low temperatures or soft at high temperatures. Therefore, care should be used in the handling of modules.

3.2 INSTALLATION

A. General:

1. Remove existing tube settlers to the limits indicated in the Contract Drawings. Dispose of removed material in accordance with local regulations.
2. Installation shall be in complete accordance with manufacturer's instructions.
3. Check and align all other components of the equipment as required.

B. Tube Settler Supports:

1. Existing support beams and support brackets shall be power washed to remove existing surface scale/tuberculation.

C. Installation:

1. Install tube modules in accordance with the manufacturer's instructions.
2. Install tube modules over the support system required and shown.
3. Exercise care in placing the modules, with particular attention to the edges and corners. Do not handle or prod with sharp objects. Protect the modules from environmental extremes and from welding sparks or open flames.

4. To access the tube settler surface, place a minimum of a 4' X 4' x 3/8" thick plywood sheets or protective surface grating on top of modules. The sheeting/grating is required to prevent damage to the tube settler edges and to distribute the weight of the worker. A potential safety hazard may occur if the

sheeting/grating is not utilized when walking atop the tube settlers. Do not stand or walk directly on top of the modules.

5. Top of adjacent tube modules shall be installed true level, with a tolerance of plus or minus 1/2 inch in full length.
6. Modules to be installed as closely as possible to minimize space between them with a maximum 1/2" allowed.
7. Cross corrugation of tubes with mixing points within individual modules is not allowed.
8. Replace all modules that have been damaged during fabrication, shipping, storage and installation.
9. Modules shall be cut to fit at the structural supports for locations as may be required. Cutting shall be done in accordance with manufacturer's recommendations.
10. The tube settling modules shall not be stacked more than four high (8 ft.) (one over the other). Modules shall be stacked such that the PVC sheet planes are in a vertical position (similar to the manner of their placement inside the tank).

3.3 START-UP

- A. Make adjustments as required to place systems in proper operating condition.
- B. Prior to installation, the CONTRACTOR shall provide the services of a manufacturer's representative for two (2) days to visit the job site to instruct the CONTRACTOR on installation methods, including cutting of the modules. Additional on-site services shall be provided as often as necessary to correct any trouble during installation. Such services shall be provided until the installation is entirely satisfactory to the OWNER/ENGINEER.

3.4 INSTRUCTION OF OPERATIONS AND MAINTENANCE PERSONNEL

- A. Comply with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
- B. Instruction Course: After equipment is fully operational, and before OWNER will assume responsibility for the operation of equipment, the equipment manufacturer's operating specialists shall be on site for one (1) day to instruct the OWNER's operating personnel in the care, maintenance and proper operation of the equipment. Training shall include cleaning of the tubes and recommended personal protection equipment needed for cleaning.
- C. All training sessions may be video-taped by OWNER.

++ END OF SECTION ++

