

**Project Manual for**  
**Northwestern Water & Sewer District**  
**Ford Road Pump Station Improvements**  
**SS-400D**



**2021**

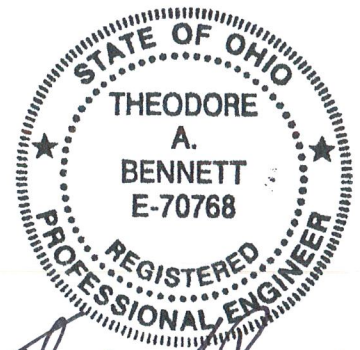
**Board of Trustees**

Mark Sheffer – Chairman  
J. Douglas Miller, P.E.- Vice Chairman  
Melinda Kale - Secretary

William Hirzel  
John A. Cheney  
Tim Phillips  
Charles Latta

Steve Arnold  
Bill Barnhart  
Brooke Hahn

Jerry R. Greiner - President  
Thomas E. Stalter, P.E. - District Engineer  
Dan Wickard – Superintendent  
Garret T. Chamberlain, P.E. – Assistant Engineer



*Theodore A. Bennett*  
7/21/2021



3103 Executive Parkway, Suite 300  
Toledo, Ohio 43606  
419.473.9611



## TABLE OF CONTENTS

	Page
C-111 Advertisement for Bids	1-2
C-200 Instruction to Bidders	1-12
C-410 Bid Form for Construction Projects	1-9
C-430 Bid Guaranty and Contract Bond	1-2
C-510 Notice of Award	1
C-520 Agreement Between Owner and Contract for Construction Contract	1-9
C-550 Notice to Proceed	1
C-610 Performance Bond	1-2
C-614 Maintenance and Guarantee Bond	1-3
C-620 Contractor's Application for Payment	1
C-620A Contractor's Affidavit	1
C-620A Final Estimate Affidavit	1
C-625 Certificate of Substantial Completion	1
C-700 General Conditions	1-69
C-800 Supplementary Conditions	1-14
Exhibit 1 - Wage Rates	
Exhibit 2 – OPWC Documents	
Exhibit 3 – WPCLF Documents	
Exhibit 4 – Electronic Document Release	

## Foreword to Technical Specifications

### DIVISION 1 - GENERAL REQUIREMENTS

01010	Definition of Contract Items
01021	Allowances
01043	Coordination and Control of the Work
01090	Reference Standards
01300	Submittals
01310	Construction Schedules and Documentation
01320	Electronic Project Management System (EPMS)
01350	Common Product Requirements
01410	Laboratory Services
01500	Maintaining Traffic
01565	Temporary Restoration and Maintenance of Pavements, Curbs, and Walkways
01568	Pollution Control
01580	Project Sign
01800	Construction Survey Work
01810	Video Recording
01820	Video Recording of Underground Infrastructure

**DIVISION 2 - UNDERGROUND, PAVEMENT, AND SITE WORK**

02100	Clearing and Grubbing
02110	Removal of Structures and Obstructions
02200	Excavation and Backfill
02550	Storm Sewers and Sanitary Sewers
02551	Precast Concrete Structures
02552	Precast Concrete Manholes
02555	Pressure Pipe (Sewer & Water)
02557	Valves
02600	Pavements, Curbing, and Walks
02710	Fencing
02800	Sodding, Seeding, and Mulching
02810	Trees

**DIVISION 3 – CONCRETE**

03100	Concrete Formwork
03150	Waterstop
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
03310	Grout

**DIVISION 4 – MASONRY**

04200	Unit Masonry
-------	--------------

**DIVISION 5 – METALS**

05120	Structural Steel
05500	Metal Fabrications
05540	Iron Castings

**DIVISION 6 - WOOD AND PLASTICS**

06630	Manhole Steps
-------	---------------

**DIVISION 7 - THERMAL AND MOISTURE PROTECTION**

07240	Roof Insulation
07532	Adhered Rubber Membrane Roofing System
07600	Flashing and Sheet Metal Work
07900	Caulking and Sealants

**DIVISION 8 - DOORS AND WINDOWS**

08125	Heavy Duty Aluminum Doors and Frames
08315	Roll-Up Doors
08320	Floor Doors
08520	Aluminum Windows
08700	Finish Hardware

08800      Glazing

**DIVISION 9 – FINISHES**

09255      PVC Wall & Ceiling Panel Construction

09900      Painting

09903      Concrete Floor Coating

**DIVISION 10 - SPECIALTIES**

**DIVISION 11 - EQUIPMENT AND SYSTEMS**

11050      Common Equipment Requirements

11735      Pumping Equipment

**DIVISION 12 – FURNISHINGS**

**DIVISION 13 - SPECIAL CONSTRUCTION**

**DIVISION 14 - CONVEYING SYSTEMS**

14320      Monorail Hoists and Scale

**DIVISION 15 – MECHANICAL**

15010      General Mechanical Provisions

15210      Piping

15211      Small Piping and Valves

15250      Valves

15260      Sluice Gates, Slide Gates, Roller Gates, and Constant Level  
Gates

15400      Plumbing

15500      Heating, Ventilating, and Air Conditioning

15502      Testing, Adjusting, and Balancing of HVAC Systems

15503      Fans

15504      Mechanical Systems Insulation

15506      Ductwork

**DIVISION 16 – ELECTRICAL**

16010      General Electrical Provisions

16020      Grounding and Bonding

16030      Electrical Identification

16050      Electrical Testing

16060      Hangers and Supports

16120      Conductors and Cables (600 Volts and Less)

16121      Control and Signal Conductor and Cables

16122      Wiring Devices

16130      Conduit, Surface Metal Raceways and Accessories

16131      Cable Trays and Wire Ways

**796-7552.002**  
**2021**

**Northwestern Water & Sewer District**  
**Ford Road Pump Station Improvements**

16132	Accessories
16220	Diesel Generators
16410	Panelboards
16411	Switchboards
16430	Disconnect Switches
16440	Automatic Transfer Switches
16510	Lighting
16902	Metering and Control Equipment
16903	Control Panels

IF ANY OF THE PAGES LISTED ABOVE ARE NOT INCLUDED IN THESE CONTRACT DOCUMENTS, PLEASE ADVISE.

END OF SECTION

**NORTHWESTERN WATER & SEWER DISTRICT  
FORD ROAD PUMP STATION IMPROVEMETS**

**ADVERTISEMENT FOR BIDS**

Sealed Bids for Ford Road Pump Station Improvements, will be received by the Northwestern Water & Sewer District, at the District's Office, 12560 Middleton Pike, Bowling Green, Ohio 43402, until 11:00 AM, local time, on August 24, 2021 at which time they will be publicly opened and read.

In general, the work consists of replacement of the District's Ford Road Pump Station. The new pump station will be a submersible style station along with utility and sitework improvements.

The issuing office is Jones & Henry Engineers, Ltd., 3103 Executive Parkway, Suite 300, Toledo, Ohio 43606. Copies of the Bidding Documents may be examined at the Owner's office listed above or the issuing office, without charge.

Technical questions regarding the project should be e-mailed to the Project Manager Theodore Bennett, P.E. at [tbennett@jheng.com](mailto:tbennett@jheng.com) at Jones & Henry Engineers, Ltd.

Copies of Bidding Documents and Contract Documents may be obtained electronically from Newfax Corporation, Phone 419-241-5157, [www.newfaxcorp.com](http://www.newfaxcorp.com). A non-refundable fee will be required for each set of Bidding and Contract Documents by Newfax Corporation payable to Newfax Corporation.

Neither Owner nor Engineer has any responsibility for the accuracy, completeness or sufficiency of any bid documents obtained from any source other than the source indicated in these documents. Obtaining these documents from any other source(s) may result in obtaining incomplete and inaccurate information. Obtaining these documents from any source other than directly from the source listed herein may also result in failure to receive any addenda, corrections, or other revisions to these documents that may be issued.

Bids must be submitted on the forms bound herein, must contain the names of every person or company interested therein, and shall be accompanied by either a Bid Guaranty and Contract Bond in the amount of 100% of the amount bid with satisfactory corporate surety, or by a certified check on a solvent bank in the amount of not less than 10% of the amount of the Bid, subject to conditions provided in the Instructions to Bidders. The successful bidder will be required to furnish satisfactory Performance Bond and Maintenance and Guarantee Bond in the amount of 100% of the Bid.

The Contractor shall be required to pay not less than the prevailing wage rates established by the federal Davis-Bacon Wage Determinations issued by the U.S. Department of Labor.

Any Bid may be withdrawn prior to the scheduled closing time for receipt of Bids, but no bidder shall withdraw his Bid within 90 days after the actual opening thereof.

This procurement is subject to the EPA policy of encouraging the participation of small business in rural areas (SBRAs). The Owner reserves the right to reject any or all Bids, waive irregularities in any Bid, and to accept any Bid which is deemed most favorable to the Owner.

This procurement is partially funded through loan and grant from the Ohio EPA DEFA WPCLF and the Ohio Public Works Commission.

796-7552.002  
2021

Northwestern Water & Sewer District  
Ford Road Pump Station Improvements

Jerry R. Greiner

---

President

---

To Newspaper:

Advertise: July 27,2021

August 3, 2021

Furnish Affidavit:



## **INSTRUCTIONS TO BIDDERS**

### **ARTICLE 1 – DEFINED TERMS**

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. Bidder - One who submits a Bid directly to Owner as distinct from a sub-bidder, who submits a bid to a Bidder.
  - B. Issuing Office - The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.
  - C. Successful Bidder - The Bidder to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

### **ARTICLE 2 – COPIES OF BIDDING DOCUMENTS**

- 2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

### **ARTICLE 3 – QUALIFICATIONS OF BIDDERS**

- 3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:
- A. Evidence of Bidder's authority to do business in the state where the Project is located.
  - B. Subcontractor and Supplier qualification information; coordinate with provisions of Article 12 of these Instructions, "Subcontractors, Suppliers, and Others."
  - C. List of equipment suppliers to be used.
- 3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.
- 3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

**ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER’S SAFETY PROGRAM; OTHER WORK AT THE SITE**

4.01 *Site and Other Areas*

- A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.
- B. Easements and their conditions are listed in these documents.

4.02 *Existing Site Conditions*

- A. Subsurface and Physical Conditions; Hazardous Environmental Conditions
  - 1. The Supplementary Conditions identify:
    - a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
    - b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
    - c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
    - d. Technical Data contained in such reports and drawings.
  - 2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
  - 3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.
- B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.
- C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated

in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 *Site Visit and Testing by Bidders*

- A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.
- B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.
- D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.
- E. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.04 *Owner's Safety Program*

- A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 *Other Work at the Site*

- A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

**ARTICLE 5 – BIDDER'S REPRESENTATIONS**

5.01 It is the responsibility of each Bidder before submitting a Bid to:

- A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;
- B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

- C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;
- D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;
- E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;
- F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid 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 required, and in accordance with the other terms and conditions of the Bidding Documents;
- G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
- H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;
- I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and
- J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

#### **ARTICLE 6 – N/A**

#### **ARTICLE 7 – INTERPRETATIONS AND ADDENDA**

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions after the date established in the Instructions to Bidders may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

#### **ARTICLE 8 – BID SECURITY**

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 100 percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.
- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and 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 released. 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 consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.
- 8.03 The Bid security of other Bidders that 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 Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

#### **ARTICLE 9 – CONTRACT TIMES**

- 9.01 The number of days within which, or the dates by which, the Work is to be substantially completed, and completed and ready for final payment, are set forth in the Agreement.

#### **ARTICLE 10 – LIQUIDATED DAMAGES**

- 10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

#### **ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS**

- 11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.
- 11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

## **ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS**

- 12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.
- 12.02 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.
- 12.03 The apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the Work:
- If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.
- 12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

## **ARTICLE 13 – PREPARATION OF BID**

- 13.01 The Bid Form is included with the Bidding Documents.
- A. All blanks on the Bid Form shall be completed in ink or printed format. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
- B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."
- 13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown. The corporate seal shall be affixed and attested by the corporate secretary or an assistant corporate secretary.

- 13.03 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership's address for receiving notices shall be shown.
- 13.04 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm's address for receiving notices shall be shown.
- 13.05 A Bid by an individual shall show the Bidder's name and address for receiving notices.
- 13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture's address for receiving notices shall be shown.
- 13.07 All names shall be printed in ink below the signatures.
- 13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.
- 13.10 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

#### ARTICLE 14 – BASIS OF BID

14.01 N/A

##### 14.02 *Unit Price*

- A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
- B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity" (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
- C. 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.

##### 14.03 *Allowances*

- A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

#### **ARTICLE 15 – SUBMITTAL OF BID**

- 15.01 The Bidding Documents have been provided electronically, a Bidder is responsible for furnishing separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.
- 15.02 A Bid shall be received 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 a plainly marked package 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 package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to 12560 Middleton Pike, Bowling Green, Ohio 43402.
- 15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

#### **ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID**

- 16.01 A Bid may be withdrawn by an appropriate document duly executed in the same 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. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.
- 16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

#### **ARTICLE 17 – OPENING OF BIDS**

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

#### **ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE**

- 18.01 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.



#### **ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT**

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.
- 19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.
- 19.03 Evaluation of Bids
- A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
  - B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.
  - C.
- 19.04 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.
- 19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

#### **ARTICLE 20 – BONDS AND INSURANCE**

- 20.01 Article 6 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 Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

#### **ARTICLE 21 – SIGNING OF AGREEMENT**

- 21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

## **ARTICLE 22 – SALES AND USE TAXES**

- 22.01 Owner is exempt from Ohio state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Bid. Refer to Paragraph SC-7.09 of the Supplementary Conditions for additional information.

## **ARTICLE 23 – N/A**

## **ARTICLE 24 – RETAINAGE**

- 24.01 Provisions concerning retainage are set forth in the Agreement.

## **ARTICLE 25 – WAGE RATES**

- 25.01 The Bidder to whom the Contract is awarded will be required to pay as a minimum, the prevailing wage rates, current throughout the work, promulgated by the Davis-Bacon Act. Wage rates received for this project are included in the Exhibits of the Supplementary Conditions.

## **ARTICLE 26 – PROTEST**

- 26.01 A protest based upon all alleged violation of the procurement requirements of 40 CFR Part 33 may be filed against the Owner's procurement action by a party with an adversely affected direct financial interest. The protest shall be filed with the Owner.
- 26.02 A protest shall be filed as early as possible during the procurement process but must be received by the OWNER no later than one week after the basis of the protest is known or should have been known, whichever is earlier. If the protest is mailed, the protester bears the risk of non-delivery within the required time period.
- 26.03 A protest must clearly present the procurement requirement being protested, the procurement regulation in alleged noncompliance, and the facts which support the protest, and any other information necessary to support the protest.

## **ARTICLE 27 – REQUIREMENTS FOR EQUAL EMPLOYMENT OPPORTUNITY (EEO)**

- 27.01 This procurement is subject to the provisions of orders issued by the Secretary of Labor Section 204 of Executive Order 11246 pertaining to equal employment opportunity (EEO). The form Contractor Equal Employment Opportunity Certification in the Additional Supplemental Conditions shall be completed and submitted with the bid.
- 27.02 The provisions of the Ohio Administrative Code (OAC) 123:2-3-02 through 124:2-9 regarding Equal Employment Opportunity on State Construction Contracts and State-assisted Construction Contracts, and OAC 123:2-3-02 through 123:2-9 regarding Equal Employment Opportunity and Female Utilization Goals are applicable to this project, and each contractor will be required to comply in all aspects of these provisions.

**ARTICLE 28 – CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS**

28.01 This procurement is subject to the provisions of Executive Order 12549 pertaining to the Certification Regarding Debarment, Suspension, and Other Responsibility Matters. The form Certification Regarding Debarment, Suspension, and Other Responsibility Matters in the Additional Supplemental Conditions shall be completed and submitted with the bid.

**ARTICLE 29 – DISADVANTAGE BUSINESS ENTERPRISES (DBE) UTILIZATION**

29.01 This procurement is subject to the USEPA program to encourage the participation of disadvantaged business enterprises. DBE Utilization is defined and explained in the Additional Supplemental Conditions. DBE program Forms 6100-3, 6100-4, and 6100-2 in the Additional Supplemental Conditions shall be completed and submitted with the bid.

**ARTICLE 30 – AMERICAN IRON & STEEL REQUIREMENTS**

- 30.01 This procurement is subject to the American Iron & Steel Requirements of PL 113-76, Consolidated Appropriations Act, 2014. The form titled American Iron & Steel Acknowledgement, found in the Additional Supplemental Conditions of all applicable materials shall be submitted by all Bidders.
- 30.02 Domestic steel use requirements as specified in Ohio Revised Code Section 153.011 apply to this project. Copies of §153.011 can be obtained from any of the offices of the department of administrative services or through <http://codes.ohio.gov/orc/153.011>.

**ARTICLE 31 – REQUIREMENTS FOR UTILIZATION OF SMALL BUSINESS IN RURAL AREAS (SBRAS)**

31.01 This procurement is subject to the EPA Policy of encouraging the participation of small businesses in rural areas. It is EPA Policy that recipients of EPA financial assistance awards utilize the services of small businesses in rural areas (SBRAs), to the maximum extent practical. The objective is to assure that such business entities are afforded the maximum practical opportunity to participate as subcontractors, suppliers, and otherwise in EPA-awarded financial assistance programs. This policy applies to all contracts and subcontracts for supplies, construction, and services under EPA grants or cooperative agreements. Small purchases are also subject to this policy.

**ARTICLE 32 – UNRESOLVED FINDING FOR RECOVERY**

32.01 The Contractor affirmatively represents to the local contracting authority that it is not subject to a finding for recovery under Ohio Revised Code §9.24, or that it has taken the appropriate remedial steps required under §9.24 or otherwise qualifies under that section. The Contractor agrees that if this representation is deemed to be false, the contract shall be void ab initio as between the parties to this contract, and any funds paid by the state hereunder shall be immediately repaid to the local contracting authority, or an action for recovery may be immediately commenced by the local government and/or for recovery of said funds.

#### **ARTICLE 33 – OHIO WORKERS’ COMPENSATION COVERAGE**

- 33.01 The Contractor must secure and maintain valid Ohio workers’ compensation coverage until the project has been finally accepted by the local contracting authority. A certificate of coverage evidencing valid workers’ compensation coverage must be submitted to the local contracting authority before the contract is executed.
- 33.02 The Contractor must immediately notify the local contracting authority, in writing, if it or any subcontractor fails or refuses to renew their workers’ compensation coverage. Furthermore, the Contractor must notify the local contracting authority, in writing, if its or any of its subcontractor’s workers’ compensation policies are canceled, terminated or lapse.
- 33.03 The failure to maintain valid workers’ compensation coverage shall be considered a breach of contract which may result in the Contractor or subcontractor being removed from the project, withholding of pay estimates and/or termination of the contract.

#### **ARTICLE 34 – DRUG-FREE WORKPLACE PROGRAM**

- 34.01 In accordance with Ohio Revised Code §153.03 and during the life of this project, the Contractor and all its Subcontractors that provide labor on the Project site must be enrolled in and remain in good standing in the Ohio Bureau of Worker’s Compensation (“OBWC”) Drug-Free Workplace Program (“DFWP”) or a comparable program approved by the OBWC.

#### **ARTICLE 35 – OHIO PREFERENCE**

- 35.01 In accordance with Ohio Revised Code §164.05 (A)(6), to the extent practicable, the Contractor and subcontractor shall use Ohio products, materials, services and labor in connection with this project.

#### **ARTICLE 36 – OHIO ETHICS LAW**

- 36.01 Contractor agrees that it is currently in compliance and will continue to adhere to the requirements of Ohio Ethics law as provided by Section 102.03 and 102.04 of the Ohio Revised Code.

#### **ARTICLE 37 – FUNDING AGENCY BID REQUIREMENTS**

- 37.01 This procurement is partially funded through loan and grant from the Ohio EPA DEFA WPCLF and the Ohio Public Works Commission.
- 37.02 Forms and documentation for the Ohio EPA DEFA WPCLF and the Ohio Public Works Commission programs are found in Exhibits 2 and 3 respectively.
- 37.03 All forms and documentation shall be provided with the Bid.

#### **ARTICLE 38 – QUESTIONS REGARDING BID DOCUMENTS**

- 38.01 All questions shall be submitted by e-mail to Theodore Bennett, P.E. at Jones & Henry Engineers, Ltd. at 3103 Executive Parkway, Suite 300, Toledo, OH 43606, [tbennett@jheng.com](mailto:tbennett@jheng.com), no later than August 18, 2021 at 11:00 AM.

**ARTICLE 39 – ENGINEER’S ESTIMATE**

39.01 The Engineer’s Opinion of Probable Construction costs is \$4,745,000.00.



**BID FORM**

NORTHWESTERN WATER & SEWER DISTRICT  
FORD ROAD PUMP STATION IMPROVEMENTS

**ARTICLE 1 – BID RECIPIENT**

- 1.01 This Bid is submitted to:  
Northwestern Water & Sewer District  
12560 Middleton Pike  
Bowling Green, Ohio 43402
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

**ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS**

- 2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

**ARTICLE 3 – BIDDER’S REPRESENTATIONS**

- 3.01 In submitting this Bid, Bidder represents that:
- A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Addendum, Date</u>
_____	_____
_____	_____
_____	_____
_____	_____

- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and has satisfied itself as to all 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 adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.
- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

#### **ARTICLE 4 – BIDDER'S CERTIFICATION**

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:



1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

#### **ARTICLE 5 – BASIS OF BID**

- 5.01 Bidder will complete the Work in accordance with the Contract Documents for unit prices indicated on the following page(s):

**UNIT PRICE BID**

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

Item No.	Description	Estimated Amount	Unit	Unit Cost in Numbers		Unit Price in Words	Total Estimated Cost of Item	
1	Mobilization & Demobilization	1	LS					
2a	Bypass Pumping Mobilization and Demobilization	1	LS					
2b	Bypass Pumping	2	WK					
3	Storm Water Pollution Prevention Plan	1	LS					
4	Pump Station Wet Well, Control Building, Site Improvements, Appurtenances and Accessories	1	LS					
5a	48-inch Sanitary Sewer, Type B	140	LF					
5b	12-inch Sanitary Sewer, Type B	140	LF					
5c	12-inch Storm Sewer, Type B	104	LF					
5d	12-inch Storm Sewer, Type C	160	LF					
5e	10-inch Storm Sewer, Type B	250	LF					

Item No.	Description	Estimated Amount	Unit	Unit Cost in Numbers		Unit Price in Words	Total Estimated Cost of Item	
5f	10-inch Storm Sewer, Type C	90	LF					
5g	42-inch Sanitary Sewer Abandonment	140	LF					
5h	12-inch Sanitary Sewer Abandonment	60	LF					
6a	16-inch Force Main, Type B	235	LF					
6b	16-inch Force Main, Type C	75	LF					
6c	12-inch Force Main Abandoned (Grout Filled)	65	LF					
6d	Force Main Termination and Abandonment, All Sizes	2	EA					
7a	Type I Sanitary Sewer Manhole	30	VLF					
7b	Type IV Sanitary Sewer Manhole (Doghouse)	1	LS					
7c	Type III Sanitary Sewer Manhole with Outside Drop Connection	35	VLF					
7d	Type I Storm Sewer Manhole	23	VLF					
7e	Flow Meter & Bypass Structure	1	LS					

Item No.	Description	Estimated Amount	Unit	Unit Cost in Numbers		Unit Price in Words	Total Estimated Cost of Item	
7f	Manhole 5028 Removed	1	LS					
8a	Excavation and Backfill of Unsuitable Materials for Structures	101	CY					
8b	Excavation and Backfill of Unsuitable Materials for Pavement	200	CY					
8c	Geotextile Stabilization / Separation Fabric	120	SY					
8d	Geogrid Subgrade Stabilization Material	120	SY					
9a	Catch Basin, Type 2-2B (Outlet Structure)	3	EA					
9b	Catch Basin, Type 2-2B	1	EA					
10a	ODOT Item 202 Pavement and Base Removed	90	SY					
10b	ODOT Item 254 Pavement Planing	1,700	SY					
10c	ODOT Item 452 - Concrete Drive Approach (6")	55	SY					
10d	ODOT Item 452 - Concrete Drive Approach (8")	55	SY					

Item No.	Description	Estimated Amount	Unit	Unit Cost in Numbers		Unit Price in Words	Total Estimated Cost of Item	
10e	ODOT Item 451 - Reinforced Concrete Pavement - Parking Area (10")	580	SY					
10f	Flexible Pavement Resurfacing - Roadway	1,700	SY					
10g	Flexible Pavement Trench Repair - Heavy Roadway	90	SY					
10h	ODOT Item 301 Asphalt Concrete Base Course (3-inches)	80	SY					
10i	Subgrade Support Material	620	SY					
11a	Fence with Maintenance Strip	675	LF					
11b	Vehicle Fence Gate	1	EA					
12	CCTV of New Sewers (8-inch and larger)	900	LF					
13	Video Recording the Zone of Influence	1	LS					
14	Tree Removal, Clearing & Grubbing	1	SY					
15	Maintenance of Traffic	1	LS					

Item No.	Description	Estimated Amount	Unit	Unit Cost in Numbers		Unit Price in Words	Total Estimated Cost of Item	
16	Pump Station Control Building Modifications, Dry Well and Wet Well Abandonment	1	LS					
17	6-inch Water Main, Type B	110	LF					
18	Fire Hydrant Assembly, Type A	1	EA					
19a	16-inch x 16-inch Tapping Sleeve, Valve and Box	1	EA					
19b	12-inch Inserting Valve and Box	1	EA					
19c	Abandonment of Valves at Completion	2	EA					
20	Flow Meter Manhole Converted to Piggings Manhole	1	LS					
ALLOW A	Telemetry Equipment & Programming	1	ALLOW					
ALLOW B	Chemical Feed Equipment	1	ALLOW					
ALLOW C	New Electric Service	1	ALLOW					
ALLOW D	Engineering Services for Soil Evaluation	1	ALLOW					
<b>Total Estimated Construction Cost:</b>								

**ARTICLE 6 – TIME OF COMPLETION**

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

**ARTICLE 7 – ATTACHMENTS TO THIS BID**

- 7.01 The following documents are submitted with and made a condition of this Bid:
- A. Required Bid security;
  - B. Evidence of authority to do business in the state of the Project;
  - C. Required Bidder Qualification Statement with supporting data.

**ARTICLE 8 – DEFINED TERMS**

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

**ARTICLE 9 – BID SUBMITTAL**

BIDDER: *[Indicate correct name of bidding entity]*

By:

*[Signature]*

*[Printed name]*

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

Attest:

*[Signature]*

*[Printed name]*

Title:

Submittal Date:

Address for giving notices:

**796-7552.002  
2021**

**Northwestern Water & Sewer District  
Ford Road Pump Station Improvements**

---

---

Telephone Number:

Email Address:

Contact Name:

Bidder's License No.:

*(where applicable)*



PERSONAL PROPERTY TAX AFFIDAVIT

STATE OF OHIO )  
 )ss.  
COUNTY OF \_\_\_\_\_)

\_\_\_\_\_, being first duly sworn, deposes and says as follows: answering whichever is applicable by placing an "X" before items 1 or 2.

1.           (    )   We are not charged with any delinquent personal property taxes on the general tax list of personal property in \_\_\_\_\_ County, Ohio.
2.           (    )   We are charged with delinquent personal property taxes on the general tax list of \_\_\_\_\_ County, Ohio including unpaid penalties and interest in the amount of \$\_\_\_\_\_.

\_\_\_\_\_  
Bidder

By: \_\_\_\_\_

Title: \_\_\_\_\_

Sworn and subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_.

\_\_\_\_\_  
Notary Public in and for

\_\_\_\_\_ State

My Commission Expires:

\_\_\_\_\_ 20 \_\_\_\_\_



**BID GUARANTY AND CONTRACT BOND  
(SECTION 153.571 OHIO REVISED CODE)**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned \_\_\_\_\_  
\_\_\_\_\_ as  
principal and \_\_\_\_\_  
\_\_\_\_\_ as sureties, are hereby held and firmly  
bound unto Northwestern Water & Sewer District as OWNER in the penal sum of the dollar amount of the  
bid submitted by the principal to the OWNER on \_\_\_\_\_  
\_\_\_\_\_ to undertake the project known as \_\_\_\_\_  
\_\_\_\_\_.

The penal sum referred to herein shall be the dollar amount of the principal's bid to the OWNER incorporating any additive or deductive alternate proposals made by the principal on the date referred to above to the OWNER, which are accepted by the OWNER. In no case shall the penal sum exceed the amount of \_\_\_\_\_  
\_\_\_\_\_ dollars.

(If the foregoing blank is not filled in, the penal sum will be the full amount of the principal's bid, including alternates. Alternatively, if the blank is filled in, the amount stated must not be less than the full amount of the bid including alternates, in dollars and cents. A percentage is not acceptable.) For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above-named principal has submitted a bid on the above referred to project;

Now, therefore, if the OWNER accepts the bid of the principal and the principal fails to enter into a proper contract in accordance with the bid, plans, details, specifications, and bills of material; and in the event the principal pays to the OWNER the difference not to exceed ten percent of the penalty hereof between the amount specified in the bid and such larger amount for which the OWNER may in good faith contract with the next lowest bidder to perform the work covered by the bid; or in the event the OWNER does not award the contract to the next lowest bidder and resubmits the project for bidding, the principal pays to the OWNER the difference not to exceed ten percent of the penalty hereof between the amount specified in the bid, or the costs, in connection with the resubmission, of printing, new contract documents, required advertising, and printing and mailing notices to prospective bidders, whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect; if the OWNER accepts the bid of the principal and the principal within fifteen days after the awarding of the contract enters into a proper contract in accordance with the bid, plans, details, specifications, and bills of material, which said Contract is made a part of this bond the same as though set forth herein.

Now also, if the said principal shall well and faithfully do and perform the things agreed to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, materialmen, and laborers, for labor performed and material furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the OWNER herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of the said contract or in or to the plans or specifications therefore shall in any way affect the obligations of said surety on its bond and does hereby waive notice of any such modifications, omissions, or additions to the terms of the contract or in or to the plans and specifications.

SIGNED AND SEALED this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**Principal:**

\_\_\_\_\_  
By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Surety: \_\_\_\_\_

Surety Company Address:

\_\_\_\_\_  
Street  
By \_\_\_\_\_  
Attorney-in-Fact City State Zip

Surety Agent's Address:

\_\_\_\_\_  
Agency Name  
\_\_\_\_\_  
Street  
\_\_\_\_\_  
City State Zip

---

**NOTICE OF AWARD**

---

Date of Issuance:

Owner: Northwestern Water & Sewer District Owner's Contract No.:

Engineer: Jones & Henry Engineers, Ltd. Engineer's Project No.: 796-7552.002

Project: Ford Road Pump Station Contract Name:  
Improvements

Bidder:

Bidder's Address:

**TO BIDDER:**

You are notified that Owner has accepted your Bid dated [ ] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

In general, the work consists of replacement of the District's Ford Road Pump Station. The new pump station will be a submersible style station along with utility and sitework improvements.

The Contract Price of the awarded Contract is: \$ [ ] *[note if subject to unit prices, or cost-plus]*

[ ] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. *[revise if multiple copies accompany the Notice of Award]*

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award:

1. Deliver to Owner [ ] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

---

Owner:

Authorized Signature

By:

Title:

Copy: Engineer



AGREEMENT  
BETWEEN OWNER AND CONTRACTOR  
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between Northwestern Water & Sewer District ("Owner") and  
("Contractor").

Owner and Contractor hereby agree as follows:

## ARTICLE 1 – WORK

- 1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:
1. In general, the work consists of replacement of the District's Ford Road Pump Station. The new pump station will be a submersible style station along with utility and sitework improvements.

## ARTICLE 2 – THE PROJECT

- 2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Northwestern Water & Sewer District, Ford Road Pump Station Improvements.

## ARTICLE 3 – ENGINEER

- 3.01 The part of the Project that pertains to the Work has been designed by Jones & Henry Engineers, Ltd..
- 3.02 The Owner has retained Jones & Henry Engineers, Ltd. ("Engineer") to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with 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 *Contract Times: Days*
- A. The Work will be substantially completed within 300 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 360 days after the date when the Contract Times commence to run.
- 4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration 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):
1. Substantial Completion: Contractor shall pay Owner \$1000.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.
  2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$500.00 for each day that expires after such time until the Work is completed and ready for final payment.
  3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

#### 4.04 *Special Damages*

- A. In addition to the amount provided for liquidated damages, Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

### ARTICLE 5 – CONTRACT PRICE

- A. Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents.

For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

### ARTICLE 6 – PAYMENT PROCEDURES

#### 6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.



6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment once each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in 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 elsewhere in the Contract.
  - 1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract
    - a. 92 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and
    - b. 92 percent of cost of materials and equipment not incorporated in the Work.
- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 98 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less amounts of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

**ARTICLE 7 – INTEREST**

- 7.01 All amounts not paid when due shall not bear interest.

**ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS**

- 8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:
- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
  - B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, 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 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 adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.
- F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no 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.
- 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 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.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

## ARTICLE 9 – CONTRACT DOCUMENTS

### 9.01 *Contents*

- A. The Contract Documents consist of the following:
  - 1. This Agreement (pages 1 to 9, inclusive).
  - 2. Bid Guarantee & Contract bond (pages C-430-1 to C-430-2, inclusive).
  - 3. Performance bond (pages C-610-1 to C-610-2, inclusive).
  - 4. Labor and Maintenance bond (pages  to , inclusive).
  - 5. Maintenance and Guarantee bond (pages C-614-1 to C-614-3, inclusive).
  - 6. General Conditions (pages C-700-1 to C-700-69, inclusive).
  - 7. Supplementary Conditions (pages  to , inclusive).
  - 8. Specifications as listed in the table of contents of the Project Manual.

9. Drawings (not attached but incorporated by reference) consisting of [ ] sheets with each sheet bearing the following general title: [ ] [or] the Drawings listed on the attached sheet index.
  10. Addenda (numbers [ ] to [ ], inclusive).
  11. Exhibits to this Agreement (enumerated as follows):
    - a. Contractor's Bid (pages [ ] to [ ], inclusive).
  12. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    - a. Notice to Proceed.
    - b. Work Change Directives.
    - c. Change Orders.
    - d. Field Orders.
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

## ARTICLE 10 – MISCELLANEOUS

### 10.01 *Terms*

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

### 10.02 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, 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, money that may become due and money that is 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.

### 10.03 *Successors and Assigns*

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

### 10.04 *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.

10.05 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:
1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;
  2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
  3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
  4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 *Other Provisions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on \_\_\_\_\_ (which is the Effective Date of the Contract).

OWNER:

CONTRACTOR:

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

*(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest: \_\_\_\_\_

Attest: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Address for giving notices:

Address for giving notices:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

License No.: \_\_\_\_\_  
*(where applicable)*

CERTIFICATION OF FISCAL OFFICER

The undersigned, as \_\_\_\_\_ of \_\_\_\_\_ hereby certifies that funds sufficient to meet the requirement of this Contract have been lawfully appropriated for such purpose and are in the treasury, or in the process of collection.

By: \_\_\_\_\_

Title: \_\_\_\_\_

APPROVAL BY OWNER'S LEGAL OFFICER

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

---

**NOTICE TO PROCEED**

---

Owner:	Northwestern Water & Sewer District	Owner's Contract No.:	
Contractor:		Contractor's Project No.:	
Engineer:	Jones & Henry Engineers, Ltd.	Engineer's Project No.:	796-7552.002
Project:	Ford Road Pump Station Improvements	Contract Name:	
		Effective Date of Contract:	

---

**TO CONTRACTOR:**

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [\_\_\_\_\_, 20\_\_]. *[see Paragraph 4.01 of the General Conditions]*

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, [the date of Substantial Completion is \_\_\_\_\_, and the date of readiness for final payment is \_\_\_\_\_] **or** [the number of days to achieve Substantial Completion is \_\_\_\_\_, and the number of days to achieve readiness for final payment is \_\_\_\_\_].

Before starting any Work at the Site, Contractor must comply with the following:  
*[Note any access limitations, security procedures, or other restrictions]*

---

Owner:

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer





**PERFORMANCE BOND**

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_  
\_\_\_\_\_, Contractor, as Principal and \_\_\_\_\_  
\_\_\_\_\_, as Surety, are held and firmly bound  
unto Northwestern Water & Sewer District, hereinafter called the Owner, in the penal sum of  
\_\_\_\_\_ dollars (\$ \_\_\_\_\_), good and lawful money of the United States of  
America to be paid to said Owner, its legal representatives and assigns, for which payment well and truly  
to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, and each and  
every one of them jointly and severally, firmly by these presents.

WHEREAS, the above-named Principal has entered into a certain written Agreement with the  
Owner, dated the \_\_\_\_\_ day of \_\_\_\_\_ A.D. 2019, for  
construction of work entitled Ford Road Pump Station Improvements (hereinafter called the Contract)  
which Contract and Specifications for said work shall be deemed a part hereof as fully as if set out herein.

NOW THEREFORE, THE CONDITIONS OF THIS OBLIGATION IS SUCH, that if the said Principal shall  
well and faithfully do and perform the things agreed by him to be done and performed according to the  
terms of said Contract and shall pay all lawful claims of subcontractors, material suppliers, and laborers,  
for labor performed and materials furnished in carrying forward, performing or completing of the said  
Contract, we agreeing and assenting that this undertaking shall be for the benefit of any material supplier  
or laborer having a just claim as well as for the obligee herein, then this obligation shall be void, otherwise  
the same shall remain in full force and effect; it being expressly understood and agreed that the liability  
of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation  
as herein stated.

The said surety, for value received, hereby stipulates and agrees that no charge, extension of time,  
alteration or addition to the terms of the Contract or to the work to be performed thereunder or the  
Specifications accompanying the same shall in any wise affect its obligations on this bond, and it does  
hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the  
Contract or to the work of the Specifications.

WITNESS our hands and seals this \_\_\_\_\_ day of \_\_\_\_\_ A.D. 20\_\_\_\_\_.

Witnesses:

Principal:

\_\_\_\_\_  
Printed

\_\_\_\_\_  
Printed

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Principal Signature (Seal)

\_\_\_\_\_  
Printed

\_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Surety Signature (Seal)

I hereby approve the form and correctness of the foregoing Bond.

\_\_\_\_\_  
Owner's Legal Officer

Date: \_\_\_\_\_

**MAINTENANCE AND GUARANTEE BOND**

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_  
\_\_\_\_\_, Contractor, as Principal and \_\_\_\_\_  
\_\_\_\_\_, as Surety, are held and firmly bound  
unto Northwestern Water & Sewer District, hereinafter called the Owner, in the penal sum of  
\_\_\_\_\_ dollars (\$ \_\_\_\_\_), good and lawful money of the United States of  
America to be paid to said Owner, its legal representatives and assigns, for which payment well and truly  
to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, and each and  
every one of them jointly and severally, firmly by these presents.

WHEREAS, the above-named Principal has entered into a certain written Agreement with the  
Owner, dated the \_\_\_\_\_ day of \_\_\_\_\_ A.D. 20\_\_\_\_, for  
construction of work entitled Ford Road Pump Station Improvements (hereinafter called the Contract)  
which Contract and Specifications for said work shall be deemed a part hereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that by and under said  
Contract, the above-named Principal has agreed with the Owner that for a period specified in paragraph  
15.08. of the General Conditions, to keep in good order and repair any defect in all the work done under  
said Contract either by the Principal or his Subcontractors, or his material suppliers, that may develop  
during said period due to improper materials, defective equipment, workmanship or arrangements, and  
any other work affected in making good such imperfections, shall also be made good all without expense  
to the Owner, excepting only such part or parts of said work as may have been disturbed without the  
consent or approval of the Principal after the final acceptance of the work, and that whenever directed

so to do by the Owner by notice served in writing, either personally or by mail on the Principal at

\_\_\_\_\_

OR

\_\_\_\_\_

legal representatives, or successors, or on the Surety at \_\_\_\_\_

\_\_\_\_\_

WILL PROCEED at once to make such repairs as directed by said Owner; and in case of failure so to do within one week from the date of service of such notice, or within reasonable time not less than one week, as shall be fixed in said notice, then the Owner shall have the right to purchase such materials and employ such labor and equipment as may be necessary for the purpose, and to undertake, do and make such repairs, and charge the expense thereof, to and receive same from said Principal or Surety. If any repair is necessary to be made at once to protect life and property, then and in that case, the Owner may take immediate steps to repair or barricade such defects without notice to the Contractor. In such accounting, The Owner shall not be held to obtain the lowest figures for the doing of the work, or any part thereof, but all sums actually paid therefore shall be charged to the Principal or Surety. In this connection, the judgment of the Owner is final and conclusive. If the said Principal for a period specified in paragraph 15.08. of the General Conditions and, shall keep said work so constructed under said Contract in good order and repair, excepting only such part or parts of said work which may have been disturbed without the consent or approval of said Principal after the final acceptance of the same, and shall whenever notice is given as hereinbefore specified, at once proceed to make repair as in said notice directed, or shall reimburse said Owner for any expense incurred by making such repairs, should the Principal or Surety fail to do as hereinbefore specified, and shall fully indemnify, defend, and save harmless the Owner from all suits and actions for damages of every name and description brought or claimed against it for or on account of any injury or damage to person or property received or sustained by any party or parties, by or from any of the acts or omissions or through the negligence of said Principal, servants, agents, or employees, in the prosecution of the work included in said Contract, then the above obligation shall be void, otherwise to remain in full force and effect.

\_\_\_\_\_

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed by their respective authorized officers this \_\_\_\_\_ day of \_\_\_\_\_ A.D. 20\_\_.

Signed, Sealed, and Delivered

In the Presence of:

Witnesses:

_____	_____
Printed	
_____	_____ (Seal)
Signature	Principal
_____	_____
Printed	
_____	_____ (Seal)
Signature	Surety

I hereby approve the form and correctness of the foregoing Bond.

\_\_\_\_\_  
Owner's Legal Officer

Date: \_\_\_\_\_



OHIO WATER DEVELOPMENT AUTHORITY  
**CONTRACTOR'S ESTIMATE**

TO OWNER:

APPLICATION NO: \_\_\_\_\_

PERIOD TO: \_\_\_\_\_

OWDA LOAN NO: \_\_\_\_\_

FROM CONTRACTOR:

FOR OWDA OFFICE USE ONLY

Fund: \_\_\_\_\_

Voucher: \_\_\_\_\_

OWDA Pay: \_\_\_\_\_

Date: \_\_\_\_\_

PROJECT:

1 ORIGINAL CONTRACT PRICE	
2 Net change by CHANGE ORDER	\$0.00
3 CURRENT CONTRACT PRICE (Line 1 + 2)	\$0.00
4 TOTAL COMPLETED & STORED TO DATE	
5 RETAINAGE	
a.                      % of completed work	
b.                      % of stored work	
Total Retainage (Line 5a + 5b)	\$0.00
6 TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5 total)	\$0.00
7 LESS PREVIOUS PAYMENTS (Line 6 from prior certificate)	
8 CURRENT PAYMENT DUE	\$0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Approved Change Orders through Change Order No: _____		
NET CHANGES by Change Order		\$0.00

**CONTRACTOR'S CERTIFICATE**

I hereby certify that the above materials and services have been furnished and performed in accordance with the conditions of the contract for the above work, and that payment has not been received and therefore is due and to be paid on said contract

CONTRACTOR:

BY: \_\_\_\_\_

DATE: \_\_\_\_\_

ENGINEER: \_\_\_\_\_ By: \_\_\_\_\_ Date: \_\_\_\_\_

OWNER: \_\_\_\_\_ By: \_\_\_\_\_ Date: \_\_\_\_\_

OWDA: \_\_\_\_\_

Chief Engineer

Executive Director





STATE OF \_\_\_\_\_ )  
 ) ss  
County of \_\_\_\_\_ )

The undersigned, \_\_\_\_\_, hereby represents that on \_\_\_\_\_ it was awarded a contract by Northwestern Water & Sewer District, hereinafter called Owner, to construct Ford Road Pump Station Improvements, in accordance with terms and conditions of Contract No. \_\_\_\_\_; and the undersigned further represents that all progress payments heretofore received by the Contractor from the Owner on account of the Work have been applied by the Contractor to discharge in full all of the Contractor's obligations incurred in connection with the Work covered by all prior progress payments in accordance with the applicable subcontracts, except as follows:

This affidavit is freely and voluntarily given with full knowledge of the facts, on this \_\_\_\_\_ day of \_\_\_\_\_, A.D. 20\_\_\_\_.

Contractor

By \_\_\_\_\_  
Title \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, A.D. 20\_\_\_\_\_

Notary Public

(Seal)

My Commission Expires



**CONTRACTOR'S AFFIDAVIT  
WAIVER OF LIENS/FINAL ESTIMATE**

STATE OF \_\_\_\_\_)

) ss

County of \_\_\_\_\_)

The undersigned, \_\_\_\_\_  
hereby represents that on \_\_\_\_\_ it was awarded a contract by the Northwestern Water & Sewer District hereinafter called the OWNER, to construct the Ford Road Pump Station Improvements in accordance with terms and conditions of Contract No. \_\_\_\_\_; and the undersigned further represents that the subject work has now been accomplished and the said Contract has now been completed.

The undersigned hereby warrants and certifies that all of its indebtedness arising by reason of the said Contract has been fully paid or satisfactorily secured; and that all claims from Subcontractors and others for labor and material used in accomplishing the said project, as well as all other claims arising from the performance of the said Contract, have been fully paid or satisfactorily settled. The undersigned further agrees that, if any such claim should hereafter arise, he (it) shall assume responsibility for the same immediately upon request to do so by the OWNER.

The undersigned, for a valuable consideration, the receipt of which is hereby acknowledged, does further hereby waive, release and relinquish any and all claims or right of lien which the undersigned now has or may hereafter acquire upon the subject premises for labor and material used in accomplishing said project owned by the OWNER.

This affidavit is freely and voluntarily given with full knowledge of the facts, on this day of \_\_\_\_\_, A.D. 20\_\_.

By \_\_\_\_\_  
CONTRACTOR

Title \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, A.D. 20\_\_.

\_\_\_\_\_  
Notary Public

(Seal)

My Commission Expires \_\_\_\_\_



## CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: Northwestern Water & Sewer District	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer: Jones & Henry Engineers, Ltd.	Engineer's Project No.: 796-7552.002
Project: Ford Road Pump Station Improvements	Contract Name:

**This [preliminary] [final] Certificate of Substantial Completion applies to:**

☐ All Work ☐ The following specified portions of the Work:

### Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: ☐ None  
☐ As follows

Amendments to Contractor's responsibilities: ☐ None  
☐ As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

EXECUTED BY ENGINEER:	RECEIVED:	RECEIVED:
By: _____ (Authorized signature)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____



## STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

### TABLE OF CONTENTS

	Page
ARTICLE 1 – Definitions and Terminology .....	1
1.01 Defined Terms .....	1
1.02 Terminology .....	5
ARTICLE 2 – Preliminary Matters.....	6
2.01 Delivery of Bonds and Evidence of Insurance .....	6
2.02 Copies of Documents .....	6
2.03 Before Starting Construction .....	7
2.04 Preconstruction Conference; Designation of Authorized Representatives .....	7
2.05 Initial Acceptance of Schedules .....	7
2.06 Electronic Transmittals.....	8
ARTICLE 3 – Documents: Intent, Requirements, Reuse.....	8
3.01 Intent.....	8
3.02 Reference Standards .....	8
3.03 Reporting and Resolving Discrepancies .....	9
3.04 Requirements of the Contract Documents .....	9
3.05 Reuse of Documents .....	10
ARTICLE 4 – Commencement and Progress of the Work.....	10
4.01 Commencement of Contract Times; Notice to Proceed .....	10
4.02 Starting the Work .....	10
4.03 Reference Points .....	11
4.04 Progress Schedule .....	11
4.05 Delays in Contractor’s Progress .....	11
ARTICLE 5 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions .....	12
5.01 Availability of Lands .....	12
5.02 Use of Site and Other Areas .....	12
5.03 Subsurface and Physical Conditions.....	13
5.04 Differing Subsurface or Physical Conditions .....	14
5.05 Underground Facilities .....	15

5.06	<del>Hazardous Environmental Conditions at Site</del> .....	17
ARTICLE 6 – Bonds and Insurance .....		19
6.01	Performance, Payment, and Other Bonds .....	19
6.02	Insurance—General Provisions .....	20
6.03	Contractor’s Insurance .....	21
6.04	Owner’s Liability Insurance .....	23
6.05	Property Insurance.....	23
6.06	Waiver of Rights .....	25
6.07	Receipt and Application of Property Insurance Proceeds .....	26
ARTICLE 7 – Contractor’s Responsibilities .....		27
7.01	Supervision and Superintendence .....	27
7.02	Labor; Working Hours .....	27
7.03	Services, Materials, and Equipment.....	27
7.04	“Or Equals” .....	28
7.05	Substitutes .....	29
7.06	Concerning Subcontractors, Suppliers, and Others .....	30
7.07	Patent Fees and Royalties .....	32
7.08	Permits .....	32
7.09	Taxes .....	33
7.10	Laws and Regulations.....	33
7.11	Record Documents.....	33
7.12	Safety and Protection.....	33
7.13	Safety Representative .....	34
7.14	Hazard Communication Programs .....	35
7.15	Emergencies .....	35
7.16	Shop Drawings, Samples, and Other Submittals.....	35
7.17	Contractor’s General Warranty and Guarantee.....	37
7.18	Indemnification .....	38
7.19	Delegation of Professional Design Services .....	39
ARTICLE 8 – Other Work at the Site .....		39
8.01	Other Work .....	39
8.02	Coordination .....	40
8.03	Legal Relationships.....	40



ARTICLE 9 – Owner’s Responsibilities.....	41
9.01 Communications to Contractor.....	41
9.02 Replacement of Engineer .....	41
9.03 Furnish Data .....	41
9.04 Pay When Due.....	42
9.05 Lands and Easements; Reports, Tests, and Drawings .....	42
9.06 Insurance.....	42
9.07 Change Orders.....	42
9.08 Inspections, Tests, and Approvals.....	42
9.09 Limitations on Owner’s Responsibilities .....	42
9.10 Undisclosed Hazardous Environmental Condition.....	42
9.11 Evidence of Financial Arrangements.....	42
9.12 Safety Programs .....	42
ARTICLE 10 – Engineer’s Status During Construction .....	43
10.01 Owner’s Representative.....	43
10.02 Visits to Site.....	43
10.03 Project Representative.....	43
10.04 Rejecting Defective Work.....	43
10.05 Shop Drawings, Change Orders and Payments.....	43
10.06 Determinations for Unit Price Work .....	44
10.07 Decisions on Requirements of Contract Documents and Acceptability of Work .....	44
10.08 Limitations on Engineer’s Authority and Responsibilities.....	44
10.09 Compliance with Safety Program.....	45
ARTICLE 11 – Amending the Contract Documents; Changes in the Work .....	45
11.01 Amending and Supplementing Contract Documents .....	45
11.02 Owner-Authorized Changes in the Work .....	45
11.03 Unauthorized Changes in the Work.....	46
11.04 Change of Contract Price .....	46
11.05 Change of Contract Times .....	47
11.06 Change Proposals .....	47
11.07 Execution of Change Orders.....	48
11.08 Notification to Surety.....	48
ARTICLE 12 – Claims .....	49

12.01	Claims .....	49
ARTICLE 13 – Cost of the Work; Allowances; Unit Price Work .....		50
13.01	Cost of the Work .....	50
13.02	Allowances .....	52
13.03	Unit Price Work .....	53
ARTICLE 14 – Tests and Inspections; Correction, Removal or Acceptance of Defective Work ....		53
14.01	Access to Work.....	53
14.02	Tests, Inspections, and Approvals.....	54
14.03	Defective Work.....	55
14.04	Acceptance of Defective Work.....	55
14.05	Uncovering Work .....	55
14.06	Owner May Stop the Work .....	56
14.07	Owner May Correct Defective Work.....	56
ARTICLE 15 – Payments to Contractor; Set-Offs; Completion; Correction Period .....		57
15.01	Progress Payments.....	57
15.02	Contractor’s Warranty of Title .....	60
15.03	Substantial Completion .....	60
15.04	Partial Use or Occupancy .....	61
15.05	Final Inspection .....	61
15.06	Final Payment.....	62
15.07	Waiver of Claims .....	63
15.08	Correction Period .....	63
ARTICLE 16 – Suspension of Work and Termination .....		64
16.01	Owner May Suspend Work .....	64
16.02	Owner May Terminate for Cause.....	64
16.03	Owner May Terminate For Convenience .....	65
16.04	Contractor May Stop Work or Terminate .....	66
ARTICLE 17 – Final Resolution of Disputes .....		66
17.01	Methods and Procedures.....	66
ARTICLE 18 – Miscellaneous.....		67
18.01	Giving Notice .....	67
18.02	Computation of Times.....	67
18.03	Cumulative Remedies .....	67

18.04	Limitation of Damages .....	67
18.05	No Waiver .....	67
18.06	Survival of Obligations .....	67
18.07	Controlling Law .....	67
18.08	Headings.....	67



## ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

### 1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. 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, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
  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. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
  5. *Bidder*—An individual or entity that submits a Bid to Owner.
  6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
  7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
  8. *Change Order*—A document 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, or other revision to the Contract, issued on or after the Effective Date of the Contract.
  9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
  10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance

with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
27. *Notice to Proceed*—A written notice 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.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *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.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.
35. *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.

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
37. *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, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *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.
40. *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.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *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 a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *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 but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.



47. *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; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

## 1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
  1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 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 15.03 or 15.04).
- 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. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- 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. *Bonds:* 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 Contractor’s Insurance:* When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance:* After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

### 2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
  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.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, 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 and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *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 2.03.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 the component parts of the Work.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

**ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, 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.
- ~~C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.~~
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

- A. Standards Specifications, Codes, Laws and Regulations
  - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, 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, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract 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, reference standard, 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 part of the Contract Documents prepared by or for Engineer. 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 part of the Contract Documents prepared by or for Engineer.

### 3.03 *Reporting and Resolving Discrepancies*

#### A. *Reporting Discrepancies:*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or 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) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) 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 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
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 part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
  - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); 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 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract

Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
  - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or 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; or
  - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- 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.

**ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK**

4.01 *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 Contract 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 Contract. 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 Contract, whichever date is earlier.~~

4.02 *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 such date.

4.03 *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.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 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 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
  - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. 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, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, 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 Times and Contract Price. 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.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. 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. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
  - 1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;
  3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
  4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

## **ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

### **5.01 *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.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

### **5.02 *Use of Site and Other Areas***

- A. *Limitation on Use of Site and Other Areas:*
  1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for



Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, 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 any such claim, and against all 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 directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent 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 and adjacent areas 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 of 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 structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
  1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
  2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
  3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with

respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on 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.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site 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 5.03 is materially inaccurate; or
2. is of such a nature as to require a change in the Drawings or Specifications; 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 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in

question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments:*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, 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 fall within any one or more of the categories described in Paragraph 5.04.A;
  - 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 Paragraph 13.03; and,
  - c. 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.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
  - a. Contractor knew of the existence of such condition at the time Contractor made a 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 otherwise; or
  - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
  - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent 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 do not warrant or guarantee 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 information and data regarding existing Underground Facilities at the Site;
    - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
    - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
    - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then 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 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

- a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
  - 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 Paragraph 13.03;
  - c. 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; and
  - d. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
  3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

~~5.06 Hazardous Environmental Conditions at Site~~

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

- ~~1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and~~
- ~~2. Technical Data contained in such reports and drawings.~~

~~B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on 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 removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.~~

- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) 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 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. 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, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. 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, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2)

was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- J. 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 failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

## ARTICLE 6 – BONDS AND INSURANCE

### 6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, 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. 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 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond 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 the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then 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 bond and surety requirements above.

- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, 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.



- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

- A. *Workers' Compensation:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
  - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
  - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
  - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
  - 4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
  - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
  - 2. claims for damages insured by reasonably available personal injury liability coverage.
  - 3. 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.
- C. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
  - 1. Products and completed operations coverage:
    - a. Such insurance shall be maintained for three years after final payment.
    - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
  3. Broad form property damage coverage.
  4. Severability of interest.
  5. Underground, explosion, and collapse coverage.
  6. Personal injury coverage.
  7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
  8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against 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. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; 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 (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after

Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

~~I. General provisions: The policies of insurance required by this Paragraph 6.03 shall:~~

- ~~1. include at least the specific coverages provided in this Article.~~
  - ~~2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.~~
  - ~~3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.~~
  - ~~4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.~~
  - ~~5. be appropriate for the Work being performed and provide protection from claims that 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.~~
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

#### 6.04 *Owner's Liability Insurance*

- ~~A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, 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.~~
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

#### 6.05 *Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the

remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as “insureds.”

2. be written on a builder’s risk “all risk” policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder’s risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
6. extend to cover damage or loss to insured property while in transit.
7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder’s risk insurance.
8. allow for the waiver of the insurer’s subrogation rights, as set forth below.
9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
10. not include a co-insurance clause.
11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
12. include performance/hot testing and start-up.

13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to

the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
  - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
  - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, 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 builder's risk insurance and any other property insurance applicable to the Work.

**6.07**    *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

## ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

### 7.01 *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.
- 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.

### 7.02 *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, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner’s written consent, which will not be unreasonably withheld.

### 7.03 *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, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work 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.

7.04 "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 Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item 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 is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
1. If Engineer in its sole discretion determines that 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, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
    - a. in the exercise of reasonable judgment Engineer determines that:
      - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
      - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
      - 3) it has a proven record of performance and availability of responsive service; and
      - 4) it is not objectionable to Owner.
    - 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.
- B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.



- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer consider the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
  2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
  3. 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:
    - a. shall certify that the proposed substitute item will:
      - 1) perform adequately the functions and achieve the results called for by the general design,
      - 2) be similar in substance to that specified, and
      - 3) be suited to the same use as that specified.
    - b. will state:
      - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
      - 2) 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
      - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
    - c. will identify:
      - 1) all variations of the proposed substitute item from that specified, and
      - 2) available engineering, sales, maintenance, repair, and replacement services.

- d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. 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.
- E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. 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 the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. 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.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. 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.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

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

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, 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 the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *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.

7.10 *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 or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and 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 such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
  - 1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
  3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, 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 Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
  - C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
  - D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
  - E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.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 at its expense (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 protection 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 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
  - G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

#### 7.13 *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.

7.14 *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.

7.15 *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.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
  - a. reviewed and coordinated the 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 and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
  - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the 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 set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*
  - a. Contractor shall submit the number of copies required in the Specifications.
  - 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 7.16.D.
2. *Samples:*
  - a. Contractor shall submit the number of Samples required in the Specifications.
  - b. Contractor shall 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 7.16.D.
3. 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. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- 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 or to safety precautions or programs incident thereto.
  3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
  4. Engineer's review and approval of a Shop Drawing or Sample 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 7.16.A.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 will document any such approved variation from the requirements of the Contract Documents in a Field Order.
  5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.



6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

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.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *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 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;
  6. the issuance of a notice of acceptability by Engineer;
  7. any inspection, test, or approval by others; or
  8. any correction of defective Work by Owner.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.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 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *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 Laws and Regulations.
- 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, 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, 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 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

**ARTICLE 8 – OTHER WORK AT THE SITE**

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other

work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, 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.

#### 8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
  - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
  - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
  - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

#### 8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. 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.

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.
- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) 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 any such claims, and against all 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 damage, delay, disruption, or interference.

## ARTICLE 9 – OWNER'S RESPONSIBILITIES

### 9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

### 9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

### 9.03 *Furnish Data*

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

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

## ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

### 10.01 *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.

### 10.02 *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 10.08. Particularly, but without limitation, during or as a result of Engineer’s visits or observations of Contractor’s Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

### 10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. 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.

### 10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

### 10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer’s authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, 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 15.06.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 10.08 shall also apply to the Resident Project Representative, if any.



10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

**ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK**

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
  - 1. *Change Orders:*
    - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
    - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
  - 2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.
  - 3. *Field Orders:* Engineer may authorize minor changes in the Work if the changes 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. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-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. Such

changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

**11.03** *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, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

**11.04** *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. 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, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
  - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
  - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. *Contractor's Fee:* When applicable, 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 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
    - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

- c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
- d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
- 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 11.04.C.2.a through 11.04.C.2.e, inclusive.

#### 11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

#### 11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.
  - 1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

#### 11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
  1. 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;
  2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
  3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
  4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

#### 11.08 *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.

## ARTICLE 12 – CLAIMS

### 12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
  - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
  - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
  - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation:*
  - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
  - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.
  - 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval:* If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim:* If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any

time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

- G. *Final and Binding Results:* If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

## ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

### 13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work:* The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
  2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work 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 13.01.C, 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, and 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 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
  - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
  - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
  - c. ~~Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.~~
  - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
  - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
  - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), 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 communication 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 that Contractor is required by the Contract Documents to purchase and maintain.
  - C. *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 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here 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 Paragraph 13.01.B.
  - D. *Contractor's Fee:* When the Work as a whole 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, Change Proposal, Claim, set-off, or other 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 11.04.C.
  - E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, 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.

#### 13.02 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:* Contractor agrees that:
  - 1. 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



2. 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*: 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.

13.03 *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. Payments to Contractor for Unit Price Work will be based on actual quantities.
- 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. 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 the following paragraph.
- ~~E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price 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;~~
  - ~~2. there is no corresponding adjustment with respect to any other item of Work; and~~
  - ~~3. Contractor believes that it 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 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the

Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- ~~B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.~~
- 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, obtaining, and paying for all inspections and tests required:
  - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
  - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
  - 3. by manufacturers of equipment furnished under the Contract Documents;
  - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
  - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. 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. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages 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. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then 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, and provide all necessary labor, material, and equipment.
  - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages 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 pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
  - 2. 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, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

**14.06 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, then 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.

**14.07 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, 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, then 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 14.07, 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, 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 incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-

offs against payments due under Article 15. 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 14.07.

## ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

### 15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 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 during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *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, a warehouse bond, 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.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
  2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design

professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

- a. the Work has progressed to the point indicated;
  - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
  - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
- a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; 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 money 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 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, requiring correction or replacement;
  - b. the Contract Price has been reduced by Change Orders;

- c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
- d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
- e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

- 1. Thirty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner:*

- 1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
  - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
  - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
  - c. Contractor has failed to provide and maintain required bonds or insurance;
  - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
  - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
  - f. the Work is defective, requiring correction or replacement;
  - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
  - h. the Contract Price has been reduced by Change Orders;
  - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
  - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
  - k. 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;

- I. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, 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, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
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 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *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 and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- 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 preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.



- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. 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 punch list.

15.04 *Partial Use or Occupancy*

- 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. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be 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 15.03.A through E for that part of the Work.
  - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work 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 15.03 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 6.05 regarding builder's risk or other property insurance.

15.05 *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, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *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, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
  - a. all documentation called for in the Contract Documents;
  - b. consent of the surety, if any, to final payment;
  - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
  - d. a list of all disputes that Contractor believes are unsettled; and
  - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.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, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

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 have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. 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 15.07. 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. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.
- D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

#### 15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

#### 15.08 *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 Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
  - 1. correct the defective repairs to the Site or such other adjacent areas;
  - 2. correct such defective Work;
  - 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 to 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. 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 repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

- 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, 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 are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

## ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

### 16.01 *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 written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

### 16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and 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);
  - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
  - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
  - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
  - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
  - 2. enforce the rights available to Owner under any applicable performance bond.

- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.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 the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds 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.
- F. 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, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

**16.03 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; and
  - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) 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 16.03.
- 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 are not intended to preclude Contractor from submitting a Change Proposal 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 17 – FINAL RESOLUTION OF DISPUTES**

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
  - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
  - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
  - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
  - 2. agree with the other party to submit the dispute to another dispute resolution process; or
  - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

## ARTICLE 18 – MISCELLANEOUS

### 18.01 *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, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
  - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

### 18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract 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.

### 18.03 *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. 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.

### 18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

### 18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

### 18.06 *Survival of Obligations*

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

### 18.07 *Controlling Law*

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

### 18.08 *Headings*

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





**STATE OF OHIO EQUAL EMPLOYMENT OPPORTUNITY**  
**REQUIREMENTS AND BID CONDITIONS FOR**  
**OPWC-ASSISTED CONSTRUCTION PROJECTS**

The following materials are provided for use by local subdivisions in receipt of financial assistance from the Ohio Public Works Commission for the development or redevelopment of capital infrastructure improvements. The materials relate to the State of Ohio's equal employment opportunity requirements for contractors when they participate in State-assisted construction projects.

**These materials must be inserted into the contracting subdivision's bidding documents for such State-assisted projects, and must be regarded as an integral component of the bidder's response. The bidder must, as a part of its bid response: elect one of the two Bidder's Affirmative Action Requirements, adopt the Bidder's EEO Covenants, and complete the Bidder's Certification. Failure to complete the required sections may cause the bidder's proposal to be rejected as being non-responsive to the State's Equal Employment Opportunity Requirements and in non-compliance with the State Equal Employment Opportunity Bid Conditions. In addition, the bidder must submit a copy of a valid Certificate of Compliance for Equal Employment Opportunity purposes prior to the execution of a contract.**

Should there be any questions regarding the use or meaning of any portion of these materials, questions should be directed to the Equal Opportunity Division at 30 East Broad Street, 18<sup>th</sup> floor, Columbus, Ohio 43266-0408.

**STATE OF OHIO EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS**

**NOTICE TO CONTRACTORS:**

The provisions of the Ohio Administrative Code (OAC) 123:2-3-02 through 124:2-9 regarding Equal Employment Opportunity on State Construction Contracts and State-assisted Construction Contracts, and OAC 123:2-3-02 through 123:2-9 regarding Equal Employment Opportunity and Female Utilization Goals are applicable to this project, and each contractor will be required to comply in all aspects of these provisions.



### **CERTIFICATE OF COMPLIANCE FOR EEO PURPOSES:**

All prime contractors must secure a valid Certificate of Compliance from the Department of Administrative Services, Equal Opportunity Division, prior to execution of a construction contract.

See <http://www.das.ohio.gov/Divisions/EqualOpportunity/CertificateofCompliance/tabid/129/Default.aspx> for instructions for electronic filing.

>>> Does this bidder have a valid Certificate of Compliance? \_\_\_\_ Yes \_\_\_\_ No

>>> If "No" to the above, will this bidder be able to obtain a valid Certificate of Compliance prior to the execution of a contract? \_\_\_\_ Yes \_\_\_\_ No

**Bidder must provide a "Yes" answer to one or the other of the above questions.**

### **BIDDER'S AFFIRMATIVE ACTION REQUIREMENTS:**

Each prime contract bidder must submit an affirmative action program regarding equal employment opportunity to and receive approval from the State Equal Employment Opportunity (EEO) Coordinator prior to the bid opening, **OR** the prime contract bidder must have evidence within its bid adoption of the minority and female utilization work hour utilization goals and the specific affirmative action steps set forth in 123:2-3 through 123:2-9 of the Ohio Administrative Code.

>>> Has the prime contract bidder prepared and submitted an Affirmative Action Program to the State Equal Employment Opportunity Coordinator and that program has been approved by the State Equal Employment Opportunity Coordinator prior to the bid opening ? \_\_\_\_ Yes \_\_\_\_ No

>>>If "no", with this bid response, the prime contract bidder hereby adopts the minority and female work hour utilization goals and the specific affirmative action steps set forth in 123:2-3 through 123:2-9 of the Ohio Administrative Code.

### **BIDDER'S EEO COVENANTS:**

Throughout its performance of any contract awarded to it on this State-assisted project, the prime contract bidder agrees to the following covenants:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, ancestry or sex. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, national origin, ancestry or sex. Such action shall include, but is not limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will in all solicitations or advertisements for employees placed by or on behalf of the prime contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, ancestry or sex.

(3) The contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the State Administering Agency advising the said labor union or workers' representatives of the contractor's

commitments under this covenant and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of the Ohio Department of Administrative Services, Equal Opportunity Division and with the implementing rules, regulations and applicable orders of the State Equal Employment Opportunity Coordinator.

(5) The contractor agrees to fully cooperate with the State Administering Agency, the State Equal Employment Opportunity Coordinator and with any other official or agency, or the State or Federal government which seeks to eliminate unlawful employment discrimination, and with all other State and Federal efforts to assure equal employment practices under its contract and the contractor shall comply promptly with all requests and directions from the State Administering Agency, the State Equal Employment Opportunity Coordinator and any of the State of Ohio officials and agencies in this regard, both before and during construction.

(6) Full cooperation as expressed in clause (5), above, shall include, but not be limited to, being a witness and permitting employees to be witnesses and complainants in any proceeding involving questions of unlawful employment practices, furnishing all information and monthly utilization work hour reports required by the OAC 123: 2-9-01 and by the rules, regulations and orders of the State Equal Employment Opportunity Coordinator pursuant thereto, and permitting access to its books, records, and accounts by the State Administering Agency and the State Equal Employment Opportunity Coordinator for purposes of investigation to ascertain compliance with such rules, regulations and orders. Specifically, contractors will submit workforce utilization reports to the State Equal Opportunity Coordinator by the 10th of each month. The monthly reports must be electronically submitted through the following website: <http://das.ohio.gov/EOD/CCInputForm29.htm>

(7) In the event of the contractor's noncompliance with the nondiscrimination clauses of its contract or with any of the said rules, regulations, or orders, its contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further State Contracts or State-assisted Construction Contracts in accordance with procedures authorized in OAC 123:2-3 through 2-9 and such other sanctions may be instituted and remedies invoked, as provided in OAC 123:2-3 through 2-9 or by regulation, or order of the State Equal Employment Opportunity Coordinator, or as otherwise provided by law.

In the event that its contract is terminated for a material breach of OAC 123:2-3 through 2-9 the contractor shall become liable for any and all damages which shall accrue to the State Administering Agency and Applicant and the State of Ohio as a result of said breach.

(8) The contractor will require the inclusion of language reflecting these same eight covenants within every subcontract or purchase order it executes in the performance of its contract unless exempted by rules, regulations or orders of the State Equal Employment Opportunity Coordinator issued pursuant to O.A.C. 123:2-3-02 so that these provisions will be binding upon each subcontractor or vendor. The contractor will take such actions as the Administering Agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in any litigation with a subcontractor, vendor or other party as a result of such direction by the State Administering Agency, the contractor may be requested to protect the interests of the State.

>>>The prime contract bidder hereby adopts the foregoing covenants ? \_\_\_ Yes \_\_\_ No

**BIDDER'S CERTIFICATION:**

The undersigned, being a duly authorized officer of the prime contract bidder, does hereby certify to and agree with the foregoing statements and covenants regarding its subscription to the State's Equal Employment Opportunity Requirements for State-assisted Construction Contracts.

\_\_\_\_\_  
Signature of Authorized Officer

\_\_\_\_/\_\_\_\_/\_\_\_\_  
Date

\_\_\_\_\_  
Title

**>>> PLEASE NOTE: Only a bidder possessing a valid certificate will be awarded a contract pursuant to Chapter 153 of the Revised Code by an owner referred to in section 153.01 of the Revised Code. Application shall be made at least ten working days prior to the date that the bidder expects to receive the certificate. The bidder's failure to elect one of the two Bidder's Affirmative Action Requirements, adopt the Bidder's EEO Covenants, and complete the foregoing certification may cause the bidder's proposal to be rejected as being non-responsive to the State's Equal Employment Opportunity Requirements and in non-compliance with the State Equal Employment Opportunity Bid Conditions. In addition, the bidder must, prior to the execution of a contract, submit to the local subdivision a valid Certificate of Compliance for Equal Employment Opportunity purposes.**

**"APPENDIX A" OF THE STATE EEO BID CONDITIONS**

**MINORITY MANPOWER UTILIZATION GOALS AND TIMETABLES**

The following minority goals listed are expressed in terms of percentages of work hours for each trade to be used by the contractor in a designated area. Designated areas are defined as Ohio's Standard Metropolitan Statistical Areas (SMSA). They are: Akron, Cincinnati, Cleveland, Columbus, Dayton, Toledo and Youngstown-Warren. In cases where the project is not located in a designated area, the contractor may adopt minority utilization goals of the near/nearest designated area.

<b>AKRON</b>		<b>CINCINNATI</b>		<b>CLEVELAND</b>	
		<u>Trade</u>		<u>Trade</u>	
All Trades	10%	Asbestos Workers	9%	Asbestos Workers	17%
		Boilermakers	9 %	Boilermakers	10%
		Carpenters	10%	Carpenters	16%
<b>COLUMBUS</b>					
All Trades	10%	Elevator Constructors	11%	Electricians	20%
		Floor Layers	10%	Elevator Constructors	20%
		Glaziers	10%	Floor Layers	11%
<b>DAYTON</b>					
All Trades	11%	Lathers	10%	Glaziers	17%
		Marble, Tile, Terrazzo	8%	Ironworkers	13%
		Millwright	10%	Operating Engineers	17%
		Operating Engineers	11%	Painters	17%
<b>TOLEDO</b>					
All Trades	9%	Painters	11%	Pipefitters	17%
		Pipefitters	11%	Plasterers	20%
		Plasterers	10%	Plumbers	17%
		Plumbers	11%	Roofers	17%
<b>YOUNGSTOWN</b>					
All Trades	9%	Sheet Metal Workers	11%	Other Trades	17%
		Other Trades	11%		



**"APPENDIX B" OF THE STATE EEO BID CONDITIONS**

**SPECIFIC AFFIRMATIVE ACTION STEPS**

The following Affirmative Action steps are directed at increasing minority utilization:

(1) The contractor should maintain a file of the names and addresses of each minority and female referred to it by any individual or organization and what action was taken with respect to each such referred individual, and if the individual was not employed by the contractor, and the reasons therefore. If such individual was sent to the union hiring hall for referral and not referred back by the union or if referred back by the union or if referred, not employed by the contractor, the file should document this and the reason therefore.

To Demonstrate Compliance: Maintain a file of the names, addresses, telephone numbers, and craft of each minority and female applicant showing (a) the date of contact and whether the person was hired; if not, the reason, (b) if the person was sent to a union for referral, and the results (c) follow-up contacts when the contractor was hiring.

(2) The contractor should promptly notify the State Contracting Agency when the Union or Unions with which the contractor has collective bargaining agreements does not refer to the contractor a minority or female worker referred (to the union) by the contractor, or when the contractor has information that the union referral process has impeded efforts to meet its goals.

To Demonstrate Compliance: Have a copy of letters sent, or do not claim the union is impeding the contractors' efforts to comply.

(3) The contractor should disseminate its Equal Employment Opportunity policy within its organization by including it in any company newsletters and annual reports; by advertising at reasonable intervals in union publications; by posting of the policy; by specific review of the policy with minority and female employees; and by conducting staff meetings to explain and discuss the policy.

To Demonstrate Compliance: Have a written EEO policy which includes the name and how to contact the contractor's EEO Officer and (a) include the policy in any company policy manuals, (b) post a copy of the Policy on all company bulletin boards (in the office and on all job sites), (c) records, such as reports or diaries, etc., that each minority and female employee is aware of the Policy and that it has been discussed with them, (d) that the policy has been discussed regularly at staff meetings and (3) copies of newsletters and annual reports which include the Policy.

(4) The contractor should continually monitor all personnel activities to ensure that its EEO policy is being carried out, including the evaluation of minority and female employees for promotional opportunities on a quarterly basis and the encouragement of such employees to seek those opportunities.

To Demonstrate Compliance: Have records that the company EEO Officer reviews all: (a) monthly workforce reports, (b) hiring and terminations, (c) training provided on-the-job, (d) minority and female employees quarterly for promotion and encourages them to prepare for and seek promotion. The records should be the EEO Officer's job description, reports, memos, personnel files, etc., documenting the activities for possible discriminatory patterns.

(5) The contractor should disseminate its EEO policy externally by informing and discussing it with all recruiting sources; by advertising it in news media, specifically including minority and female news media; and by notifying and discussing it with all subcontractors.





To Demonstrate Compliance: Have copies of (a) letters sent, at least six months or at the start of each new major contract, to all recruiting sources (including labor unions) requiring compliance with the Policy, (b) advertising, which has the EEO "tagline" on the bottom, and (c) purchase order and subcontract agreement forms will include or make reference to the State EEO Covenant, Appendix A or B of the Ohio Administrative Code 123:2-3-02.

(6) The contractor should make specific and reasonably recurrent oral and written recruitment efforts directed at minority and women's organizations, and training organizations with the contractor's recruitment area.

To Demonstrate Compliance: Have a record either in a follow-up file for each organization or on the reverse of the notification letter sent under Item 1, above, of the dates, individuals contacted and the results of the contract from telephone calls or personal meetings with the individuals or groups notified under Item 1.

(7) The contractor, where reasonable, should develop on-the-job training opportunities and participate and assist in all Department of Labor funded and/or approved training programs (including Apprenticeship) Programs relevant to the contractor's employee needs consistent with its obligations in the Bid Conditions.

To Demonstrate Compliance: Have records of contributions in cash, equipment supplied and/or contractor personnel provided as instructors for Bureau of Apprenticeship and Training approved or Department of Labor funded training programs and records of the hiring and training of minorities and females referred to Company by such programs.

(8) The contractor should solicit bids for subcontracts (and joint ventures) from available minority and female subcontractors engaged in the trades covered by the Bid Conditions, including circulation of minority and female contractors associations.

To Demonstrate Compliance: Have copies of letters or other direct solicitation of bids for subcontracts/joint ventures from minority/female contractors with a record of the specific response and any follow-up the contractor has done to obtain a price quotation or to assist a minority/female contractor in preparing or reducing a price quotation; have a list of all minority/female subcontracts awarded or joint ventures participated in with dollar amounts, etc.

#### **EXPLANATION OF AN ACCEPTABLE AFFIRMATIVE ACTION PROGRAM:**

An Affirmative Action Program is a set of specific and result-oriented procedures to which a Contractor shall apply every good faith effort. The objective of those procedures and efforts is to assure equal employment opportunity. An acceptable Affirmative Action Program will include an analysis of all trades employed by the Contractor within the last year with an explanation of whether Minorities are currently being under-utilized in any one or more trades. A necessary prerequisite to the development of a satisfactory Affirmative Action Program is the identification and analysis of problem areas inherent in Minority employment and an evaluation of opportunities for utilization of Minority group personnel.

##### Part I - Basic Contents of an Affirmative Action Program:

1. Development or reaffirmation of the contractor's EEO policy in all personnel actions.
2. Formal internal and external dissemination of contractor's EEO policy.
3. Establishment of responsibilities for implementation of the contractor's affirmative action program.
4. Identification of problem areas (deficiencies) by organizational units and job classification.

5. Establishment of goals and objectives by organizational units and job classification, including timetables for completion.
6. Development and execution of action oriented programs designed to eliminate problems and further designed to attain established goals and objectives.
7. Design and implementation of internal audit and reporting systems to measure effectiveness of the total programs.
8. Compliance of personnel policies and practices with Federal sex discrimination guidelines (41 CFR Part 60-20).
9. Active support of local and national community action programs and community service programs, designed to improve the employment opportunities of minorities.
10. Consideration of ethnic minorities and women not currently in the work force having requisite skills who can be recruited through affirmative action measures.
11. Summary data on applicant flow, hires, terminations and promotions, and training for the last twelve months or the last one hundred applicants, hires, etc., whichever is less.

Part II - Analysis of Individual Trades

1. The minority population of the labor area surrounding (contractor's) projects.
2. The size of the minority unemployment force in the labor area surrounding (the contractor's) projects.
3. The percentage of minority work force as compared with the total work force in the immediate labor area.
4. The general availability of minorities having requisite skills in the immediate labor area.
5. The availability of minorities having requisite skills in the area in which the contractor can reasonably recruit.
6. The availability of promotable minority employees within the contractor's organization.
7. The anticipated expansion, contraction, and turnover of an in the work force.
8. The existence of training institutions capable of training minorities in the requisite skills.
9. The degree of training which the contractor is reasonably able to undertake as a means of making all job classes available to minorities.

Goals, timetables and affirmative action commitments must be designed to correct any identifiable deficiencies. Where deficiencies exist and where numbers or percentages are relevant in developing corrective action, the contractor shall establish and set forth specific goals and timetables. Such goals and timetables, with supporting data and the analysis thereof shall be a part of the contractor's written affirmative action program. Where the contractor has not established a goal, its written affirmative action program must specifically analyze each of the factors listed above, and must detail its reason for a lack of a goal. The goals and timetables should be attainable in terms of the contractor's analysis of its deficiencies and its entire action. Thus, in establishing its

goals and timetables, the contractor should consider the results which could be reasonably expected from its good faith efforts to make its overall affirmative action program work. If the contractor does not meet its goals and timetables, the contractor's good faith efforts shall be judged as to whether the contractor is following its program and attempting to make the program work toward the attainment of its goals.

Support data for the above analysis and program shall be compiled and maintained as part of the contractor's affirmative action program. This data should include applicant flow data and applicant rejection ratios indicating minority status.

Compliance Status: No State Contractor's compliance status shall be judged alone by whether or not he reaches his goals and meets his timetables. Rather each Contractor's compliance posture shall be reviewed and determined by reviewing the contents of his program, the extent of his adherence to his program and his good faith efforts to make his program work toward the realization of the program's goals within the timetables set for completion.

#### **“APPENDIX C” OF THE STATE EEO BID CONDITIONS**

##### **FEMALE UTILIZATION GOALS**

OAC 123:2-3-05 Required utilization analysis and goals

(A) Each state-involved contractor shall include in his/her affirmative action program the information and analysis required pursuant to part IV 401-C of appendix A of rule 123:2-1-01 of the Administrative Code, in addition to female utilization requirements pursuant to the governor's "Executive Order 84-9" and this rule.

(B) As required by the governor's "Executive Order 84-9", the utilization of women shall be, at a minimum, that currently in use by the federal government as of February 15, 1984. This requirement stated at C.F.R. part 60-4 is 6.9 percent utilization of women. This requirement shall remain at 6.9 percent unless further amended by the governor in a subsequent order. This requirement shall be met by a determination of work hours utilized in the same manner as minority utilization hours are calculated.



## EPA PROCUREMENT RULES AND REGULATIONS

Ohio Environmental Protection Agency Regulations require that a copy of Sub agreement Provisions and other provisions be included in the bidding documents.

The Contractor's attention is called to the following sections which contain binding requirements:

Contractor Equal Opportunity Certification

Certification Regarding Debarment, Suspension and other Matters

Disadvantaged Business Enterprises Utilization

American Iron and Steel Acknowledgement

Violating Facilities Clause

Utilization of Small Business in Rural Areas

**Equal Employment Opportunity (EEO) Requirements**  
(Required Contract Provision)

The Contractor's EEO Certification Form provided on the following page must be:

- (1) included in the contract documents and
- (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

NOTE: If the loan applicant has its own EEO requirements, local procedures and forms may be substituted for the EPA form.

## Contractor Equal Employment Opportunity Certification

During the performance of this contract, the undersigned agrees as follows:

1. The undersigned will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The undersigned will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The undersigned agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this equal opportunity (federally assisted construction) clause.
2. The undersigned will, in all solicitations or advertisements for employees placed by or on behalf of the undersigned, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
3. The undersigned will send to each labor union or representative of workers, with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representative of the undersigned's commitment under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The undersigned will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
5. The undersigned will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and relevant orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the administering agency of the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the undersigned's non-compliance with the equal opportunity (federally assisted construction) clause of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part, and the undersigned may be declared ineligible for further Government contracts of federally assisted construction contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rules, regulations, or order of the Secretary of Labor, or as provided by law.
7. The undersigned will include this equal opportunity (federally assisted construction) clause in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order No. 11246 of September 24, 1965, so that such provision will be binding upon each subcontract or vendor. The undersigned will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for non compliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor, as a result of such direction by the administering agency the undersigned may request the United States to enter into such litigation to protect the interest of the United States.

---

(Signature)

---

(Date)

---

(Name and Title of Signer, Please type)

---

(Firm Name)

## **Debarment Requirements**

(Required Contract Provision)

The Certification Regarding Debarment, Suspension, and Other Responsibility Matters form included on the following page must be:

- (1) included in the contract documents and
- (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.



## **Certification Regarding Debarment, Suspension, and Other Responsibility Matters**

### **INSTRUCTIONS**

Under Executive Order 12549 an individual or organization debarred or excluded from participation in Federal assistance or benefit programs may not receive any assistance award under a Federal program or a subagreement thereunder for \$25,000 or more.

Accordingly, each prospective recipient of an EPA grant, loan, or cooperative agreement and any contract or subagreement participant thereunder must complete the attached certification provide an explanation why they cannot. For further details, see the regulation 40 CFR 32.510, Participants' responsibilities.

Go to [www.epls.gov](http://www.epls.gov) to access the Excluded Parties List System (EPLS). The EPLS includes information regarding entities debarred, suspended, proposed for debarment, excluded or disqualified under the nonprocurement common rule, or otherwise declared ineligible from receiving Federal contracts, certain subcontracts, and certain Federal assistance and benefits. This information may include names, addresses, DUNS numbers, Social Security Numbers, Employer Identification Numbers or other Taxpayer Identification Numbers, if available and deemed appropriate and permissible to publish by the agency taking the action.

#### **Where To Submit**

The prospective EPA grant, loan, or cooperative agreement recipient must return the signed certification or explanation with its application to Ohio EPA.

A prospective prime contractor must submit a complete certification or explanation to the individual or organization awarding the contract.

Each prospective subcontractor must submit a complete certification or explanation to the prime contractor for the project.

Applicants may reproduce these materials as needed and provide them to their prospective prime contractor, who, in turn, may reproduce and provide them to prospective subcontractors.

Additional copies / assistance may be requested from:

Ohio EPA  
Division of Environmental and Financial Assistance  
P.O. Box 1049  
Columbus, Ohio 43216-1049  
(614) 644-2798  
[www.epa.state.oh.us/defa/](http://www.epa.state.oh.us/defa/)

### **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 judgement 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 of 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 (b) of this certification;
- (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; and
- (e) Will not utilize a subcontractor or supplier who is unable to certify (a) through (d) above.

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.

---

Type Name & Title of Authorized Representative

---

Signature of Authorized Representative

---

Date

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

## **Disadvantaged Business Enterprises (DBE) Utilization**

### **(Required Contract Provision)**

USEPA has a program to encourage the participation of disadvantaged businesses in the construction activities funded by the Clean Water and Drinking Water SRF's. "DBE" is an all inclusive term that includes Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Small Business Enterprises (SBE), Small Business in Rural Areas (SBRA), HUBZone Small Business, Labor Surplus Area Firms (LSAF), and other entities defined as socially and/or economically disadvantaged. While the WPCLF and WSRLA strongly encourage participation by all disadvantaged groups, specific participation goals are negotiated with USEPA only for Minority Business Enterprises and Women's Business Enterprises.

### **Goals**

As a condition of receiving capitalization grants from U.S. EPA for the Water Pollution Control Loan Fund (WPCLF) and the Water Supply Revolving Loan Account (WSRLA), the Ohio EPA negotiates "fair share" Disadvantaged Business Enterprises (DBE) objectives with U.S. EPA. The current negotiated goals for construction related activities are 1.3% of all contracts to MBEs and 1.0% of all contracts to WBEs.

### **DBE Certification**

Under the DBE program, qualified DBE's are those that have been certified as an MBE or WBE. Certifications can be obtained from a federal agency such as the Small Business Administration or the Department of Transportation or by an approved State agency. The Unified Certification Program (UCP) administered by the Ohio Department of Transportation (ODOT) can provide the necessary DBE certifications. Information on the UCP can be found at [www.ohioucp.org](http://www.ohioucp.org) as well as the ODOT website [www.dot.state.oh.us/divisions/equalopportunity/pages/dbe.aspx](http://www.dot.state.oh.us/divisions/equalopportunity/pages/dbe.aspx). Applications for certification by EPA can be found on EPA's Small Business Programs website at [www.epa.gov/osbp](http://www.epa.gov/osbp) under the Disadvantaged Business Enterprise Program link. Any questions regarding EPA's certification process should be directed to Teree Henderson of EPA at 202-566-2222.

### **DBE Qualifications**

To qualify for MBE certification, businesses must be 51 percent owned and controlled by a U.S. citizen and Ohio resident belonging to an African American, Native American, Hispanic, or Asian American ethnic group. In addition, the business must be in operation for at least one year prior to submitting an application. For DBE status, a business must be at least 51 percent owned by a socially and economically disadvantaged person who participates in the daily operations of the business. This person must be a woman or of African-American, Hispanic, Native American, Asian American ethnicity.

### **Program Requirements**

**To comply with DBE program requirements the WPCLF/WSRLA loan recipient must do the following:**

1. Create and maintain a bidder's list (see description below)

2. Include contract conditions applicable to the DBE program in all procurement contracts entered into by the Borrower for all WPCLF and WSRLA projects. These conditions are listed below.
3. Follow, document, and maintain documentation of good faith efforts on the part of prime contractors to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project.
4. Review the Form 6100-3 and 6100-4 submittals provided by bidders on the project for completeness and obtain any additional information necessary to verify the certification status of all proposed subcontractors.
5. Obtain documentation of the good faith efforts of the prime contractor if the prime contractor does not meet the MBE or WBE goal.
6. Obtain a written confirmation from any prime contractor states that they will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual.
7. Submit the following to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined:
  - Form 6100-3 from each subcontractor
  - Form 6100-4 from each prime contractor
  - a copy of the Good Faith Efforts documentation from any prime contractors that will not meet the MBE and WBE goals,
  - if any of the prime contractors will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual, a copy of the written confirmation from that prime contractor
8. Report MBE/WBE accomplishments on Form 5700-52A annually (within 15 days after October 1<sup>st</sup>).

**NOTE:** It is up to the WPCLF/WSRLA loan recipient whether or not to require completion and submission of Forms 6100-3 and 6100-4 from all bidders with the bid proposal or to accept completion and submission from the successful bidder(s) only at some time after bids are received. Regardless of whether the forms are completed and submitted with the bids or at some later time once the successful bidders are identified, completed forms are to be submitted to Ohio EPA with the bid package.

**To comply with DBE program requirements all prime contractors must do the following:**

1. Follow, document, and maintain documentation of their good faith efforts.
2. Complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the bid proposal package to the loan recipient.
3. Have its Disadvantaged Business Enterprise subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form** and submit those as part of the bid proposal package to the loan recipient.
4. Provide **Form 6100-2 DBE Subcontractor Actual Participation Form** to all of its Disadvantaged Business Enterprise subcontractors for completion at the end of the work.
5. During construction, provide the data necessary so that the loan recipient can report MBE/WBE accomplishments on Form 5700-52A annually (within 15 days after October 1<sup>st</sup>).

## **Bidders List**

The Borrower must create, maintain, and use a bidders list for purposes of soliciting both MBE/WBEs and non-MBE/WBEs during procurement of construction, equipment, supplies, and services. This list shall include:

1. Entity's name with point of contact;
2. Entity's mailing address, telephone number, and e-mail address;
3. The procurement on which the entity bid or quoted, and when; and
4. Entity's status as an MBE/WBE or non-MBE/WBE.

Borrowers that receive less than \$250,000 or less in any one fiscal year can be exempt from maintaining a Bidders List.

The Bidders List shall be maintained until the project period has expired and the Borrower is no longer receiving EPA funding. The Bidders List must include all firms that bid on the prime contracts, or bid or gave a quote on subcontracts, including both MBE/WBEs and non-MBE/WBEs.

## **Required Contract Conditions**

The DBE Specification language and instructions to the bidders and Forms 6100-2, 6100-3 and 6100-4 must be included in the contract documents and referenced in the Instructions to Bidders, informing bidders that the forms must be completed and submitted with their bid for all WPCLF and WSRLA projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six Good Faith Efforts (listed below) if soliciting a replacement contractor.
4. The prime contractor must employ the six Good Faith Efforts even if the prime contractor has achieved its fair share objectives.
5. An owner must ensure that each procurement contract it awards contains the following terms and conditions:

The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

## **Good Faith Efforts**

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts as listed below to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. 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. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

## **DBE Forms**

Form 6100-3 – Each prime contractor must have its DBE subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form**. This form gives the DBE subcontractor the opportunity to report the scope and cost of the subcontract and it should be forwarded to the Prime Contractor along with the DBE's quote. Each subcontractor completes one Form 6100-3. The Borrower must submit all Form 6100-3 forms to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Form 6100-4 – Each prime contractor must complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the prime contractor's bid proposal package to the Borrower. This form summarizes the Prime Contractor's intended use of identified DBE(s) and the estimated dollar amount of each subcontract. Only one Form 6100-4 form is required from each Prime Contractor. The Borrower must submit this form to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Form 6100-2 - The prime contractor must provide **Form 6100-2 DBE Subcontractor Actual Participation Form** to all of its Disadvantaged Business Enterprise subcontractors.

This form gives the DBE subcontractor the opportunity to describe the work the DBE received from the Prime Contractor, how much the DBE was paid and any other concerns the DBE might have. Disadvantaged Business Enterprise subcontractors must send completed Form 6100-2 directly to the Region 5 DBE Coordinator:

Adrienne M. Callahan, Region 5 MBE/WBE Coordinator  
USEPA, Acquisition and Assistance Branch  
77 West Jackson Boulevard (MC-10J)  
Chicago, IL 60604

This form is completed after the work by the subcontractor is done, and is NOT submitted with the bid package to Ohio EPA.

### **Reporting During Construction – Form 5700-52A**

The purpose of MBE/WBE reporting is to monitor the grant recipient's accomplishments in utilizing MBEs and WBEs; and adherence to the good faith efforts (i.e., outreach to MBEs, WBEs, and other DBEs); and progress in achieving MBE and WBE Goals. During the progress of the construction project, the loan recipient must complete & submit Form 5700-52A annually (**within 15 days after October 1<sup>st</sup>**). If there were no MBEs or WBEs utilized, or no procurement expenditures of any kind were made during the reporting period, a "negative report" is still required.

Reports are to be sent to:

Becky McKinney Ohio EPA – DEFA  
P.O. Box 1049  
Columbus, OH 43216-1049  
E-mail address: [Rebecca.McKinney@epa.ohio.gov](mailto:Rebecca.McKinney@epa.ohio.gov)  
Phone: (614) 644-3636  
Fax: (614) 644-3687





**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Performance Form**

This form is intended to capture the DBE<sup>1</sup> subcontractor's<sup>2</sup> description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor
<input type="radio"/>	<input type="radio"/>	
DBE Certified By: <input type="radio"/> DOT <input type="radio"/> SBA <input type="radio"/> Other: _____		Meets/ exceeds EPA certification standards? <input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> Unknown

<sup>1</sup> A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

<sup>2</sup> Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Performance Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

<b>Prime Contractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

<b>Subcontractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Utilization Form**

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE<sup>1</sup> subcontractors<sup>2</sup> and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Issuing/Funding Entity:			

I have identified potential DBE certified subcontractors	<input type="checkbox"/> YES <span style="margin-left: 100px;"><input type="checkbox"/> NO</span>		
If yes, please complete the table below. If no, please explain:			
Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt.	Currently DBE Certified?

Continue on back if needed

<sup>1</sup> A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

<sup>2</sup> Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program**  
**DBE Subcontractor Utilization Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

<b>Prime Contractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Participation Form**

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE<sup>1</sup> subcontractor<sup>2</sup> the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

<sup>1</sup> A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

<sup>2</sup> Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

## Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

[illegible]

<b>Subcontractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

## U.S. ENVIRONMENTAL PROTECTION AGENCY MBE/WBE UTILIZATION UNDER FEDERAL GRANTS AND COOPERATIVE AGREEMENTS

### PART I. (Reports are required even if no procurements are made during the reporting period.)

1A. FEDERAL FISCAL YEAR (Oct. 1-Sep 30)  20_____		1B. REPORTING PERIOD (Check ALL appropriate boxes) <input type="checkbox"/> 1 <sup>st</sup> (Oct-Dec) <input type="checkbox"/> 2 <sup>nd</sup> (Jan-Mar) <input type="checkbox"/> 3 <sup>rd</sup> (Apr-Jun) <input type="checkbox"/> 4 <sup>th</sup> (Jul-Sep) <input type="checkbox"/> Semi-Annual (Oct-Mar) <input type="checkbox"/> Semi-Annual (Apr-Sep) <input type="checkbox"/> Annual <input type="checkbox"/> Check if this is the last report for the project (Project completed).																				
1C. REVISION OF A PRIOR REPORT? Y or N Year: _____ Quarter: _____		BRIEFLY DESCRIBE THE REVISIONS YOU ARE MAKING:																				
2A. EPA FINANCIAL ASSISTANCE OFFICE ADDRESS ( ATTN: DBE Coordinator)		3A. RECIPIENT NAME AND ADDRESS																				
2B. EPA DBE COORDINATOR  Name:  E-mail:	2C. PHONE:  Fax:	3B. RECIPIENT REPORTING CONTACT:  Name:  E-mail:	3C. PHONE:  Fax:																			
4A. FINANCIAL ASSISTANCE AGREEMENT ID NUMBER (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C.)		4B. FEDERAL FINANCIAL ASSISTANCE PROGRAM TITLE or CFDA NUMBER:																				
5A. TOTAL ASSISTANCE AGREEMENT AMOUNT (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C.)  EPA Share: \$ _____  Recipient Share: \$ _____		5B. If NO procurement and NO accomplishments were made this reporting period (by the recipients, sub-recipients, loan recipients, and prime contractors), <b>CHECK</b> and <b>SKIP</b> to Block No. 7. (Procurements are all expenditures through contract, order, purchase, lease or barter of supplies, equipment, construction, or services needed to complete Federal assistance programs. <u>Accomplishments</u> , in this context, are procurements made with MBEs and/or WBEs.  <div style="text-align: center;"><input type="checkbox"/></div>																				
5C. <div style="text-align: center;">Total Procurements This Reporting Period</div> (Only include amount not reported in any prior reporting period)  Total Procurement Amount \$ _____ (Include total dollar values awarded by recipient, sub-recipients and SRF loan recipients, including MBE/WBE expenditures.)																						
5D. Were sub-awards issued under this assistance agreement? Yes <input type="checkbox"/> No <input type="checkbox"/> Were contracts issued under this assistance agreement? Yes <input type="checkbox"/> No <input type="checkbox"/>																						
5E. <div style="text-align: center;">MBE/WBE Accomplishments This Reporting Period</div> Actual MBE/WBE Procurement Accomplished: (Include total dollar values awarded by recipient, sub-recipients, SRF loan recipients and Prime Contractors.)  <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;"></th> <th style="width: 20%; text-align: center;"><u>Construction</u></th> <th style="width: 20%; text-align: center;"><u>Equipment</u></th> <th style="width: 20%; text-align: center;"><u>Services</u></th> <th style="width: 20%; text-align: center;"><u>Supplies</u></th> <th style="width: 20%; text-align: center;"><u>Total</u></th> </tr> </thead> <tbody> <tr> <td><b>\$MBE:</b></td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td><b>\$WBE:</b></td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table>						<u>Construction</u>	<u>Equipment</u>	<u>Services</u>	<u>Supplies</u>	<u>Total</u>	<b>\$MBE:</b>	_____	_____	_____	_____	_____	<b>\$WBE:</b>	_____	_____	_____	_____	_____
	<u>Construction</u>	<u>Equipment</u>	<u>Services</u>	<u>Supplies</u>	<u>Total</u>																	
<b>\$MBE:</b>	_____	_____	_____	_____	_____																	
<b>\$WBE:</b>	_____	_____	_____	_____	_____																	
6. COMMENTS: (If no MBE/WBE procurements were accomplished during the reporting period, please explain what steps you are taking to achieve the MBE/WBE Program requirements specified in the terms and conditions of the Assistance Agreement.)																						
7. NAME OF RECIPIENT'S AUTHORIZED REPRESENTATIVE		TITLE																				
8. SIGNATURE OF RECIPIENT'S AUTHORIZED REPRESENTATIVE		DATE																				

PART II.

MBE/WBE PROCUREMENTS MADE DURING REPORTING PERIOD

EPA Financial Assistance Agreement Number: \_\_\_\_\_

1. Procurement Made By			2. Business Enterprise		3. \$ Value of Procurement	4. Date of Procurement MM/DD/YY	5. Type of Product or Services <sup>A</sup> (Enter Code)	6. Name/Address/Phone Number of MBE/WBE Contractor or Vendor
Recipient	Sub-Recipient and/or SRF Loan	Prime	Minority	Women				
	Recipient							

Type of product or service codes:

1 = Construction

2 = Supplies

3 = Services

4 = Equipment

Note: Refer to Terms and conditions of your Assistance Agreement to determine the frequency of reporting. Recipients are required to submit MBE/WBE reports to EPA beginning with the Federal fiscal year quarter the recipients receive the award, continuing until the project is completed.

EPA FORM 5700-52A - (Approval Expires 06/30/17)



# Instructions:

## A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33. EPA Form 5700-52A must be completed by recipients of Federal grants, cooperative agreements, or other Federal financial assistance which involve procurement of supplies, equipment, construction or services to accomplish Federal assistance programs.

Recipients are required to report 30 days after the end of each federal fiscal quarter, semiannually, or annually, per the terms and conditions of the financial assistance agreement.

	Quarterly Reporting Due Date	Semiannual Reporting Due Date	Annual Reporting Due Date
Agreements awarded prior to May 27, 2008	January 30, April 30, July 30, October 30	N/A	October 30
Agreements awarded on or after May 27, 2008	N/A	April 30, October 30	October 30

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement.

## B. Definitions:

**Procurement** is the acquisition through contract, order, purchase, lease or barter of supplies, equipment, construction or services needed to accomplish Federal assistance programs.

A **contract** is a written agreement between an EPA recipient and another party (also considered "prime contracts") and any lower tier agreement (also considered "subcontracts") for equipment, services, supplies, or construction necessary to complete the project. This definition excludes written agreements with another public agency. This definition includes personal and professional services, agreements with consultants, and purchase orders.

A **minority business enterprise (MBE)** is a business concern that is (1) at least 51 percent owned by one or more minority individuals, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minority individuals; and (2) whose daily business operations are managed and directed by one or more of the minority owners. In order to qualify and participate as an MBE prime or subcontractor for EPA

recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

U.S. citizenship is required. Recipients shall presume that minority individuals include Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, or other groups whose members are found to be disadvantaged by the Small Business Act or by the Secretary of Commerce under section 5 of Executive order 11625. The reporting contact at EPA can provide additional information.

A **woman business enterprise (WBE)** is a business concern that is, (1) at least 51 percent owned by one or more women, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more women and (2) whose daily business operations are managed and directed by one or more of the women owners. In order to qualify and participate as a WBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

Business firms which are 51 percent owned by minorities or women, but are in fact managed and operated by non-minority individuals do not qualify for meeting MBE/WBE procurement goals. U.S. Citizenship is required.

## **Good Faith Efforts**

A recipient is required to make the following good faith efforts whenever procuring construction, equipment, services, and supplies under an EPA financial assistance agreement. These good faith efforts for utilizing MBEs and WBEs must be documented. Such documentation is subject to EPA review upon request:

1. Include of MBEs/WBEs on solicitation lists.
2. Assure that MBEs/WBEs are solicited once they are identified.
3. Divide total requirements into smaller tasks to permit maximum MBE/WBE participation, where feasible.
4. Establish delivery schedules which will encourage MBE/WBE participation, where feasible.
5. Encourage use of the services of the U.S. Department of Commerce's Minority Business Development Agency (MBDA) and the U.S. Small Business Administration to identify MBEs/WBEs.

6. Require that each party to a subgrant, subagreement, or contract award take the good faith efforts outlined here.

**C. Instructions for Part I:**

- 1a. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1<sup>st</sup> through September 30<sup>th</sup> (**e.g. November 29, 2010 falls within Federal fiscal year 2011**)
- 1b. Check applicable reporting box, quarterly, semiannually, or annually. Also indicate if this is the last report for the project.
- 1c. Indicate if this is a revision to a previous year, half-year, or quarter, and provide a brief description of the revision you are making.
- 2a-c. Please refer to your financial assistance agreement for the mailing address of the EPA financial assistance office for your agreement.
- The "EPA DBE Reporting Contact" is the DBE Coordinator for the EPA Region from which your financial assistance agreement was originated. For a list of DBE Coordinators please refer to the EPA OSBP website at [www.epa.gov/osbp](http://www.epa.gov/osbp). Click on "Regional Contacts" for the name of your coordinator.
- 3a-c. Identify the agency, state authority, university or other organization which is the recipient of the Federal financial assistance and the person to contact concerning this report.
- 4a. Provide the Assistance Agreement number assigned by EPA. A separate report must be submitted for each Assistance Agreement.
- \*For SRF recipients:** In box 4a list numbers for ALL OPEN Assistance Agreements being reported on this form. Please note that although the New DBE Rule (which took effect May 27, 2008) revised the reporting frequency requirements from quarterly to semiannually, that change only applies to agreements awarded AFTER the New DBE Rule took effect. Therefore, SRF recipients may either continue to report activity for all Agreements on one form on a quarterly basis until the last award that was made prior to the New DBE Rule has been closed out; OR, the recipient may split the submission of SRF reports into quarterly reports for Agreements awarded prior the New DBE Rule, and semiannually for the awards made after the New DBE Rule.

- 4b. Refer back to Assistance Agreement document for this information.
- 5a. Provide the total amount of the Assistance Agreement which includes Federal funds plus recipient matching funds and funds from other sources.
- \*For SRF recipients only:** SRF recipients will not enter an amount in 5a. Please leave 5a blank.
- 5b. Self-explanatory.
- 5c. Provide the total dollar amount of **ALL** procurements awarded this reporting period by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).
- \*NOTE:** To prevent double counting on line 5C, if any amount on 5E is for a subcontract and the prime contract has already been included on Line 5C in a prior reporting period, then report the amount going to MBE or WBE subcontractor on line 5E, but exclude the amount from Line 5C. To include the amount on 5C again would result in double counting because the prime contract, which includes the subcontract, would have already been reported.
- 5d. State whether or not sub-awards and/or subcontracts have been issued under the assistance agreement by indicating "yes" or "no".
- 5e. Where requested, also provide the total dollar amount of all MBE/WBE procurement awarded during this reporting period by the recipient, sub-recipients, SRF loan recipients, and prime contractors in the categories of construction, equipment, services and supplies. These amounts include Federal funds plus recipient matching funds and funds from other sources.
- \*For SRF recipients only:** In 5c please enter the total procurement amount for the quarter, or semiannual period, under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. **(SRF state recipients report state procurements in this section)**
6. If there were no MBE/WBE accomplishments this reporting period, please briefly explain what

specific steps you are taking to achieve the MBE/WBE requirements specified in the terms and conditions of the Assistance Agreement.

7. Name and title of official administrator or designated reporting official.
8. Signature, month, day, and year report submitted.

#### D. Instructions for Part II:

For each MBE/WBE procurement made under this assistance agreement during the reporting period, provide the following information:

1. Check whether this procurement was made by the recipient, sub-recipient/SRF loan recipient, or the prime contractor.
2. Check either the MBE or WBE column. If a firm is both an MBE and WBE, the recipient may choose to count the entire procurement towards EITHER its MBE or WBE accomplishments. The recipient may also divide the total amount of the procurement (using any ratio it so chooses) and count those divided amounts toward its MBE and WBE accomplishments. If the recipient chooses to divide the procurement amount and count portions toward its MBE and WBE accomplishments, please state the appropriate amounts under the MBE and WBE columns on the form. **The combined MBE and WBE amounts for that MBE/WBE contractor must not exceed the "Value of the Procurement" reported in column #3**
3. Dollar value of procurement.
4. Date of procurement, shown as month, day, year. Date of procurement is defined as the date the contract or procurement was awarded, **not** the date the contractor received payment under the awarded contract or procurement, unless payment occurred on the date of award. **(Where direct purchasing is the procurement method, the date of procurement is the date the purchase was made)**
5. Using codes at the bottom of the form, identify type of product or service acquired through this procurement (e.g., enter 1 if construction, 2 if supplies, etc).
6. Name, address, and telephone number of MBE/WBE firm.

\*\*This data is requested to comply with provisions mandated by: statute or regulations

and 33); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.

The public reporting and recording burden for this collection of information is estimated to average 1 hour per response annually. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclosure or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and

maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OPPE Regulatory Information Division, U.S. Environmental Protection Agency (2136), 1200 Pennsylvania Avenue, NW, Washington, D.C. 20460. Include the OMB Control number in any correspondence. Do not send the completed form to this address.



## **AMERICAN IRON AND STEEL ACKNOWLEDGEMENT**

The Contractor acknowledges to and for the benefit of Northwestern Water & Sewer District ("Purchaser") and the State of Ohio (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name and Title of Authorized Signatory, Please Print or Type

\_\_\_\_\_  
Bidder's Firm

- ☐ Check here if the WPCLF or WSRLA applicant will be requesting an individual waiver for non-American made iron and steel products. Please note that the waiver box does not need to be marked for nationwide waivers.





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

**MAR 20 2014**

OFFICE OF WATER

**MEMORANDUM**

**SUBJECT:** Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

**FROM:** f ( Andrew D. Sawyers, Director C. ' )  
l) Office of Wastewater Management (4201M)

Peter C. Grevatt, Director  
Office of Ground Water and Drinking Water (4601M)

**TO:** Water Management Division Directors  
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.





**Violating Facilities Clause**  
(Required Contract Provision)

Language prohibiting this use of equipment or services from anyone on the EPA List of Violating Facilities must be included in the contract documents.

**Violating Facilities:**

The Contractor agrees to comply with all applicable standards, orders or requirements under Section 306 of the Clean Air Act, 42 USC 1857 (h), Section 508 of the Clean Water Act, 33 USC 1368, Executive Order 11738, and EPA regulations, 40 CFR Part 32, which prohibits the use under non-exempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities.

**NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.**

## **Requirement For Utilization Of Small Businesses In Rural Areas (SBRA)**

(Required Contract Provision)

The following policy should be added to the “Instructions to Bidders” section and referenced in the Table of Contents for the contract documents:

This procurement is subject to the EPA policy of encouraging the participation of small businesses in rural areas. It is EPA policy that recipients of EPA financial assistance awards utilize the services of small businesses in rural areas (SBRAs), to the maximum extent practicable. The objective is to assure that such small business entities are afforded the maximum practicable opportunity to participate as subcontractors, suppliers and otherwise in EPA-awarded financial assistance programs. This policy applies to all contracts and subcontracts for supplies, construction, and services under EPA grants or cooperative agreements. Small purchases are also subject to this policy.

If possible, also add the following language to the “Advertisement for Bids”:

This procurement is subject to the EPA policy of encouraging the participation of small business in rural areas (SBRAs).

**NOTE: THE CONTRACT LANGUAGE SAMPLES PROVIDED HEREIN ARE EXAMPLES OF WHAT COULD BE INCLUDED IN ALL CONTRACTS THAT USE WPCLF OR WSRLA FUNDS. OHIO EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THESE CLAUSES WITH RESPECT TO STATE OR LOCAL LAW. IT IS IMPERATIVE THAT ANY PARTY INSERTING THESE CLAUSES INTO A CONTRACT VERIFY THAT THEY ARE LEGAL AND ENFORCEABLE ACCORDING TO STATE AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.**





## **CHANGE ORDER INSTRUCTIONS:**

All Change Orders for this work, regardless of costs and whether Water Pollution Control Loan Fund (WPCLF) or Water Supply Revolving Loan Account (WSRLA) funding will be used to finance the changes, must be submitted to Ohio EPA for review.

### *Changes Requiring Prior Approval*

Any change which substantially modifies the Project Facilities as specified in the Ohio EPA approved Facilities Plan and Final Permit to Install or Final Plan Approval (when applicable) or alters the direct or indirect impact of the Project Facilities upon the environment must be incorporated into a Change Order. One copy of the Change Order prior to execution is to be submitted to Ohio EPA for review and prior approval of the acceptability of the change. "Prior to execution" means before the Change Order is signed by the Owner.

Ohio EPA will review the Change Order and inform the Owner of the technical, environmental and operational acceptability of the change, and give the Owner permission to proceed with the proposed work.

### *All Other Changes*

Change Orders not requiring prior approval as described above must be submitted to Ohio EPA within one (1) month of the time at which they are approved by the Owner. Change Orders for WPCLF projects should be submitted to the Division of Environmental and Financial Assistance (DEFA) while Change Orders for WSRLA projects should be submitted to the Division of Drinking and Ground Water (DDAGW) in central office.

### *Change Order Approval Process*

After the Change Order is executed, one (1) copy of the Change Order, including the supporting documentation, is to be sent to Ohio EPA for final review. The WPCLF/WSRLA Change Order forms must have original signatures.

Communities have the option to submit hard copies of the project Change Orders via mail to Ohio EPA or to send PDF Change Order forms and supporting documentation electronically. With either hard copy or electronic submittals, the WPCLF Change Orders should be submitted to DEFA and WSRLA Change Orders should be submitted to DDAGW - Central Office.

The dedicated e-mail address for the electronic submittal of WPCLF Change Orders is [EPAWPCLFCO@epa.ohio.gov](mailto:EPAWPCLFCO@epa.ohio.gov).

The dedicated e-mail address for the electronic submittal of WSRLA Change Orders is [EPAWSRLACO@epa.ohio.gov](mailto:EPAWSRLACO@epa.ohio.gov).

After the Change Order is accepted and eligible costs determined, Ohio EPA will issue a letter informing the Owner and authorizing OWDA to disburse funds from Project Contingency for the work. The OEPA letter will be sent electronically. OWDA will return a PDF of the WPCLF/WSRLA Change Order form which will be signed by all parties including Ohio EPA and OWDA.

Please notify Ohio EPA if the community prefers a hard copy of change order approval documentation and then Ohio EPA and OWDA will send hard copies of approval documentation through the mail.

#### *Payments for Change Order Work*

The Owner is precluded from submitting to the OWDA payment requests for Eligible Project Costs associated with the Change Orders until such time as the Ohio EPA's approval of the Change Orders has been obtained.

# MEMORANDUM



To: Contractor

Subject: Northwestern Water and Sewer District  
Ford Road Pump Station Improvements  
Electronic Document Release  
AutoCAD File for Base Drawing  
796-7552.002

From: Jones & Henry Engineers, Ltd.

Date: \_\_\_\_\_

---

In reference to your request for electronic CAD files for the project, we will provide the requested base drawing electronic file upon your signature below indicating agreement with our electronic document release policy.

*These electronic files are provided to you for your convenience and the Owner's Benefit. Because electronic files can deteriorate or be damaged or be modified inadvertently or information from the electronic documents may be presented to you on your system differently than the original because of your software or system setup, these files may not be accurate. Any conclusion or information obtained or derived from such electronic files will be at your sole risk.*

*Information contained in the electronic documents is for information and reference in connection with this project only. The information is not intended or represented to be suitable for reuse on extensions of the original project or on any other project.*

*You should perform an acceptance test of the electronic documents immediately and inform us of any problems with the electronic documents. Jones & Henry will not be responsible for providing additional copies of these electronic files to you after 60 days from the date the documents are provided to you.*

*Additional conditions relative to Use of Documents may be in the Agreement between Jones & Henry and our client and should be reviewed before you attempt to use the documents.*

\_\_\_\_\_ accepts the conditions of the above statement.  
(FIRM NAME)

Authorized Signature

\_\_\_\_\_

DATE

c: Project Distribution





## SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition). All provisions that are not so amended or supplemented remain in full force and effect.

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

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

---

### ARTICLE 2 – PRELIMINARY MATTERS

#### SC-2.02 Copies of Documents

##### **SC-2.02 Add the following new paragraphs following Paragraph 2.02.B**

C. The Engineer can provide electronic drawing files to assist the Contractor with layout and construction staking of the improvements. The Engineer will require the Contractor sign an electronic release prior to providing the files to the Contractor. The wording of the release shall be as follows:

*"These electronic files are provided to you for your convenience. Because electronic files can deteriorate or be damaged or be modified inadvertently or information from the electronic documents may be presented to you on your system differently than the original because of your software or system setup, these files may not be accurate. Any conclusion or information obtained or derived from such electronic files will be at your sole risk.*

*Information contained in the electronic documents is for information and reference in connection with this project only. The information is not intended or represented to be suitable for reuse on extensions of the original project or on any other project.*

*You should perform an acceptance test of the electronic documents immediately and inform us of any problems with the electronic documents. Jones & Henry will not be responsible for providing additional copies of these electronic files to you after 60 days from the date the documents are provided to you."*

D. Files will be provided in the Engineer's CAD software format. The Contractor's surveyor will be responsible for making any required conversions necessary to permit the surveyor to use the files for layout or staking.

E. The Contractor's surveyor should check horizontal and vertical control points to confirm there has been no shift in the electronic drawing file during the staking operation.

*SC2.06 Electronic Submittals*

**SC-2.06 Add the following new paragraphs immediately after Paragraph 2.06 C.**

- D. Electronic files are provided to you for your convenience. Because electronic files can deteriorate or be damaged or be modified inadvertently or information from the electronic documents may be presented to you on your system differently than the original because of your software or system setup, these files may not be accurate. Any conclusion or information obtained or derived from such electronic files will be at your sole risk.
- E. Information contained in the electronic documents is for information and reference in connection with this project only. The information is not intended or represented to be suitable for reuse on extensions of the original project or on any other project.
- F. You should perform an acceptance test of the electronic documents immediately and inform us of any problems with the electronic documents. Jones & Henry will not be responsible for providing additional copies of these electronic files to you after 60 days from the date the documents are provided to you.

**ARTICLE 3 – DOCUMENTS; INTENT, REQUIREMENTS, REUSE**

*SC3.01 Intent*

**SC-3.01.C Delete Paragraph 3.01.C in its entirety and insert the following new paragraph in its place:**

- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version, as printed by Engineer, shall govern.

**ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK**

*SC4.01 Commencement of Contract Times; Notice to Proceed*

**SC 4.01 Delete Paragraph 4.01.A and substitute the following in its place:**

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

**ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

*SC-5.03 Subsurface and Physical Conditions*

**SC 5.03 Add Paragraph 5.03.A.4 immediately after Paragraph 5.03.A.3.**

- 4. No reports of explorations or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.

*SC-5.03 Subsurface and Physical Conditions*

**SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.B:**

- C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:
1. Soils Investigation – Boring Marked B-1 (SS-12) & B-2 (SS-9)
    - a. “Northwestern Water & Sewer District Bowling Green, Ohio Geotechnical Subsurface Investigation Proposed Ford Road Pump Station Improvements Near the Northeast Corner of Ford Road and White Road Perrysburg, Ohio.” January 2021.
    - b. This report is available at: <http://bit.ly/FORDRD2021>
- D. The following drawings of physical conditions relating to existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities) are known to Owner:
1. Finkbeiner, Pettis & Strout, Ltd. (1973). Sewerage Improvements, SS-400A (Gravity Sewers), Wood County Ohio.
  2. Finkbeiner, Pettis & Strout, Ltd. (1977). Sewerage Improvements, SS-302 (West Boundary Sewers), Wood County Ohio.
  3. Finkbeiner, Pettis & Strout, Ltd. (1973). Sewerage Improvements, SS-400C (Gravity Sewers, FM & Ford Road Pump Station), Wood County Ohio.
  4. Burgess & Niple, Limited (1982). City of Perrysburg Contract No. 82-1, 16-inch Force Main. NWWSD Record Plan Database.
  5. Poggemeyer Design Group (2005). NWWSD – Ford Road Pump Station Improvements. Bowling Green, Ohio. NWWSD Record Plan Database
  6. Poggemeyer Design Group (2008). NWWSD – Sanitary Sewer #400C (16-inch FM). Bowling Green, Ohio. NWWSD Record Plan Database

Contractor may request copies of reports and drawings identified in SC 5.03.C and SC 5.03.D that were not included with the Bidding Documents from Engineer.

*SC-5.06 Hazardous Environmental Conditions*

**SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following new paragraphs in their place:**

- A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.
- B. Not Used.

**ARTICLE 6 – BONDS AND INSURANCE**

*SC-6.01 Performance, Payment, and Other Bonds*

**SC 6.01 Add the following new paragraph immediately after Paragraph 6.01.F:**

- G. The Contractor shall furnish a Performance Bond and a Maintenance and Guarantee Bond, each in the amount of at least 100% of the Contract Price as security for the faithful performance and payment of all Contractor's obligations.

*SC-6.03 Contractor's Insurance*

**SC 6.03 Delete Paragraph 6.03.I of the General Conditions and substitute the following in its place:**

- I. General provisions: The policies of insurance required by these Paragraphs 6.03, 6.04 and 6.05 shall:

**SC 6.03 Delete Paragraph 6.03.I.3 of the General Conditions and substitute the following in its place:**

3. 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 Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

**SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J**

- K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

<b>State:</b>	<b>Statutory</b>
Federal, if applicable (e.g., Longshoreman's):	Statutory
Jones Act coverage, if applicable:	
Bodily injury by accident, each accident	\$ 1,000,000
Bodily injury by disease, aggregate	\$ 1,000,000
Employer's Liability:	
Bodily injury, each accident	\$ 1,000,000
Bodily injury by disease, each employee	\$ 1,000,000
Bodily injury/disease aggregate	\$ 1,000,000
For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	Statutory

- |                                       |                  |
|---------------------------------------|------------------|
| Foreign voluntary worker compensation | <u>Statutory</u> |
|---------------------------------------|------------------|
2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:
- |   |                     |
|---|---------------------|
| General Aggregate                                   | \$ <u>1,000,000</u> |
| Products - Completed Operations Aggregate           | \$ <u>1,000,000</u> |
| Personal and Advertising Injury                     | \$ <u>1,000,000</u> |
| Each Occurrence (Bodily Injury and Property Damage) | \$ <u>1,000,000</u> |
3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:
- Bodily Injury:
- |               |                     |
|---------------|---------------------|
| Each person   | \$ <u>1,000,000</u> |
| Each accident | \$ <u>1,000,000</u> |
- Property Damage:
- |               |                     |
|---------------|---------------------|
| Each accident | \$ <u>1,000,000</u> |
|---------------|---------------------|
- [or]
- |                          |                     |
|--------------------------|---------------------|
| Combined Single Limit of | \$ <u>1,000,000</u> |
|--------------------------|---------------------|
4. Excess or Umbrella Liability:
- |                   |                     |
|-------------------|---------------------|
| Per Occurrence    | \$ <u>5,000,000</u> |
| General Aggregate | \$ <u>5,000,000</u> |
5. Contractor's Pollution Liability:
- |                   |                     |
|-------------------|---------------------|
| Each Occurrence   | \$ <u>1,000,000</u> |
| General Aggregate | \$ <u>1,000,000</u> |
- ☒ If box is checked, Contractor is required to provide Contractor's Pollution Liability insurance under this Contract
6. Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following: NONE

*SC-6.04 Owner's Liability Insurance*

**SC-6.04 Delete Paragraph 6.04.A and B of the General Conditions and substitute the following in its place:**

- A. The Contractor shall purchase and maintain during the entire term of this Contract one separate policy providing Owner's and Contractor's Protective Liability coverages. The named insured on this policy shall be:
  - 1. The Owner; and
  - 2. The Engineer - Jones & Henry Engineers, Ltd.; and
  - 3. Others if specifically required by special provision in the Contract Documents.
- B. The policy shall be provided on a form commonly referred to in the insurance industry as an "occurrence" type of policy form. (Claims made policy forms are not acceptable.)
- C. This insurance policy shall be a separate policy in addition to the coverage required in 6.03. No other insurance policy may substitute for or contribute to the coverage or limits afforded by this insurance policy, except a separate excess Owner's and Contractor's Protective Policy.
- D. This policy shall cover the total project and include explosion, collapse, and underground coverages for the entire Work provided by the Contractor and Subcontractors.
- E. The policy shall stipulate that the "designated Contractor" includes the Contractor and all Sub-contractors engaged in the Work.
- F. The original policy shall be submitted to and filed with the Owner or its designated representative.

*SC-6.05 Property Insurance*

**SC-6.05. Add the following new paragraphs immediately before 6.05.A. and continue on the numbering sequentially.**

- A. Contractor shall provide either property insurance in the form of Builder's Risk or installation floater as appropriate for the work as required herein.
- B. Contractor shall provide and maintain installation floater insurance for property under the care, custody, or control of Contractor. The installation floater insurance shall be a broad form or "all risk" policy providing coverage for all materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work. Coverage under the Contractor's installation floater will include:
  - 1. any loss to property while in transit,
  - 2. any loss at the Site, and
  - 3. any loss while in storage, both on-site and off-site.

Coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable. The Contractor will be solely responsible for any deductible carried under this coverage and claims on materials, supplies, machinery, fixture, and equipment that will be incorporated into the Work while in transit or in storage. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

**SC-6.05.A.1 Add the following new subparagraph after subparagraph 6.05.A.1:**

- a. In addition to Owner, Contractor, and all Subcontractors, include as insureds the following:
  - 1) Engineer

**ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES**

*SC-7.09 Taxes*

**SC 7.09 Add a new paragraph immediately after Paragraph 7.09.A:**

- B. Owner is exempt from payment of sales and compensating use taxes of the State of Ohio and of cities and counties thereof on all materials to be incorporated into the Work.
  - 1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
  - 2. Owner’s exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

*SC-7.12 Safety and Protection*

**SC-7.12 Insert the following after the second sentence of Paragraph 7.12.C:**

The Owner’s Safety Program is applicable to the Work.

A copy of the Safety Program requirements may be obtained from the Owner.

**ARTICLE 9 – OWNER’S RESPONSIBILITIES**

*SC-9.11 Evidence of Financial Arrangements*

**SC-9.11 Add the following new paragraph immediately after Paragraph 9.11.A:**

- B. The Owner has funded this project with the assistance of Funding Agencies. The requirements of the funding agency are listed in the Exhibits to the Supplementary Conditions and are made a part of the Contract Documents. Contractor shall comply with the requirements of the funding agencies, when there is a conflict between the funding agency requirements and any part of the Contract Documents the funding agency requirements shall take precedence, without voiding any requirement of the Contract Documents.

*SC-9.13 Owner's Site Representative*

**SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:**

SC-9.13 The Owner may furnish an Owner's Site Representative to represent the Owner at the site to observe progress and quality of the work. The Owner's Site Representative is not the Engineer's Consultant, agent or employee, but will possess the same authority over the work as defined for the RPR in Section SC10.03.B.

**ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION**

*SC-10.03 Project Representative*

**SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:**

- B. The Resident Project Representative (RPR), if provided, will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.
1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.
  2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.
  3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.
  4. Liaison:
    - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
    - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
    - c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
  5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
  6. Shop Drawings and Samples:



- a. Record date of receipt of Samples and Contractor-approved Shop Drawings.
  - b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.
  - c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.
7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.
8. Review of Work and Rejection of Defective Work:
  - a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
  - b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
9. Inspections, Tests, and System Start-ups:
  - a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
  - b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.
10. Records:
  - a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
  - c. Maintain records for use in preparing Project documentation.
- 11. Reports:
  - a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
  - b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
  - c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.
- 12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, 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.
- 13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.
- 14. Completion:
  - a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
  - b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
  - c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.
- C. The RPR shall not:
  - 1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

**ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

*SC-13.01 Cost of the Work*

**SC 13.01.B.5.c Delete Paragraph 13.01.B.5.c in its entirety and insert the following in its place:**

- c. Construction Equipment and Machinery:
  - 1) Rentals of all construction equipment and machinery, and the parts thereof, 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.
  - 2) Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the Rate Book appropriate for the Project. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than \$1,000 will be considered small tools.

*SC-13.03 Unit Price Work*

**SC 13.03.E Delete Paragraph 13.03.E in its entirety and insert the following in its place:**

- E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
1. if the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and
  2. if there is no corresponding adjustment with respect to any other item of Work; and
  3. if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.

**ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

*SC-14.02 Tests, Inspections and Approvals*

**SC 14.02.B Delete Paragraph 14.02.B in its entirety and insert the following in its place:**

- B. Contactor shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Contractor, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

**ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD**

*SC-15.01 Progress Payments*

**SC 15.01.A Add the following new subparagraph to Paragraph 15.01.A:**

1. Mobilization for Contractor and any tier of subcontractor(s) shall be considered collectively and shall not exceed 5 percent of the Contract Price. Mobilization shall be those costs associated with the initiation of the project and site work, including but not limited to, transporting of personnel, equipment, materials, supplies, incidental items; establishment of the field offices, temporary facilities necessary for the project, bonds and insurances, submittal requirements, permits, field supervision, final cleanup and demobilization. Mobilization does not include such items as, contract negotiations and bid preparation.

- a. Where the work is covered by unit price and no item has been included for mobilization as defined in Section 01010., then this work is considered incidental to the work and will not be paid separately.
  - b. Where the work is covered by unit prices, and item(s) for mobilization, as described in Section 01010 have been included, the maximum allowable amount shall be ten percent of the aggregate of all items excluding mobilization. Where mobilization is included as multiple items, then the aggregate amount of all mobilization items shall not exceed the allowable 5 percent.
2. Costs for submittal requirements, field office and supervision, where identified separately in the schedule of values shall be considered for payment monthly. When the cost is a lump sum as submitted in accordance with 2.6, the monthly cost shall be established by dividing the lump sum by the number of monthly estimates based on the original contract time. No adjustments shall be made for any contract time extensions.
3. Mobilization shall be included in the progress payments, in accordance with the schedule of values and unit prices. When the work, excluding mobilization and inventory, has progressed to an amount equal to five percent or more of the contract price, then an amount of not more than 50 percent of the mobilization cost will be considered for inclusion in the progress payment. Prior to the established five percent, Owner may consider payment on invoices for bonds and insurances and permits; this amount shall be subtracted for the total amount from mobilization.  
  
Up to an additional 40 percent of the mobilization cost will be considered for inclusion in the progress payments once the work, excluding mobilization and inventory, has progressed to an amount equal to 50 percent of the Contract Price. The remaining mobilization payment will be paid as part of the final payment.

**15.03 Substantial Completion**

**SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:**

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

END OF SECTION

**EXHIBIT 1**

**DAVIS BACON WAGE RATES**  
(To be Provided by Addendum)

**EXHIBIT 2**

**OPWC Documents**

**EXHIBIT 3**

**WPLCLF Documents**



**EXHIBIT 4**

**Electronic Document Release**



**SECTION 01010  
DEFINITION OF CONTRACT ITEMS**

**ITEM 0 GENERAL**

**1.01 FOREWORD**

- A. This Section describes the various Contract Items listed in the Bid.

**1.02 WORK INCLUDED**

- A. Under each Item the Contractor shall furnish all labor, materials, tools, plant equipment, supplies, maintenance of equipment, heating, lighting and power, insurance and bonds, coordination, and all Work and in accordance with the Specifications Parts A, B, and Divisions 1 through 16 of Part C and necessary to complete the Work in accordance with the obvious or expressed intent of the Contract Documents.

**1.03 WORKMANSHIP AND MERIALS**

- A. The quality of workmanship and materials entering into any and all of the Items and the Work included shall conform to pertinent sections, paragraphs, sentences, and clauses, both directly and indirectly applicable thereto, contained in the Contract Documents, whether or not direct reference to such occurs under each Item in this Section.

**1.04 PAYMENT**

- A. The lump sum and unit prices stated in the Bid shall be payment in full for the completion of all Work specified and described or required to be included in the Contract, complete, and ready for use.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

**PART 4 SPECIAL PROVISIONS**

**4.01 CONTRACT ITEMS**

- A. The contract items are defined on the following pages.

**ITEM 1**  
**MOBILIZATION AND DEMOBILIZATION**

**1.01 DESCRIPTION**

- A. This Item is intended to pay non-recurring cost to the Contractor not recovered under other pay Items of the Contract.
- B. This Item shall include, but not be limited to, the cost for moving equipment in and out, performance and payment bonds, insurance, permits, inspections utility connection cost, and other expenses associated with preparation for construction in accordance with the requirements of the Contract Documents.
- A. The bid price for Mobilization for the Contractor and any subcontractors, measured collectively, shall not exceed 5-percent of the Contract amount, less mobilization.

**1.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.
- B. Any work specifically included in an Allowance Item.

**1.03 DEFINITION OF ITEM**

- A. Item 1 - Mobilization and Demobilization.

**1.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 1.

**1.05 PAYMENT**

- B. The lump sum stated in the Bid shall be full compensation for all Work required under Item 1.
- C. The Contractor is reminded of the requirements of Supplemental Conditions Section 15.01.A regarding Mobilization and Demobilization costs as a percentage of the total project cost.
- D. Payment shall be in accordance with Supplemental Conditions 15.01 A. The Engineer may reduce the amount to be paid under Item 1 if the percentage requested is not represented by the actual amount performed.

**ITEM 2**  
**BYPASS PUMPING**

**2.01 DESCRIPTION**

- A. Under this Item, the Contractor shall include materials, equipment and labor required to maintain sanitary sewer service during periods when the existing pump stations or new equipment are not in service as needed to complete the scope of work identified for the Contractor in the Contract Documents including all pumping equipment, piping, accessories, maintenance, and controls.
- B. Maintaining existing sewers in operation and temporary flow stoppage, diversions and sewer flow by-pass connections shall be included under this Item.
- C. This item shall include the cost of mobilizing and demobilizing bypass pumping equipment to the site.

**2.02 DEFINITION OF ITEM**

- A. Item 2a - Bypass Pumping Mobilization and Demobilization.
- A. Item 2b - Bypass Pumping.

**2.03 MEASUREMENT & PAYMENT**

- A. The unit price for mobilization and demobilization of bypass pumping equipment shall be a lump sum. When the bypass pumping equipment is onsite and operational, the Contractor may include 40-percent of the lump sum cost for payment.
- B. The quantities to be paid for under Item 2b shall be measured per week that the bypass pumping equipment is on site and functioning. No payment will be paid for periods when the equipment is on site, but not operating. A week shall be defined as 7 working days.
- C. Payment for periods less than 7-days shall be measured as a percentage of a week.
- D. This item is provided as a contingency measure to be used at the discretion of the Contractor with the Engineer's approval.

**ITEM 3**  
**STORM WATER POLLUTION PREVENTION**

**3.01 DESCRIPTION**

- A. This Item shall include all Work specified in the SWPPP including preparation of a Storm Water Pollution Prevention Plan, installation, maintenance, and removal of all Storm Water Pollution Prevention measures.

- B. The weekly inspection and reporting of all Storm Water Pollution Prevention measures shall be included under this item.
- C. Obtaining permits and co-permittee coverage, if required or specified shall be included under this item.

**3.02 WORK NOT INCLUDED**

Not used.

**3.03 DEFINITION OF ITEM**

- A. Item 3 - Storm Water Pollution Prevention.

**3.04 MEASUREMENT & PAYMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 3.
- B. Payment shall be made in the amount of 20% of the lump sum Bid price for Item 3 for the first monthly estimate and 10% for each monthly estimate thereafter until the lump sum Bid amount for Item 3 has been paid.
- C. The Engineer may reduce the amount to be paid under Item 3 if the percentage requested is not represented by the actual amount performed.

**ITEM 4  
PUMP STATION CONTROL BUILDING AND WET WELL  
ACCESSORIES AND APPURTENANCES**

**4.01 DESCRIPTION**

- A. This Item includes all work shown on the Drawings and in accordance with the Specifications, Divisions 1 through 16 for the new pump station unless identified in other Items. The summary of work listed below is not intended to be an exhaustive list, instead the list is provided to highlight major work components and to differentiate what work is not included in the other Items provided.
- B. Under this Item, the Contractor shall include materials, equipment, electrical mechanical and civil work and controls, piping and valves, labor, supervision, coordination, overhead, and profit as specified, shown on the Drawings, or otherwise required to complete and place in operation the new pump station wet well and control building, including all specified equipment, accessories, and appurtenances with the expectation of a fully functional project at completion.

- C. The construction of the wet well, control buildings along with all equipment including but not limited to valves, piping fittings, pumps control panels, floor doors and accessories and appurtenances is included in this Item.
- D. The provision of new electrical equipment including a generator and automatic transfer switch is included in this Items
- E. This Item includes all excavation of materials including native soils, rock, cobbles, or other materials indicated on relevant technical documents included as referenced, not included for payment under other Items, including hauling excess spoil material from Site and the placement and compaction of backfill in excavated areas.
- F. This Item included the construction of shoring & earth retaining systems as required for excavations included in this Item.
- G. This item includes the maintenance of trenches and excavations including dewatering and others measures to maintain open excavations necessary for work included under this Item.
- H. The furnishing and placing of special backfill as specified in Section 02200 in areas excavated for this work included under this Item. All required testing of backfill for excavations made under this Item shall be included in this Item.
- I. The temporary support of utilities as required to complete the Work, shall be included under this Item. All repairs to existing utilities damaged, due to the Work, are included under this Item.
- J. This Item includes all site improvements including site lighting and pipe bollards.
- K. The improvement of the site to place or remove material to the final grades as shown on the plans is included in this item. In paved areas, the site shall be constructed to the bottom of the pavement subgrade under this Item. Hauling excess spoil material from Site is Included in this Item.
- L. The construction of the storm water detention pond including flow rate outlet controls are included in this Item.
- M. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under this Item.
- N. Installation of the chemical feed equipment to be purchased under the Allowance Item is included under this Item.
- O. The construction of force main pipe up to 5-feet outside of the building foundation is included in this Item.
- P. The new water service line and accessories for the Control Building is included in this Item.

**4.02 WORK NOT INCLUDED**

- A. Pavement replacement and construction within the Contract limits is included under other Items.
- B. The excavation and backfill of unsuitable subgrade materials encountered as part of the work is included under other Items.

**4.03 DEFINITION OF ITEM**

- A. Item 4 – Pump Station Wet Well, Control Building, Site Improvements, Appurtenances and Accessories.

**4.04 MEASUREMENT & PAYMENT**

- A. The quantities to be paid for under Item 4 shall be lump sums for the identified scope of work in accordance with the Specifications and Drawings.

**ITEM 5  
SEWER PIPE**

**5.01 DESCRIPTION**

- A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of the sewer pipe as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.
- B. These Items shall include all Work to install gravity sewers by open-cut methods, including but not limited to the following: excavation; hauling excess spoil material from the Site; bedding; pipe materials; fittings; backfill; compaction; maintenance of trenches and related Work such as performing material testing; deflection and infiltration tests.
- C. Connections of new sewers to existing sewers and new manholes shall be included under these Items.
- D. The removal and replacement of sewer pipe and new manholes necessary to construct the Work are included in these Items. The removal of sewer pipes shall include the disposal of pipe, manholes and bedding materials removed.
- E. The abandonment of sewers to be taken out of service shall be included in these Items. The abandonment of sewers shall include the placement of fill material inside the sewer pipes along with all required accessories such as plugs, accessories, grout tubes, vent holes and inspection ports. The removal of accessories constructed for the purpose of abandoning sewers shall be included in these Items.
- F. Replacement or repair of existing sewers or field drainage tiles removed or damaged as a result of construction are included in these Items.



- G. All required sheeting, shoring and trench and excavation protection is included in this item.
- H. All Work required to dewater sewer pipe trenches and excavations are included under these Items.
- I. The furnishing and placing of special backfill in required areas excavated for this work included under these Items is included in these Items. Special backfill for the purpose of delineation is as carried to the bottom of aggregate pavement base.
- J. Temporary support for existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during sewer construction is included under these Items.
- K. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under these Items, unless specifically included under other Items.
- L. The provision of erosion protection for daylighting storm sewers shall be included in these Items.
- M. The provision of temporary plugs for the purpose of managing flow in the sewers during construction is included in these items.

#### **5.02 WORK NOT INCLUDED**

- A. Pavement replacement and construction within the Contract limits is included under other Items.
- B. Closed circuit television inspection of new sewers 8-inches in diameter and larger installed as part of the Work are included under other Items.
- C. The excavation and backfill of unsuitable subgrade materials encountered as part of the work is included under other Items.

#### **5.03 DEFINITION OF ITEMS**

- A. Item 5a – 48-inch Sanitary Sewer, Type B.
- B. Item 5b - 12-inch Sanitary Sewer, Type B.
- C. Item 5c – 12-inch Storm Sewer, Type B.
- D. Item 5d – 12-inch Storm Sewer, Type C.
- E. Item 5d - 10-inch Storm Sewer, Type B.
- F. Item 5e - 10-inch Storm Sewer, Type C.
- G. Item 5f – 42-inch Sanitary Sewer Abandonment.
- H. Item 5g – 12-inch Sanitary Sewer Abandonment.

**5.04 MEASUREMENT & PAYMENT**

- A. The quantities to be paid under Items 5a through 5h shall be the horizontal length of pipe measured parallel to the axis of the line along the surface of the ground, with no deduction for laying length of fittings for the specified sizes and trench detail, unless otherwise amended herein.
- B. Measurement will be to the center of existing and new manholes or catch basins and the inside face of chambers. A manhole is defined as a round structure with a diameter of 7-feet or less. A catch basin is defined as a round or square structure accepting drainage with a diameter or largest inside measurement of 7-feet or less. Structures shall be all other locations where sewer pipes connect or outlet to. No deduction will be made for precast manholes on lines of the same size. Where branches or lines of different diameters enter such manholes, each will be measured to the center thereof.
- C. Measurement of Item 5a shall be from the Center of MH1 to the inside face of the new Wet Well.

**ITEM 6  
FORCE MAIN**

**6.01 DESCRIPTION**

- A. Under these Items, the Contractor shall provide all materials, equipment, labor, supervision and coordination as necessary for the installation of the force main pipe by open-cut or trenchless methods as scheduled, as shown on the Drawings.
- B. These Items shall include all Work to install the force mains by open-cut methods, including but not limited to the following: excavation; hauling excess spoil material from the Site, bedding; pipe materials; fittings; backfill; compaction; special trench details as provided herein, maintenance of trenches and related Work such as performing material testing.
- C. These Items shall include all related Work and materials such as blowoffs testing, flushing, performing pressure tests as shown on the Drawings and specified in conformance with relevant Sections of the Specifications.
- D. The removal of force main segments necessary to construct the new work is included in these Items. The removal of force main pipes shall include the disposal of pipe and bedding materials removed.
- E. The abandonment of force mains including caps, to be taken out of service shall be included in these Items.
- F. These Items includes providing all bends and joint restraints as shown on the Drawings, as Specified, and as Directed or required for the installation of the force main.
- G. Replacement or repair of existing sewers or field drainage tiles removed or damaged as a result of construction are included in these Items.

- H. All required sheeting, shoring and trench and excavation protection is included in this item.
- I. All Work required to dewater sewer pipe trenches and excavation is included under these Items.
- J. The furnishing and placing of special backfill in required areas excavated for this work included under these Items is included in these Items. Special backfill for the purpose of delineation is as carried to the bottom of aggregate pavement base.
- K. Temporary support for existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during sewer construction is included under these Items.
- L. The connection of new force mains to pipe stubs from structures shall be include in this Item.

**6.02 WORK NOT INCLUDED**

- A. Work specifically included for payment under other Items.
- B. The restoration of disturbed areas is included in other Items.

**6.03 DEFINITION OF ITEMS**

- A. Item 6a - 16-inch Force Main, Type B.
- B. Item 6b - 16-inch Force Main, Type C.
- C. Item 6c – 12-inch Force Main Abandoned (Grout Filled).
- D. Item 6d – Force Main Termination and Abandonment, All Sizes.

**6.04 MEASUREMENT & PAYMENT**

- A. The quantities to be paid under Items 6a through 6c shall be the horizontal length of pipe measured parallel to the axis of the line along the surface of the ground. Items 6a and 6b shall be measured to within 5-feet of the pump control building and to the inside faces of the flow meter chamber and to the connection with the existing force main.
- B. The quantities to be paid under Item 6d shall be the full compensation for each force main termination and abandonment installed in accordance with the Specifications and Drawings.

**ITEM 7**  
**MANHOLES AND PRECAST STRUCTURES**

**7.01 DESCRIPTION**

- A. Under these Items, the Contractor shall construct manholes and manhole drop connections in locations and of types shown and scheduled on the Drawings and in accordance with the Contract Documents.
- B. These Items shall include all Work to install the manholes by open-cut methods, including but not limited to the following: excavation; hauling excess spoil material from the Site, bedding; manhole materials; backfill; compaction; maintenance of trenches and related Work such as performing material testing.
- C. The new flow meter and bypass chamber is included under this Item.
- D. Work beyond the specified pay limits for the pipe trench, but necessary for the placement of the manholes, shall be included under this Item. Such Work shall include excavation of any material encountered, special backfill material, and pavement replacement.
- E. These Items shall include all work to remove the existing manholes at locations shown on the plans. The removal shall include all necessary excavation, removal of existing manhole and foundations, backfill of excavated areas as shown on the Drawings and specified in conformance with relevant Sections of the Specifications.
- F. These Items shall include all work to abandon or remove existing manholes at locations shown on the plans. The abandonment of manholes shall include the removal of the specified section of the manhole and casting along with the placement of fill material inside the manhole to the specified limits.
- G. These Items shall include all work to construct manholes over existing sewers at locations shown on the plans including a cast in place concrete base, concrete fill and the removal of the existing pipes as needed to convey flow to new sewer segments / outlets.
- H. All castings, accessories and appurtenances required for manhole structures shown on the Drawings are included in these Items.
- I. All required sheeting, shoring and trench and excavation protection is included in this item.
- J. All Work required to dewater manhole excavations is included under these Items.
- K. The furnishing and placing of special backfill in required areas excavated for this work included under these Items is included in these Items.
- L. Temporary support for existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during sewer construction is included under these Items.

**7.02 WORK NOT INCLUDED**

- A. Pavement replacement within the Contract limits is included under other Items.
- B. Pipe connections to manholes shall be included under other Items.
- C. The restoration of disturbed areas is included in other Items.

**7.03 DEFINITION OF ITEMS**

- A. Item 7a - Type I Sanitary Sewer Manhole.
- B. Item 7b –Type IV Sanitary Sewer Manhole (Doghouse).
- C. Item 7c – Type III Sanitary Sewer Manhole with Outside Drop Connection.
- D. Item 7d - Type I Storm Sewer Manhole.
- E. Item 7e – Flow Meter & Bypass Structure.
- F. Item 7f – Manhole 5028 Removed.

**7.04 MEASUREMENT & PAYMENT**

- A. The quantities to be paid for under Items 7a and 7c, shall be the measured height of manholes, as built, measured from the invert of the deepest pipe to the top of the manhole casting.
- B. The quantities to be paid for under Item 7b, 7e and 7f shall be lump sum for the identified scope of work for each of the identified structures. in accordance with the Specifications and Drawings.

**ITEM 8  
EXCAVATION AND BACKFILL OF UNSUITABLE MATERIAL**

**8.01 DESCRIPTION**

- A. Under this Item, the Contractor shall over excavate and dispose of any material that the Engineer determines to be unsuitable.
- B. Only the removal of unsuitable material below the elevation of the planned Work is included and will be paid for under this Item.
- C. Disposal of excavated unsuitable material is included under this Item.
- D. Backfill of over excavated area with specified materials is covered under this other Item.
- E. The provision of geotextile or geogrid materials at the direction of the Engineer is included in this Item.

**8.02 WORK NOT INCLUDED**

- A. Trench and structural excavation and backfill.

- B. The provision of an engineer to provide a recommendation on remedial measures for unsuitable materials encountered shall be included in the Allowance item provided for this purpose.

#### **8.03 DEFINITION OF ITEM**

- A. Item 8a - Excavation and Backfill of Unsuitable Materials for Structures.
- B. Item 8b – Excavation and Backfill of Unsuitable Materials for Pavement.
- C. Item 8c – Geotextile Stabilization / Separation Fabric
- D. Item 8d – Geogrid Subgrade Stabilization Material

#### **8.04 MEASUREMENT & PAYMENT**

- A. The quantity to be paid for under Item 8a & 8b will be the measured volume of material in cubic yards the original position as approved by the Engineer.
- B. The quantity to be paid for under Item 8c & 8d shall be by square yard at locations as directed by the Engineer.

### **ITEM 9 CATCH BASINS**

#### **9.01 DESCRIPTION**

- A. Under this Item, the Contractor shall perform all Work necessary for the construction of new catch basins and storm water outlet structures, shown on the Drawings, and specified herein.
- B. These Items shall include all Work to install the catch basins, including but not limited to the following: excavation; sloping & shoring excavations; hauling and disposal of material from Site; backfill; special backfill; catch basin concrete collars; compaction; bedding; pipe materials; fittings; connections to new and existing sewers; construction, maintenance and removal of temporary access to the Work area; and related Work such as performing material testing.
- C. All Work required to dewater trenches is included under these Items.
- D. Temporary supporting existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during construction is included under these Items.
- E. The provision of dump rock fill erosion protection for storm sewer pipes and structures is included in this item.
- F. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under these Items, unless specifically included under other items.

**9.02 WORK NOT INCLUDED**

- A. Pavement replacement within Contract limits is included for payment under other Items.
- B. Sewer Pipe, including the catch basin lead, shall be included under the respective sewer pipe item.

**9.03 DEFINITION OF ITEMS**

- A. Item 9a - Catch Basin, Type 2-2B (Outlet Structure).
- B. Item 9b – Catch Basin, Type 2-2B

**9.04 MEASUREMENT AND PAYMENT**

- A. The quantities to be paid under Items 9a and 9b shall be the full compensation for each new catch basin or outlet structure furnished and installed in accordance with the Specifications and Drawings.

**ITEM 10  
PAVEMENT CONSTRUCTION AND REPAIRS**

**10.01 DESCRIPTION**

- A. Under these Items, the Contractor shall remove existing pavement material including flexible or rigid pavement, roadway base material, intermediate or surface courses, sidewalk or pavement base for pipeline construction or parking areas as scheduled, shown on the Drawings and specified herein.
- B. The saw-cutting and preparation of the trench excavation both prior to the removal pavement for trench construction and for new pavement placement is included in these Items.
- C. Under these Items, the Contractor shall construct aggregate base, flexible pavement base and surface courses for new roadways or to replace pavement removed for pipeline construction as scheduled, shown on the Drawings and specified herein.
- D. The construction of concrete pavement driveway approaches is included under these Items.
- E. The removal of pavement by milling or planing is included in these Items.
- F. The preparation of subgrade material prior to the placement of roadway base is included in these Items.
- G. The provision of a subgrade support material under roadways at the direction of the engineer is included in this Item.
- H. The provision of the specified compaction testing is included in these Items.
- I. Tack coat as specified is included in these Items.

- J. The hauling of spoil material from the site is included in these Items.
- K. The replacement of pavement markings removed by pavement removal or planning shall be included in these Items.

#### 10.02 WORK NOT INCLUDED

- A. Pavement replacement required beyond specified pay limits for construction of manholes and chambers is included for payment under other Items.
- C. The removal of pavement is included under other items.

#### 10.03 DEFINITION OF ITEMS

- A. Item 10a - ODOT Item 202 Pavement and Base Removed.
- B. Item 10b – ODOT Item 254 Pavement Planing.
- C. Item 10c – ODOT Item 452 Concrete Drive Approach (6”).
- D. Item 10d – ODOT Item 452 Concrete Drive Approach (8”).
- E. Item 10e – ODOT Item 451 – Reinforced Concrete Pavement – Parking Area (10”).
- F. Item 10f – Flexible Pavement Resurfacing - Roadway
- G. Item 10g – Flexible Pavement Trench Repair - Heavy Roadway.
- H. Item 10h – ODOT Item 301 Asphalt Concrete Base Course (3-inches)
- I. Item 10i – Subgrade Support Material

#### 10.04 MEASUREMENT

- A. Quantities to be paid for under these Items shall be the actual quantity constructed, measured in place within the limits as defined below, and scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions. Bituminous materials will be measured in gallons at 60-degrees F applied at the specified rates and within the pay limits.
- B. Pay Limits:
  - 1. Depth - As specified, scheduled, or directed by the Engineer. To differentiate from special backfill material provided to backfill pipes and appurtenance excavations, aggregate base shall only be measured for the thickness shown on the Drawings or directed by the Engineer.
  - 2. Length - The actual length measured.
  - 3. Width:
    - a. Except as otherwise scheduled on the Drawings, the width of replacement over pipe trenches shall not exceed the nominal diameter



of the pipe plus 2-1/2 feet on each side for trench depths of 16 feet and less; and 4 feet on each side for trench depths greater than 16 feet. No additional width will be allowed for precast manholes or manhole chamber construction.

4. Trench depth as used herein shall mean the distance from the original surface of the pavement to the invert grade of the main line pipe.

#### **10.05 PAYMENT**

- A. The unit prices for Items 10a through 10g shall be full compensation for each square yard of driveway, roadway or approach removed, planed, constructed or repaired with in accordance with the typical sections provided including all specified pavement materials down to the bottom of the aggregate base course and with lift thicknesses specified, so measured.
- B. The unit prices stated in the Bid Item 10h shall be measured for each square yard of asphalt base material placed as directed by the Engineer to replace flexible pavement in areas where the existing pavement is discovered to be thicker than the provided typical sections.
- C. The unit price for Item 10i shall be measured for each square yard of pavement subgrade support material at locations as directed by the Engineer.

### **ITEM 11 FENCE**

#### **11.01 DESCRIPTION**

- A. Under these Items, the Contractor shall furnish and install the fencing and accessories as shown on the Drawings and specified in conformance with relevant Sections of the Specifications.
- B. This Item shall include all the materials, equipment, labor, and supervision necessary for the installation of new fencing as shown on the Drawings and to replace fencing damaged during construction in accordance with the Contract Documents.
- C. This Item shall include the fence fabric, fence posts and rails, accessories, gates, aggregate maintenance strip, barbed wire, and concrete footings as shown on the drawings and specified in conformance with relevant Sections of the Specifications.

#### **11.02 DEFINITION OF ITEM**

- A. Item 11a – Fence with Maintenance Strip
- B. Item 11b – Vehicle Fence Gate

**11.03 MEASUREMENT & PAYMENT**

- A. The quantities to be paid for under Item 11a shall be linear foot of fence installed and provided in accordance with the Specifications and Drawings.
- B. The quantity to be paid under Item 11b shall be for each vehicle gate installed and provided in accordance with the Specifications and Drawings. The vehicle gate for this project shall include both leaves in the each item.

**ITEM 12  
CCTV INSPECTION OF SEWERS**

**12.01 DESCRIPTION**

- A. Under this Item, the Contractor shall perform closed circuit television inspection of new sewers 8-inch and larger, installed as part of the work, as specified.
- B. Cleaning of the sewers prior to the CCTV inspection shall be included under this Item.
- C. The preparation and submittal of video records and submission to the Owner and Engineer shall be included under this Item.

**12.02 DEFINITION OF ITEM**

- A. Item 12 – CCTV of New Sewers (8-inch and Larger).

**12.03 MEASUREMENT**

- A. The quantities to be paid for under Item 12 shall be the horizontal length of new sewer inspected as measured, parallel to the axis of the sewer line along the surface of ground from the center of manholes. No deductions shall be made for manholes along the length of the sewer inspected.

**12.04 PAYMENT**

- A. The unit price stated in the Bid for Item 12 shall be full compensation for each linear foot inspected, as specified, so measured.

**ITEM 13  
VIDEO RECORDING**

**13.01 DESCRIPTION**

- A. Under this Item, the Contractor shall produce and deliver to the Owner, color video recordings of existing topography within the zone of influence along all sewer routes and video recordings of designated buildings and dwellings as specified and directed.

**13.02 DEFINITION OF ITEM**

- A. Item 13 - Video Recording of the Zone of Influence.

**13.03 MEASUREMENT**

- A. The quantities to be paid for under Item 13 shall be a lump sum for video recording of the defined zone of influence along specified routes.

**13.04 PAYMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 13.

**ITEM 14  
CLEARING AND GRUBBING**

**14.01 DESCRIPTION**

- A. This Item shall include all clearing and grubbing of lands required to complete the Work as specified, shown in the Contract Documents and as directed by the Engineer.
- B. This Work shall include, but not limited to, the complete removal of all vegetation including plants, shrubs, sod, agricultural crop residue, trimming and cutting of trees, removal of tree cuttings and stumps, scalping and the removal and disposal of all debris generated by the clearing and grubbing operation as specified and shown on the Drawings.

**14.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

**14.03 DEFINITION OF ITEM**

- A. Item 14 - Tree Removal, Clearing and Grubbing.

**14.04 MEASUREMENT & PAYMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 14.

**ITEM 15  
MAINTENANCE OF TRAFFIC**

**15.01 DESCRIPTION**

- A. This Item shall include the furnishing and maintaining of measures required to maintain traffic through or around the proposed Work.
- B. This Item shall include detour routes as specified in the Contract Documents.

**15.02 DEFINITION OF ITEM**

- A. Item 15 - Maintenance of Traffic.

**15.03 MEASUREMENT & PAYMEN**

- A. The quantities to be paid for under Item 15 shall be lump sum for all maintenance of traffic measures.

**ITEM 16  
PUMP STATION CONTROL BUILDING MODIFICATIONS, DRY WELL  
AND WET WELL ABANDONMENT**

**16.01 DESCRIPTION**

- A. This Item includes all demolition work at the existing pump station site shown on the Drawings unless identified in other Items. The summary of items listed below is not intended to be an exhaustive list, instead the list is provided to highlight major work.
- B. Under this Item, the Contractor shall abandon the existing pump station dry and wet well structures (above and below grade) as shown on the Drawings and according to the relevant sections of the Specifications. The removal and salvaging of existing equipment in the existing Control Building as shown on the Drawings or Specified shall be included under this Item.
- C. The filling of the existing pump station wet well and dry well structures as specified is included under this Item.
- D. This Item included the construction of shoring & earth retaining systems as required for excavations included in this Item.
- E. This item includes the maintenance of trenches and excavations including dewatering and others measures to maintain open excavations necessary for work included under this Item.
- F. The furnishing and placing of special backfill or specified backfill as specified in Section 02200 in areas excavated or to be abandoned for this work included under this Item.

- G. The temporary support of utilities as required to complete the Work, shall be included under this Item. All repairs to existing utilities damaged, as a result of construction, are included under this Item.
- H. The improvement of the site to place or remove material to the final grades as shown on the plans is included in this item. In paved areas, the site shall be constructed to the bottom of the pavement subgrade under this Item.
- I. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under this Item.
- J. The Coordination of the equipment salvage operation with the Owner's staff is included with this Item.

**16.02 WORK NOT INCLUDED**

- A. Pavement removal and construction within the Contract limits is included under other Items.
- B. Buried pipe abandonments are included in other Items.

**16.03 DEFINITION OF ITEM**

- A. Item 16 – Pump Station Control Building Modifications, Dry Well and Wet Well Abandonment.

**16.04 MEASUREMENT & PAYMENT**

- A. The quantities to be paid for under Item 16 shall be lump sums for the identified scope of work in accordance with the Specifications and Drawings.

**ITEM 17  
WATER MAINS**

**17.01 DESCRIPTION**

- A. Under this Item, the Contractor shall furnish and perform all Work necessary for the installation of the water lines as scheduled, shown on the Drawings, and specified, in conformance with relevant sections of the Specifications.
- B. This Item shall include all Work to install the waterlines, including but not limited to the following: excavation; hauling excess spoil material from Site; backfill; compaction; bedding; pipe materials; fittings; maintenance of trenches; connections to existing water mains; and related Work and materials such as blowoffs to perform disinfection, flushing, performing pressure and bacteriological tests as shown on the Drawings and specified in conformance with relevant Sections of the Specifications.

- C. Connections of new water lines to new and existing water lines shall be included under this Item. Temporary supporting of existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during construction is included under this Item.
- D. The abandonment of existing water mains, including existing pipe, fittings and other associated appurtenances shall be included under this Item.
- E. The removal of existing water mains, including existing pipe, fittings, valves, backfill, bedding, structures, concrete encasements, and other associated appurtenances incidental to water main construction shall be included under this Item.
- F. These Items shall include all water main fittings, accessories and appurtenances not included in other pay items. Fittings, including those not shown on the plans required to avoid existing utilities shall be included under this Item incidental to water main construction.
- G. The furnishing and placing of special backfill in areas excavated for this work included under this Item.
- H. All work to dewater trenches is included in this Item.
- I. All repairs of existing utilities damaged, as a result of construction, are included under this Item.
- J. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under this Item, unless specifically included under other items.

**17.02 WORK NOT INCLUDED**

- A. Pavement replacement within the Contract limits is included under other Items.

**17.03 DEFINITION OF ITEM**

- A. Item 17 - 6-inch Water Main, Type B

**17.04 MEASUREMENT & PAYMENT**

- A. The quantities to be paid for under Item 17 shall be the horizontal length of pipe measured parallel to the axis of the line along the surface of the ground, with no deduction for laying length of fittings and valves. Vertical portions of the water main shall not be measured for payment.

**ITEM 18**  
**FIRE HYDRANT ASSEMBLIES**

**18.01 DESCRIPTION**

- A. Under this Item, the Contractor shall furnish and perform all Work necessary for the installation of the fire hydrant assemblies, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.
- B. This Item shall include all Work to install the fire hydrant assemblies, including but not limited to the following: excavation; removal of concrete encasement; hauling excess spoil material from Site; backfill; compaction; bedding; pipe materials; fittings; connections to water lines; construction, maintenance, and removal of temporary access to the Work area; and related Work such as performing material testing.
- C. Fire hydrant assemblies shall include hydrant, watch valve, valve box, all 6-inch ductile iron pipe from the water main to the hydrant riser, anchoring pipe, and all associated fittings and accessories.

**18.02 WORK NOT INCLUDED**

- A. Pavement replacement within Contract limits is included for payment under other Items.

**18.03 DEFINITION OF ITEM**

- A. Item 18 – Fire Hydrant Assembly, Type A.

**18.04 MEASUREMENT & PAYMENT**

- A. The quantity to be paid under Item 18 shall be the measured quantity of each fire hydrant assembly completed as specified, shown on the drawings and so measured.

**ITEM 19**  
**VALVES**

**19.01 DESCRIPTION**

- A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of the valves, tapping sleeves and accessories as shown on the Drawings and specified in conformance with relevant Sections of the Specifications.
- B. Valve boxes and manhole structures as required or shown in the Drawings shall be included under these Items.
- C. These Items shall include all Work to install, abandon valves, including but not limited to the following: excavation; removal of concrete encasements; hauling excess spoil material from Site; backfill; compaction; bedding; pipe materials; fittings and pipe connections; and related Work such as performing material testing.

- D. The abandonment of valves 4-inches and larger shall include removal of the valve box, cover and casting walls to the specified depths.
- E. The furnishing and placing of special backfill in areas excavated for this work included under these Items is included in these Items.

**19.02 WORK NOT INCLUDED**

- A. Pavement replacement within Contract limits is included for payment under other Items.
- B. Hydrant watch valves are included in other Items.

**19.03 DEFINITION OF ITEMS**

- A. Item 19a – 16-inch x 16-inch Tapping Sleeve, Valve and Box.
- B. Item 19b - 12-inch Inserting Valve and Box.
- C. Item 19c – Abandonment of Valves at Completion.

**19.04 MEASUREMENT AND PAYMENT**

- A. The quantities to be paid for under Items 19a through 19c shall be the full compensation for each valve and box installed or abandoned in accordance with the Specifications and Drawings.

**ITEM 20  
PIGGING MANHOLE**

**20.01 DESCRIPTION**

- A. Under this Item, the Contractor shall furnish and perform all Work necessary for the installation of the pigging manhole and accessories as shown on the Drawings and specified in conformance with relevant Sections of the Specifications.
- B. This Item shall include all Work to convert an existing flow meter manhole into a pigging manhole, including but not limited to the following: pipe materials; fittings and pipe connections; and related Work.

**20.02 WORK NOT INCLUDED**

- A. Pavement replacement within Contract limits is included for payment under other Items.

**20.03 DEFINITION OF ITEM**

- A. Item 20 – Flow Meter Manhole Converted to Pigging Manhole.

**20.04 MEASUREMENT AND PAYMENT**



- B. The quantities to be paid for under Item 20 shall be the full compensation for each flow meter manhole converted to pigging manhole in accordance with the Specifications and Drawings.



**SECTION 01021  
ALLOWANCES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the allowances which are to be furnished by the Contractor per Paragraph GC-13.02. of the General Conditions.
- B. The Contractor shall include in the Contract Price all allowances stated in the Contract Documents. These allowances shall cover the net cost of the materials and equipment delivered and unloaded at the Site, and all applicable taxes.
- C. The Contractor's handling costs on the Site, labor installation costs, overhead, profit and other expenses contemplated for the original allowance shall be included in the Contract Price and not in the Allowances.
- D. The Contractor shall cause the Work covered by these allowances to be performed for such amounts and by such persons as the Engineer may direct, but the Contractor will not be required to employ persons against whom he makes a reasonable objection.
- E. If the cost, when determined, is more than or less than the allowance, the Contract Price may be adjusted accordingly by Change Order.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Contractor shall prepare and submit proposals for the Owner to select the items included in allowance.
  - 2. Information for the Record:
    - a. Operation and maintenance manuals as may be required for items included in allowance.
    - b. Invoices and delivery slips, for items provided under the allowance, shall be submitted to the resident project representative or Engineer.

**1.03 PRODUCT HANDLING**

- A. The Contractor shall provide all labor, material and equipment to ensure the safe delivery, handling and storage of goods until acceptance by Owner and Engineer.

**1.04 GUARANTEE**

- A. Contractor shall provide manufacturer's warranties to the Owner for all goods provided.

## **PART 2 PRODUCTS**

Not used.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Contractor shall advise Owner and Engineer of, and include in the schedule, the timing of the selection, Shop Drawing review and procurement of the goods or services required in the allowance.
- B. Contractor shall be responsible for the coordination, of all allowance item(s) provided, with the remainder of the contract work.

### **3.02 ERECTION, INSTALLATION AND APPLICATION**

- A. Contractor shall assemble, install or apply all goods as may be required to complete the requirements of the allowance.

### **3.03 PROTECTION**

- A. Contractor shall examine all goods on delivery. All damaged or defective goods shall be returned to the manufacturer for replacement.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 LIST OF ALLOWANCES**

	<b>Allowance Amount</b>
A. Telemetry Equipment and Programming	\$14,500.00
B. Chemical Feed Equipment	\$7,500.00
C. New Electric Service	\$20,000.00
D. Engineering Services for Soils Evaluation	\$20,000.00

### **4.02 DEFINITION OF ALLOWANCES**

- A. Telemetry Equipment and Programming:
  - 1. This Item is intended to permit District's communications consultant to provide required programming to interface alarm and status signals into the District's SCADA system.
  - 2. A copy of the proposal received from the District's communications consultant, WD Automation, is included following this specification section.
  - 3. WD Automation's scope of work includes the following:
    - a. Provision of a new telemetry cabinet and antenna.

- b. Termination of signal wires into the telemetry cabinet
  - c. Installation and provision of signal wires from the telemetry cabinet to the antenna unit.
  - d. Programming the existing PLC to incorporate new signals, alarms and equipment status or data ranges for the new pump station.
  - e. Programming of the District's Operations Facility as needed to accept signals, alarms and equipment status or data ranges.
4. Signal Information:
- a. The following signals shall be transmitted to the Northwestern Water & Sewer District Master Telemetry Unit (MTU).
    - 1) Wet Well High-Level Alarm
    - 2) Wet Well Low-Level Alarm
    - 3) Backup Level System Active
    - 4) Pump 1 Running Status
    - 5) Pump 2 Running Status
    - 6) Pump 3 Running Status (Future)
    - 7) Pump 1 VFD Fault
    - 8) Pump 2 VFD Fault
    - 9) Pump 3 VFD Fault (Future)
    - 10) Pump 1 – In Auto
    - 11) Pump 2 – In Auto
    - 12) Pump 3 – In Auto (Future)
    - 13) Pump 1 Trouble – Thermal / Moisture
    - 14) Pump 2 Trouble – Thermal / Moisture
    - 15) Pump 3 Trouble – Thermal / Moisture (Future)
    - 16) Phase Failure
    - 17) Power Failure
    - 18) Backup Generator Active
    - 19) Backup Generator Fault
    - 20) Transfer Switch Fault
    - 21) Entry Alarm
    - 22) Flow Meter Reading (gpm) – Analog
    - 23) Wet Well Level (ft) – Analog (Transducer by Contractor)

5. Any work not explicitly included in or exclude from the WD Automation quote attached to this specification section shall be included in the Contractor's bid under the provided bid items.
6. An invoice from WD Automation will be required to be submitted to substantiate payment amounts claimed under this allowance item.

**B. Chemical Feed Equipment**

1. This Item is intended to permit the Contractor to purchase the chemical feed tank, pump and accessories needed between the tank and the pump.
2. Shipping is not included in the supplied quotes, however the allowance item has been increased to account for additional work or items not included in the proposals.
3. A copy of the proposal received from the District's chemical feed supplier, Aulick Chemicals, is included following this specification section.
4. The chemical feed rate and dosing pump will be supplied by the chemical feed system manufacturer. The following information is provided for the chemical feed manufacturer's design of a system using Nitronox by Aulick Chemicals.
  - a. Average Daily Flow: 700 gpm
  - b. Force Main Length: 16,700-feet (roughly half is C900 and the remainder DIP).
  - c. Force Main Size: 16-inch Diameter (nominal)
5. The following items are not included in the allowance item and should be included in the bid items provided:
  - a. Installation of the chemical feed system.
  - b. Piping from the chemical feed pump to the wet well as shown on the design plans.
6. Any work not explicitly included in or excluded from the Aulick Chemicals quote included attached to this specification section shall be included in the Contractor's bid under the provided bid items
7. An invoice from Aulick Chemicals will be required to be submitted to substantiate payment amounts claimed under this allowance item.

**C. New Electrical Service**

1. This allowance item is intended to reimburse the Contractor for costs associated with the application for and construction of the new electrical service for the pump station. The Engineer has not obtained a work order from Toledo Edison at the time of preparation of these bid documents.
2. Permissible costs that can be reimbursed to the Contractor under this item are: Fees or charges from Toledo Edison related to the construction of the new electrical service. An

invoice from Toledo Edison will be required to be submitted to substantiate payment amounts claimed by the Contactor.

3. Costs not permissible under this item shall include work to be performed on the Customer side of the meter by the Contractor or their Subcontractors. Also, not permissible are overhead or office costs expended by the Contractor's administrative staff in applying for or coordinating the new electric service.

D. Engineering Services for Soils Evaluation

1. This allowance item is intended to reimburse the Contractor for Engineering Service costs associated with testing or making a recommendation regarding any unsuitable materials encountered at the Site.
2. An invoice from the Engineer will be required to be submitted to substantiate payment amounts claimed by the Contactor.
3. Costs not permissible under this item shall include compaction or other material testing included or specified in the Contract.

END OF SECTION





WD Automation, Inc.  
3000 Broadway Suite 2B  
Mt. Vernon, IL 62864  
Phone: 618-315-6558  
Fax: 618-315-6559

Attention: All Bidding contractors  
Customer: NWWSD  
12560 Middleton Pike  
Bowling Green, Ohio 44847  
jrossow@nwwsd.org  
Phone: (419) 354-9090

Proposal # 15015-44

## Proposal

**Item #1:** Provide a new RTU control panel for replacing the existing Ford Road Lift Station site RTU#27 for the NWWSD sewer system. This is a three pump lift station so an 8 channel analog input card is needed and an additional 8 point digital input card.

A new Stainless Steel RTU panel for the Ford road LS will be provided by WD Automation, Inc. Conduits, wire, and shielded control wire will be installed from the control panel to the LS by the contractor. PLC logic will be added to the NWWSD Office site sewer PLC program to communicate from the LS to the NWWSD office site by internet communication VIA a cellular modem (activation provided by NWWSD). The screens will be modified on the Sewer SCADA computer to display the LS status. Additional alarms will be added to the alarm dialer software. The owner will provide a sierra Wireless cellular modem to provide the internet service into the RTU panel with a static IP address. Digital and analog signals will be landed and wired from the LS devices to the RTU by the contractor. A serial cable from the RTU to the Sparling Tigermag for flow totalizer reading will be provided and installed by the contractor.

Major items to include:

- Hoffman 316 stainless steel RTU panel 30x24x10;
- Allen Bradley 1400 Micrologic PLC;
- Spectrum Controls 8 channel analog input card;
- Allen Bradley analog output card;
- Microtik Router;
- Terra wave omni-directional antenna;
- Lightning arrestor;
- APC 650 vA UPS.

Notes:

- Installation is not included.
- Analog Transducers and external switches provided by contractor.
- Startup is included.
- Price includes a one year warranty on parts and labor being provided.

Total Net Price for all options (less taxes): \$14,500.00

July 7, 2021

WD Automation, Inc. is pleased to submit our proposal for your project. If you have any additional questions or need any additional information please contact:

Mr. Tim DeJournett  
3000 Broadway Suite 2B  
Mt. Vernon, IL 62864  
Phone: 618-315-6558  
Fax: 618-315-6559  
Cell: 618-246-0628  
[tim@wdautomation.net](mailto:tim@wdautomation.net)

Payment Terms:

Net 30 days from date of invoice

\*1% Discount given if payment is received within 10 days of invoice

Price is valid for 30 days from date of this quotation.

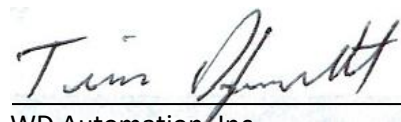
Prices do not include any applicable Sales Taxes.

\_\_\_\_\_  
Company

\_\_\_\_\_  
Accepted By

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name and Title

  
\_\_\_\_\_  
WD Automation, Inc.

---

WD Automation, Inc.  
3000 Broadway Suite 2B  
Mt. Vernon, IL 62864

# Quote

Attention: Ted Bennett, Director of  
Infrastructure

Jones and Henry Engineers, LTD

3103 Executive Pkwy

Toledo, OH 43606

2/5/2021



Aulick Chemical Solutions

111 Patton Ct.

Nicholasville, KY 40356

www.aulickchemical.com

(859) 881-5422

QUOTE NUMBER: 472

PROJECT DESCRIPTION: Tank

TERMS: 30 Days

Description	Quantity	Unit	Unit Price	Cost
1,000 Gallon Vertical Tank	1	-	\$ 1,638.00	\$ 1,638.00
*Plus Shipping			Freight	-
<b>Quote Total</b>				<b>\$ 1,638.00</b>

Thank you for the opportunity to provide this quote. Please follow up with any questions.

Pricing expires 90 days from receipt.

Chuck Howard

Water & Wastewater Consultant

Aulick Chemical Solutions

(859) 940-4145

choward@aulickchemical.com

# Quote

Attention: Ted Bennett, Director of  
Infrastructure  
Jones and Henry Engineers, LTD  
3103 Executive Pkwy  
Toledo, OH 43606  
2/10/2021



Aulick Chemical Solutions  
111 Patton Ct.  
Nicholasville, KY 40356  
www.aulickchemical.com  
(859) 881-5422

QUOTE NUMBER: 491

PROJECT DESCRIPTION: CFS

TERMS: 30 Days

Description	Quantity	Unit	Unit Price	Cost
Pedestal Mount Chemical Feed System (PM System)	1	-	\$ 2,300.00	\$ 2,300.00
*Price Quote Does Not Include Shipping Or Installation			Freight	-
<b>Quote Total</b>				<b>\$ 2,300.00</b>

Thank you for the opportunity to provide this quote. Please follow up with any questions.

Pricing expires 90 days from receipt.

Chuck Howard  
Water & Wastewater Consultant  
Aulick Chemical Solutions  
(859) 940-4145  
choward@aulickchemical.com

**SECTION 01043**  
**COORDINATION AND CONTROL OF THE WORK**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This section includes coordination and control of the Work.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. Bypass Pumping plan and procedures (If needed).
    - b. Haul routes to and from Site.
    - c. Plan and procedures for any shutdowns and bypass pumping.
    - d. Coordination drawings shall include, but not be limited to, all process piping including, but not limited to, bill of material, laying length, embedded conduit runs, and embedded plumbing lines.

**1.03 LINES AND GRADES**

- A. All Work under this Contract shall be built in accordance with the lines and grades shown on the Drawings or as altered or modified by authority of the Owner and Engineer.

**1.04 EXISTING STRUCTURES SHOWN ON DRAWINGS**

- A. Where underground and surface structures are shown on the Drawings, the location, depth, and dimensions of such structures are believed to be reasonably correct but are not guaranteed.
- B. Such structures are shown for the information of the Contractor, but information so given is not to be construed as a representation that such structures will in all cases be found or encountered just where shown, or that they represent all the structures which may be encountered.

**1.05 COOPERATION OF CONTRACTOR**

- A. The Contractor shall conduct his operations so as to interfere as little as possible with those of the Owner, other contractors, utilities, or any public authority on or near the Work.
- B. The Owner reserves the right to perform other Work by contract or otherwise, and to permit other public bodies, public utility companies, and others to do Work on or near

the project during progress of the Work. If a conflict arises, the Owner will determine when and how the Work shall proceed.

- C. Claims for delay or inconvenience due to operations of such other parties on Work specified, shown on the Drawings, as directed or which can be reasonably expected to be encountered by the nature and location of the Work will not be considered.
- D. Operations entailing the use of construction equipment and lights outside the hours or 8:00 am and 5:00 pm or outside the hours allowed for construction by local ordinances or regulations shall be approved by the Owner.
- E. Closing off clear access to any public alley, street, road, avenue or boulevard without the prior consent of municipal officials and the Engineer is prohibited.
- F. Contractor and subcontractors are required under Ohio Revised Code Section 149.53 to Notify the Ohio Historical society and the Ohio Historic Site Preservation Board of archeological discoveries located in the project area and to cooperate with these entities in archeological and historical surveys.

#### **1.06 MAINTENANCE OF SANITARY SYSTEM DURING CONSTRUCTION**

- A. All construction which requires interruption of existing sanitary system flow shall be executed during periods designated by the Owner.
- B. Bypassing of untreated sanitary wastewater to any stream or body of water is prohibited.
- C. Additional requirements for bypass pumping are included in Part 4.

#### **1.07 PERMANENT PAVEMENT AND FINAL RESTORATION**

- A. When construction is being done between April 15 and November 15, the final pavement restoration work shall be completed by November 15. When work is being performed between November 15 and April 15, temporary pavement as specified shall be provided. Final restoration of paved areas shall be completed within 30 days of the opening of asphalt plants for the season. The dates listed are intended to loosely define the period of operation of asphalt plants. Concrete pavement construction may continue beyond the dates listed with proper thermal protection as approved by the Owner.
- B. Pavement restoration shall include, but not limited to, replacement of pavement, driveways, and sidewalks.
- C. The fine grading, topsoil, and seeding operation shall be completed within 30 days of pavement restoration, unless weather conditions prevent such work from being completed.

**1.08 TEMPORARY PAVEMENT RESTORATION**

- A. The Contractor shall provide and maintain temporary pavement for all roads in which construction occurs. Temporary pavement shall be in accordance with Section 01565 and as shown on the drawings.

**1.09 TEMPORARY STAGING AND PARKING FACILITIES**

- A. No parking or staging area has been identified for this Work. The Contractor is expected to locate and obtain permission from private property owners for construction staging and parking.
- B. Parking spaces for the Contractor's personnel shall be provided and maintained in usable condition by the Contractor at all times. Provisions shall be made so that sediment is not tracked onto paved roadways from the vehicles operated by the Contractor's personnel.

**1.10 TEMPORARY WATER, HEATING, LIGHTING AND POWER**

- A. The Contractor shall provide all water, heat, lighting, and power required to construct and protect the Work until Final Completion.
- B. The source for temporary power shall be from the electric utility or portable power source.
- C. The source for temporary water can be from the District. The District shall furnish a meter and all backflow prevention devices with a deposit paid by the Contractor.
- D. There will be no charge for water used for the work and for the initial filling of the force main for testing.
- E. The installation for electric power shall meet the requirements of federal, state, and local authorities and regulatory agencies.

**1.11 DISPOSAL OF DEBRIS**

- A. All debris resulting from construction operations, i.e., packaging, waste materials, damaged equipment, etc., shall be removed from the Site by the Contractor and disposed of at spoil sites.
- B. The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely removed from public or private rights-of-way.
- C. All debris shall be disposed of in accordance with federal, state, and local laws and regulations.

**1.12 CONTROL OF NOISE**

- A. The Contractor shall eliminate noise to as great an extent as possible at all times. Air compressors shall be equipped with silencers and the exhaust of all gasoline motors and other power equipment shall be provided with mufflers

- B. The Contractor shall require strict observances of all pertinent ordinances and regulations.

#### **1.13 DUST DEBRIS AND SMOKE PREVENTION**

- A. Strict compliance with all ordinances regulating the production and emission of smoke will be required.
- B. Contractor shall control debris and dust in accordance with Section 01568.
- C. The Owner may require additional dust control measures during dry weather.
- D. The Contractor shall accept full responsibility for all damage that may occur to property as a result of negligence in providing required control.

#### **1.14 SANITARY REGULATIONS**

- A. The Contractor shall provide all necessary housing accommodations for the workers for changing clothes and for protection during inclement weather. Toilet accommodations shall also be maintained for the use of the employees on the Work. The accommodations shall be in approved locations, properly screened from public observance and shall be maintained in a strictly sanitary manner.
- B. The Contractor shall obey and enforce all other sanitary regulations and orders; shall take precautions against infectious diseases and the spread of same; and shall maintain at all times satisfactory sanitary conditions around all shanties, tool and supply houses, and on all other parts of the Work.

#### **1.15 USE OF EXPLOSIVES**

- A. The use of explosives on this project is prohibited.

#### **1.16 EMERGENCY MAINTENANCE SUPERVISOR**

- A. The Contractor shall submit to the Engineer the names, addresses, and telephone numbers of two employees responsible for performing emergency maintenance and repairs when the Contractor is not working, See GC 2.04 and 7.01. These employees shall be designated in writing by the Contractor to act as his representative and shall have full authority to act on his behalf.
- B. Contractor shall post at job Site, in a conspicuous location, the emergency numbers for the project.
- C. Contractor shall be responsible for contacting the local fire, police, and emergency response personnel and organizations in advance of the Work. The Contractor shall be responsible for the coordination and compliance with emergency response plans, whether developed by the governing agency, laws, or the Contractor for the project.
- D. At least one of the designated employees shall be available for a telephone call any time an emergency arises.



**1.17 PUBLIC SERVICE STRUCTURES**

- A. Public service structures shall be understood to include all poles, tracks, pipes, wires, conduits, house-service connections, vaults, manholes, and other appurtenances, whether owned or controlled by the Owner or other public bodies or by privately-owned corporations, used to supply the public with transportation, heating, electric, telephone, gas, water, sewer, or other services.
- B. At least a week in advance of breaking ground, the Contractor shall notify the registered underground protection service, all public bodies, and other owners of such facilities of the proposed location of his operations, advising them that their property may be affected and that such measures as they may deem necessary should be promptly taken to protect, adjust, remove, or build them.
- C. In developed residential and commercial areas, the Contractor shall assume each building and dwelling has water and sewer services and that they shall be protected and repaired as needed as part of the pipeline installation. No additional payment will be made for Work associated with supporting or repairs of such services.
- D. Three conditions which may be encountered will be dealt with as follows:
  - 1. Structures which are adjacent to but not included within the limits of an excavation required for performance of the Work shall be protected, supported, and maintained in service by the Contractor at his expense.
  - 2. Structures within the limits of the Work which can be satisfactorily supported and maintained in service and which do not require removal and rebuilding in the judgment of the Engineer shall be thus supported by the Contractor at his expense, including cost of repair of damage incident to his operations.
    - a. Supports for water and gas mains, sewers, conduits, and similar structures shall be constructed of timber or other acceptable materials; shall be supported from undisturbed foundations, and shall be sufficiently substantial to ensure against settlement when pipe trenches or other excavations are backfilled. In all cases where permits or inspection fees are required by utilities in connection with changes to or temporary support of their conduits, the Contractor shall secure such permits and pay all permit and inspection fees.
    - b. The Contractor shall assume full responsibility for maintaining all public service structures in service and shall support and protect, or remove and rebuild them at his own expense. Such services shall not be interrupted without permission of the owner of the public service structure.
  - 3. In case relocation of pipelines or other utility structures is required because of direct interference, as determined jointly by the Owner, Engineer, and Contractor, with the installation of the Work, the Contractor shall notify the Owners of the utility structure involved.
    - a. The Contractor will not be reimbursed for the cost of the relocation if the interference is shown on the Drawings, described in the

Specifications, apparent on visual inspection, or specifically included in the Work to be performed by the Contractor.

- b. The Contractor will not be paid for time lost because of such direct interference. Where it is the policy of any utility owner to perform such Work with his own forces, the Contractor shall cooperate to the fullest extent with such utility owner.

#### **1.18 UNAUTHORIZED WORK**

- A. Work done beyond the lines shown on the Drawings or ordered, Work done without required inspection, except as herein provided, or any extra work done without authority will be considered as unauthorized and will not be paid for under the provisions of the Contract. Work so done may be ordered removed at the Contractor's expense.
- B. Work completed not in accordance to the lines and grades given in the Drawings shall be considered as unauthorized and subject to rejection.

#### **1.19 DRAINING OF TANKS AND PIPELINES – RESERVED**

##### **PART 2 PRODUCTS**

Not used.

##### **PART 3 EXECUTION**

Not used.

##### **PART 4 SPECIAL PROVISIONS**

#### **4.01 POTENTIALLY HAZARDOUS ENVIRONMENT**

- A. The environment in portions of the Site is rated as Class I Division 1 or 2 or some areas of the Site are designated as permitted Confined Spaces. As a minimum, whenever the Contractor is performing Work in these areas, the Contractor shall provide Factory Mutual- and UL-approved continuous monitoring of the atmosphere for the presence of hydrogen sulfides, of low oxygen concentration, and of explosive gases (both lighter and heavier than air).
- B. The Contractor shall evacuate all personnel from the areas whenever the detection system registers hydrogen sulfide levels of greater than 20 ppm, oxygen levels less than 19.5% or combustible gas levels of greater than 10% of the LEL.
- C. In addition, whenever the Contractor is using tools producing open flames or sparks, such as cutting torches, saws, and grinders, the Contractor shall provide for the forced air exhaust ducted from the immediate area of the Work.

#### **4.02 MAINTAINING FLOW IN EXISTING SEWERS**

- A. Flow in existing storm, sanitary and private sewers shall be maintained at all times during construction of this project. The Contractor shall furnish and install all necessary

temporary facilities required to maintain the flow in existing sewers including bulkheads, plugs, stop planks, flumes, coffer dams, pumping equipment, valves, etc.

- B. The work proposed in the sequence of construction is intended to be performed without the need for bypass pumping. If the Contractor wishes to provide bypass pumping, the unit prices included in the Contract shall be used.
- C. The use of bypass pumping shall with the prior approval of Engineer and Owner.
- D. If bypass pumping is to be performed, the Contractor shall utilize the existing 16-inch force main. The location of the existing 16-inch bypass force main location is shown on the plans. The Engineer can provide design information for the 16-inch force main to the Contractor, if bypass pumping is to be used.
- E. If needed, the Contractor shall submit a bypass pumping plan for review by the Engineer. The bypass pumping plan shall include any details required to connect to the existing force main as well as measures required to block flow in gravity sewers and piping proposed for discharging flow into existing manholes. The plan shall show the proposed locations for pumping equipment. The bypass pumping plan provided shall be considered the minimum requirements.
- F. Any sewer segments surcharged for bypass pumping work shall be cleaned as part of the work.

#### **4.03 SEQUENCE OF CONSTRUCTION**

- A. The following is a suggested sequence of construction to complete the pump station improvements while maintaining reliable pumping capabilities.
- B. The Contractor may modify this sequence but will still be responsible for meeting the contract complete dates outline in the Contract.
- C. Ford Road Sequence of Construction
  - 1. Mobilization to the project site.
  - 2. Construct Temporary Construction Entrance at SWPPP Measures.
  - 3. Clearing & grubbing of pump station site.
  - 4. Rough Grading of site and removal of stored landscaping debris.
  - 5. Confirm elevation of 42-inch Sanitary Sewer at MH1 connection location and the 16-inch force main elevation at the proposed connection location.
  - 6. Excavation for Wet Well.
  - 7. Construction of Concrete Wet Well to Near Final Grade.
  - 8. Installation of MH 1 on 42-inch Sanitary Sewer.
  - 9. Construction of new 48-inch Sanitary Sewer.
  - 10. Flow to new Wet Well station to be prevented.

11. Construction of Pump Station Control Building, installation of equipment, finish wet well construction (including protective coatings – See Part 4 of Section 03300), generator and flow meter chamber.
12. Install the 12-inch inserting valve on the existing force main.
13. Construct 16-inch force main from the Pump Station Control Building to the existing force main.
14. Install the 16-inch by 16-inch tapping sleeve, valve and box.
15. Connect 16-inch force main to existing force main with configuration shown on the plans.
16. Convert the existing flow meter manhole to a pigging manhole. Close existing PV-A and the required valves upstream when ready to modify the existing piping in the manhole. The Ford Road Pump Station may be turned off for a maximum of 2 hours to perform this work during dry weather.
17. Pavement repairs and rough grading
18. The existing Pump Station shall remain in service until successful startup and testing of the new Pump Station.
19. Release sewage flow into new Wet Well.
20. Startup and test pump station.
21. Upon successful startup and testing of the new pump station demolition and abandonments of the existing dry and wet wells along with selective demolition of control building may commence.
22. Abandon 42-inch sanitary sewer downstream of MH1.
23. Final grading and seeding.
24. Restoration and cleanup.

#### 4.04 WET WEATHER CONDITIONS

- A. The sanitary sewer collection system upstream of the Ford Road Pump Station is prone to elevated flow rates and surcharged conditions during wet weather events. The duration of elevated flows and surcharged conditions is dependent upon the nature of weather conditions during the work.
- B. The Contractor shall make provisions to suspend the work during periods of elevated flow rates and surcharged conditions.
- C. The Owner will not provide temporary pumping measures to lower the level of flow in the sanitary sewer to permit the work to continue during wet weather.
- D. The occurrence of elevated wet weather flows and surcharge conditions shall not be justification for a delay claim.

**4.05 REQUIRED SAFETY DOCUMENTATION TO BE SUBMITTED**

- A. On all projects that require the Contractor's or subcontractor's personnel to occupy permitted confined spaces and/or hazardous atmospheres on the Site, the Contractor shall submit to the Owner, a written proposed safety program.
- B. The Contractor shall be expected to perform the work in accordance with the requirements of the Northwestern Water & Sewer Districts Safety Program. The safety program documentation is included attached to this Section.

**4.06 UTILITY STRUCTURES AND POLES**

- A. The Contractor shall be responsible for the cost and coordination required for the temporary support required for all utility poles or utility structures above or below grade inside the work limits.

**4.07 GAS MAIN RELOCATION**

- A. The 2-inch gas main shown in conflict with the proposed MH1 will be relocated by Columbia Gas prior to the work commencing.
- B. The route for the relocation is unknown to the Engineer at the time these documents have been prepared.
- C. The contact for the Columbia Gas work is Clint Wells, Senior Field Engineer, 419-309-5552, [clintwells@nisource.com](mailto:clintwells@nisource.com).

**4.08 PRIVATE PROPERTY**

- A. The Contractor shall coordinate with the Owner for work on private property prior to commencement of work.
- B. The Owner has notified property owners in the area of the Work of this project.

**4.09 SUBGRADE INVESTIGATION**

- A. The subgrade investigation performed prior to this work is described in SC 5.03C.
- B. The Contractor is expected to make the necessary investigations additional to the information provide sufficient for the Contractor to submit a bid for the work.

**4.10 COORDINATION WITH OUTSIDE ENTITIES**

- A. The Contractor shall contact emergency services, schools, and trash collection to coordinate access to the work area.
- B. The Contractor shall provide a door hanger notice to residents and businesses of the status of the work ahead of the work.

**4.11 BUILDING PERMIT**

- A. The contractor is responsible for obtaining all required building permits. The Owner has completed the application and it is on file.
- B. The Contractor is responsible for paying all permit fees.

**4.12 HAUL ROUTES**

- A. The Contractor shall contact the local roadway jurisdiction to obtain the required permits and permission prior to selecting a haul route.
- B. A haul route shall be submitted to the Owner for the record.
- C. The Contractor shall be responsible for any cleaning or sweeping required along the Haul Route caused by the contractor's activities.
- D. If the Haul Route or disposal site is changed, the Contractor shall notify the Owner and Engineer via a submittal.

**4.13 CONSTRUCTION STAGING AND EQUIPMENT STORAGE SITE**

- A. Limited space exists at the existing Ford Road Pump station site for construction staging and equipment storage. The existing pump station site may be used with the prior approval of the Owner.
- B. The Owner has not otherwise identified or secured a site for construction staging or equipment storage.
- C. The identification and securing a site for construction staging and equipment storage is the responsibility of the Contractor.
- D. The Contractor may wish to contact Belmont Country Club, Owners of adjacent lands for a potential staging area.

END OF SECTION



P.O Box 348  
12560 Middleton Pike  
Bowling Green, Ohio 43402  
(419) 354-9090

## CHECK LIST FOR CONTRACTORS

The purpose of this check list is to assist District personnel in assessing contractor compliance to District, State and Federal regulations that address occupational and environmental safety. In addition, this check list is designed to assist contractors in developing a safety strategy for District projects.

### YES/NO

#### Trenching and Excavation Work

- /    1. Does the contractor have a Trenching/Shoring policy in accordance with OSHA requirements?
- /    2. Does the contractor have a soil competent person on staff?
- /    3. Does the contractor have the equipment necessary to safely excavate/trench and shore?
- /    4. Is the contractor prepared to secure any trenches or excavations that may need to be left open over night/weekend?
- 5. **List Excavation Competent Person(s):** \_\_\_\_\_
- 6. **List Water Containment Method(s):** \_\_\_\_\_

#### Confined Space Entry

- /    7. Permit required confined space?
- /    8. Does the contractor have a formal CSE program in accordance with OSHA requirements?
- /    9. Does the contractor have the necessary equipment to safely enter the space?
- /    10. Has the District supplied information on the hazards associated with the space(s)?
- 11. **List Confined Space Competent Person(s):** \_\_\_\_\_

#### Fall Protection

- /    12. Does the contractor have a formal fall protection program in accordance with OSHA requirements?
- /    13. Does the contractor have the necessary fall protection equipment to safely perform the tasks?

#### Lockout/Tagout

- /    14. Does the contractor have a written LOTO Program that they can provide to the District?
- /    15. Are the contractors employees provided with locks and tags?

\_\_\_/\_\_\_ 16. Will the District's employees need to lockout energy sources in conjunction with the contractor? **(If Yes- then the District must provide the contractor with a copy of our LOTO Program and notify all parties involved that LOTO will occur.)**

Chemicals

\_\_\_/\_\_\_ 17. Does the contractor plan to use ANY products on District property?

\_\_\_/\_\_\_ 18. Has the contractor provided the District with the Material Safety Data Sheet(s)?

ARC FLASH(AF)

\_\_\_/\_\_\_ 17. Does the contractor have and ARC Flash/Electrical safety policy?

\_\_\_/\_\_\_ 18. Does the contractor poses the appropriate AF PPE?

**List Emergency Contact Numbers:**

- 1.
- 2.
- 3.

**Identify First-Aid Location:**

\_\_\_\_\_  
Printed Name of Company President or Representative

\_\_\_\_\_  
Signature of Company President or Representative



**SECTION 01090**  
**REFERENCE STANDARDS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes reference standards.

**1.02 DESIGNATION OF ASSOCIATIONS, INSTITUTIONS, SOCIETIES AND STANDARDS**

- A. Whenever in these Specifications reference is made to Associations, Institutions, Societies, or Standards, they will be designated as follows:

AA	-	Aluminum Association
AAMA	-	Architectural Aluminum Manufacturers Association
AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
ADAAG	-	Americans with Disabilities Act Accessibility Guidelines
AFBMA	-	Anti-Friction Bearing Manufacturers Association
AFI	-	Air Filter Institute
AGA	-	American Gas Association
AGMA	-	American Gear Manufacturers Association
AIHA	-	American Industrial Hygiene Association
AISC	-	American Institute of Steel Construction
AISI	-	American Iron & Steel Institute
AITC	-	American Institute of Timber Construction
AMCA	-	Air Moving and Conditioning Association
ANSI	-	American National Standards Institute
API	-	American Petroleum Institute
ARI	-	Air Conditioning and Refrigeration Institute
ASA	-	American Standards Association
ASHRAE	-	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing Materials
AWPB	-	American Wood Preservers Bureau
AWS	-	American Welding Society
AWWA	-	American Water Works Association
BLS	-	Bureau of Labor Standards
CISPI	-	Cast Iron Soil Pipe Institute
FM	-	Factory Mutual
FS	-	Federal Specifications
IBR	-	Institute of Boiler and Radiator Manufacturers
IEEE	-	Institute of Electrical and Electronic Engineers
INETA	-	International Electrical Testing Association

ISA	-	Instrument Society of America
JIC	-	Joint Industrial Council
ODOT	-	Ohio Department of Transportation
NBS	-	National Bureau of Standards
NEC	-	National Electrical Code
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
NICET	-	National Institute for Certification in Engineering Technologies
NSF	-	National Sanitation Foundation
NRTL	-	Nationally Recognized Testing Laboratory
OSHA	-	Occupational Safety and Health Act
SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association, Inc.
SSPC	-	Steel Structures Painting Council
OBC	-	Ohio Building Code
IBC	-	International Building Code
UBC	-	Uniform Building Code
UL	-	Underwriters Laboratories, Inc.
USBM	-	United States Bureau of Mines

- B. Wherever specific standard numbers are indicated, i.e., ASTM C150, it shall be understood to mean the latest revision thereof.

## **PART 2 PRODUCTS**

Not used.

## **PART 3 EXECUTION**

Not used.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 NORTHWESTERN WATER & SEWER DISTRICT SPECIFICATIONS**

- A. The General Notes and Specifications of the Northwestern Water & Sewer District shall be followed for the execution of the work, as modified by these Specifications.
- B. The Contractor shall bring any discrepancies between the District's specifications and these specifications to the attention of the Engineer for interpretation.
- C. References to the "District" shall mean the Northwestern Water & Sewer District.

END OF SECTION

**SECTION 01300  
SUBMITTALS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes requirements for submittals.
- B. Contractor shall adhere to the submittal schedule as submitted under the provisions of the General Conditions. Contractor shall modify the schedule as required to allow sufficient time for submittal review based on current construction schedule.
- C. Owner, Contractor and Engineer shall utilize the electronic project management system EPMS as specified in Section 01320 for the central repository of project related documents including but not limited to submittals, information for the record and Operation and maintenance manuals.

**1.02 COORDINATION OF SUBMITTALS**

- A. The Contractor shall be responsible for the coordination of submittals and field verifications as required for the various parts of the Work.
- B. All submittals to the Engineer, unless otherwise specified, shall be made only by the Contractor. Direct submittals from subcontractors or suppliers will not be accepted.
- C. All submittals shall reference the Specification item that it covers, the Contractor's name, the Contract title and location, and the date of submission. Submittal shall also indicate whether the information is for the Engineer's review and approval, for record purposes, or for the fulfillment of the operation and maintenance requirements.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Two categories of information are normally required:
  - 1. Shop Drawings for review.
  - 2. Information for Record:
    - a. Operation and maintenance manuals.

**2.02 SHOP DRAWINGS FOR REVIEW**

- A. Shop Drawings:
  - 1. The Contractor shall submit Shop Drawings in accordance with the General Conditions, as required by individual Sections, shown on the Drawings or as directed.

2. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with the General Conditions.
  3. The Contractor shall clearly indicate quantities and the exact intended use of the equipment or material contained in the submittal.
  4. All Submittals shall be tailored to the project by high-lighting appropriate information and deleting or crossing out nonapplicable information or where applicable the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual material or equipment furnished. All options furnished shall be indicated.
  5. Color charts or samples shall be included for all submittals where a color selection by the Owner is required. Original Color Charts (not Color Copies) and samples shall be delivered to the Site, Engineer's RPR or Owner as required. The Engineer shall be copied on the transmittal letter for record purposes.
- B. Samples shall be provided as required in the individual Sections. Samples shall be of the precise material proposed to be furnished. The number of samples and sample size shall be the industry standard unless otherwise stated in the individual Sections.

## **2.03 INFORMATION FOR RECORD**

- A. Material certificates shall be submitted for materials as indicated in the individual Sections. The certificate shall state that the products have been sampled and tested in accordance with the proper industrial and governmental standards and meet the requirements of the Specifications. Certificates shall be signed by an authorized agent of the manufacturer.
- B. Licenses and Permits - The Contractor shall submit copies of all licenses and permits required by Local, State, and Federal laws.
- C. Installation and calibration certificates shall be submitted for equipment as indicated in the individual Sections. These certificates shall indicate manufacturer's satisfaction with the installation, the accuracy of calibration and alignment, and the operation of the equipment. Such certificates must be signed by an authorized agent of the manufacturer.
- D. Progress Schedules shall be submitted in accordance with the General Conditions and Section 01310.
- E. Schedule of Shop Drawings and Sample Submittals shall be submitted in accordance with the General Conditions.
- F. Schedule of Values shall be submitted in accordance with the General Conditions.
- G. Copy of programming for all PLC's and computers on the project.

## **2.04 OPERATION AND MAINTENANCE INFORMATION**

- A. Operation and maintenance manuals shall be submitted as information for the record.

- B. Operation and maintenance manuals shall be submitted as electronic documents prior to the printing of the record copy.
  - 1. Contractor shall provide one electronic copy of the manuals for preliminary review.
  - 2. The final accepted manuals shall be provided as one electronic copy of the manual and one printed copy as specified below.
- C. Electronic manuals shall be in Portable Document Format
- D. This information will be reviewed only if properly identified with Specification Section numbers and only after revised, where necessary, to conform to the Engineer's notes on previous submittals that have been marked "Make Corrections Noted." Manuals shall be tailored to suit the specific equipment provided.
- E. Submittals shall include but not limited to the following:
  - 1. Descriptive literature, bulletins, or other data covering equipment or system.
  - 2. Complete list of equipment and appurtenances included with system, complete with manufacturer serial number and model number.
  - 3. Utility requirements.
  - 4. General arrangement drawing.
  - 5. Sectional assembly.
  - 6. Dimension print.
  - 7. Materials of construction.
  - 8. Certified performance curve.
  - 9. Parts list with assembly drawings.
  - 10. Recommended spare parts list with part and catalog number.
  - 11. Lubrication recommendations and instructions.
  - 12. Schematic wiring diagrams.
  - 13. Schematic piping diagrams.
  - 14. Description of associated instrumentation.
  - 15. Drive dimensions and data.
  - 16. Operating instructions.
  - 17. Maintenance instructions including trouble-shooting guidelines, lubrication, and preventive maintenance instructions with task schedule.
  - 18. Special tools and equipment required for operation and maintenance.
  - 19. Description of equipment controls.
  - 20. Pump seal data.
  - 21. Assembly, installation, alignment, adjustment, and checking instructions.

- 22. Confirmation of all corrections noted on Shop Drawings marked "Make Corrections Noted."
  - 23. Manufacturer's name, address, and telephone number along with manufacturers job number and Purchase Order number.
  - 24. Manufacturer's local sales representative, address, telephone number.
  - 25. All installation instructions that were provided to Contractor for use to install equipment.
- F. All manuals shall be tailored to the project by high-lighting appropriate information and deleting or crossing out nonapplicable information or the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual equipment furnished. All options furnished shall be indicated.
- G. Manuals shall be provided electronically. All manuals shall have a title label on the cover stating the specification item number and item name. A table of contents shall be included in all manuals.
- H. Equipment installations shall not be considered substantially complete until all associated operation and maintenance manual submittals are accepted by the Engineer.
- I. Field modifications to equipment during installation shall be included in the manual so that the manual reflects as-built conditions. Revisions to the manual may be submitted for incorporation into the manual where appropriate. However, the Engineer reserves the right to return all six manuals for revision to reflect as-built conditions.

### **PART 3 EXECUTION**

#### **3.01 IDENTIFICATION OF SUBMITTALS**

- A. All submittals shall have a Submittal Identification & Approval cover sheet attached. A sample of the submittal cover sheet is attached for reference. The form will be provided by Engineer and coordinated with Contractor.
- B. All submittals shall be given a consecutive number when they are entered into the Electronic Project Management System (EPMS), See Section 01320.
- C. Resubmittals shall be entered into EPMS as resubmittals.
- D. Submittals to satisfy the operation and maintenance information requirements shall be entered into the EPMS as a submittal. The description shall have the prefix "OM".

#### **3.02 PRINTING AND DISTRIBUTION**

- A. No printed documents are required.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



## Submittal Identification & Approval

Date:	Spec Section
Submittal No.	Drawing Sheet No.
Description:	
Manufacturer(s)	
Contractor Comments/Deviations/Measurements	

Contractor	Engineer
<div>Contractor Name</div> <div><input type="checkbox"/> Approved <input type="checkbox"/> Forwarded <input type="checkbox"/> Checked</div> <div>By: _____ Date: _____</div>	<div>SHOP DRAWING REVIEW SUBJECT TO CONTRACT REQUIREMENTS Jones &amp; Henry Engineers, Ltd.</div> <div><input type="checkbox"/> Approved <input type="checkbox"/> Approved—Make Corrections Noted <input type="checkbox"/> Amend &amp; Resubmit <input type="checkbox"/> Rejected—See Remarks <input type="checkbox"/> Distribute for Information</div> <div>REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS</div> <div>Approval in no way relieves the Contractor of any responsibility for capacities, performance, functions, compliance with Federal, State, and Local Codes; accuracy of dimensions and details; or continuity and completeness of the Project nor does approval constitute or imply any increase in Contract Price.</div> <div>By: _____</div>

Review Comments





**SECTION 01310**  
**CONSTRUCTION SCHEDULES AND DOCUMENTATION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the requirements for construction schedules and construction sequences.
- B. This Section includes the requirements for the tracking and documentation of the progress and activities driving the completion of the Work as specified, shown on the Drawings and as directed.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. Preliminary Construction Schedule.
    - b. Contractor's Construction Schedule and monthly updates.
    - c. Submittals Schedule.
- B. Contractor shall submit construction schedule on the EPMS.

**1.03 QUALITY ASSURANCE**

- A. Scheduling conference shall be held prior to the commencement of the construction to discuss the following including, but not limited to:
  - 1. Construction sequencing.
  - 2. Contractor's coordination of subcontractors.
  - 3. Coordination with the Owner's operations.
  - 4. Coordination with other Contractor's or other Work.
  - 5. Project milestones.
  - 6. Owner's partial utilization.

**PART 2 PRODUCTS**

**2.01 PRELIMINARY CONSTRUCTION SCHEDULE**

- A. Preliminary construction schedule shall be completed in accordance with the General Conditions and prior to the scheduling conference.
- B. The preliminary schedule shall outline the Contractor's sequencing of tasks, activities, milestones, and all critical path items within the contract time.

## **2.02 CONSTRUCTION SCHEDULE**

- A. The Contractor's submission of the construction schedule will not change the contract completion date, whether reviewed by the Owner and Engineer or not. The Contractor shall incorporate all approved change orders that have resulted in a contract time extension.
- B. The Contractor shall require all subcontractors engaged in the Work to submit to the Contractor construction schedules, as specified herein, for incorporation into the Contractor's construction schedule.
- C. The construction schedule shall include, but not limited to, the following dates:
  - 1. Notice to Proceed.
  - 2. Substantial Completion and Final Completion.
  - 3. Commencement of on-site operations.
  - 4. Milestones as specified, shown on the Drawings, and as directed.
  - 5. Ordering, submittals, fabrication, delivery, startup, and training time of major equipment items.
  - 6. Submittal schedule per the General Conditions.
- D. The Contractor shall incorporate into the construction schedule all constraints and work restrictions specified or otherwise required by the Contractor's operations, including, but not limited to, the following:
  - 1. Construction sequencing.
  - 2. Contractor's coordination of subcontractors.
  - 3. Coordination with the Owner's operations.
  - 4. Coordination with other Contractor's or other work.
  - 5. Project milestones.
  - 6. Owner's partial utilization.

## **2.03 UPDATING CONSTRUCTION SCHEDULE**

- A. The Contractor shall keep the construction schedule current to the progress of the Work continually through closeout of the project. The construction schedule shall be submitted monthly for the Engineer's review.

## **2.04 WEEKLY CONSTRUCTION SCHEDULE**

- A. The Contractor shall submit a schedule of his work for each week. This schedule shall identify the foreman of each work crew and the location and type of work the crew will be doing each day. It shall be delivered no later than 4:00 p.m. of the next to last regular workday of the preceding week to the Resident Project Representative's office.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. All phases of the Work requiring interference with normal operations of the existing facilities shall be scheduled in accordance with agreements among the Contractor, Owner, and Engineer. The Contractor shall notify the Owner at least one week before such Work is to begin.

### **PART 4 SPECIAL PROVISIONS**

#### **4.01 SCHEDULED NON-WORK DAYS**

- A. The Contractor shall restrict Work to days when the Owner's offices are open and consider the following list of holidays as mandatory non-work days, all of which shall be incorporated into the construction schedule:
  - 1. New Year's Day.
  - 2. Memorial Day.
  - 3. Fourth of July.
  - 4. Labor Day.
  - 5. Thanksgiving Day.
  - 6. Christmas Day.

END OF SECTION



**SECTION 01320**  
**ELECTRONIC PROJECT MANAGEMENT SYSTEM (EPMS)**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This section describes the requirements for the Electronic Project Management System (EPMS) which will be required on this project. Engineer will implement an internet/web site based Electronic Project Management System (EPMS) for the administration of the Contract on this project. Owner, Contractors and Engineer shall be responsible to interface with EPMS and collaborating via the EPMS on this project. The EPMS is intended to supplement the Contract Documents and the provisions of the Contract Documents shall not be superseded by the EPMS.
  - 1. The EPMS is intended to provide a mode of communication which is electronic and to reduce the reliance upon printed documents. Printed documents transmitted will not be reviewed, and electronic documents emailed outside of the EPMS will not be reviewed. The Owner, Contractor and Engineer will collaborate on unique situations or circumstances in order to preserve the project electronic records.
- C. The Owner, Contractor and Engineer shall be required to provide project related information/documents via EPMS. In general, the EPMS will receive information via uploaded documents as PDF documents, in their native format (when permitted or required), or other electronic formats designated or required for functionality. The EPMS shall be a central repository for information to all project team members. The EPMS will provide viewing, printing, up/downloading of various information/documents.
- D. In general, the following is a partial list of information/documents which shall be tracked through the EPMS:
  - 1. Drawings, Specifications and Addendums (included revisions as necessary).
  - 2. Insurance.
  - 3. General Project Communication, Emails, Memorandums, Correspondence and Collaboration or any other document any participant wishes to make part of the project records.
  - 4. Request for Information (RFI).
  - 5. Submittals (Shop Drawings, Operation and maintenance manuals, color selections etc.)
  - 6. Work Change Directives, Change Request and Change Orders.
  - 7. Schedule of Values, Pay Requests and Certified Payroll Reports.
  - 8. Schedules (project, weekly and monthly).
  - 9. Meeting Minutes.

- 10. Permits and Special Inspections Reports.
- 11. Laboratory Services (testing and reporting).
- 12. Closeout procedures (deficiency list, warranty, substantial completion).
- E. In an effort to protect proprietary information and prohibit unauthorized use or modifications, levels of access security will be assigned in order to provide safe and secure access to information with respects to involvement and responsibility on the project. The Owner, Contractor and Engineer shall establish these levels of access and rights which are appropriate for this project.
- F. Owner, Contractor and Engineer shall utilize the mark-up tool integral within the EMPS or have a PDF review software that includes the ability to mark up and apply electronic stamps (such as Adobe Acrobat, or Bluebeam PDF Revu).
- G. A high-speed internet connection is required.
- H. The EPMS will provide notifications regarding new or updated documents through an existing Email account outside of the EPMS.

## **PART 2 PRODUCTS**

Not used.

## **PART 3 EXECUTION**

### **3.01 CONTRACT REQUIREMENTS**

- A. All provisions of the Contract Documents are in full effect and enforcement. The submittal procedures specified in the Contract Documents are applicable with the understanding that they will be electronic documents and submitted via the EPMS.

### **3.02 TRAINING**

- A. One training session by the Engineer and Eastern Engineering, Inc. will be provided to the team members at the beginning of the EPMS implementation. Training will be coordinated with the Preconstruction meeting and held at the same location. There are many tutorials, help features and technical support options located on the Eastern Engineering web site.
- B. Engineer will provide project related support as needed within their ability to provide it. Technical support will be available to all project team members from Eastern Engineering, Inc.

### **3.03 OPERATION**

- A. Contractor and all Subcontractors shall maintain a Windows-based computer system including high speed internet access and ability to create/mark-up documents using Adobe Acrobat (pdf) and to scan documents.

- B. Engineer will facilitate the implementation and overall operation of the EPMS with Eastern Engineering. Eastern Engineering will provide and maintain the EPMS server and will back up the information.

**3.04 ARCHIVE PROJECT CLOSE OUT**

- A. All files on the EPMS web site will be archived at the end of the project. These archives will be made available to the Owner, Contractors and Engineer for download over the internet, at the end of the warranty period.

**3.05 ELECTRONIC SUBMITTAL FILE NAMING CONVENTION**

- A. The Contractor shall utilize the following file name convention for PDF files submitted through eComm:
  - 1. Spec Section - Number of Submittal from Section - Number of Times Submitted.
    - a. Example: 02552-01-03.
  - 2. The example represents the first submittal from Specification Section 02552 and the third time this Submittal has been submitted.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION





**SECTION 01350  
COMMON PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes general requirements for all materials, equipment and systems furnished or installed under this project.
- B. Additional specific requirements included under a particular Section shall take precedence.
- C. This Section includes, but is not limited to, the following procedural and administrative requirements:
  - 1. Product Delivery Storage and Handling.
  - 2. Warranties.
  - 3. Quality Assurance and Control.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and related specification sections.
- B. The specification sections and Drawings contain the specific submittal requirements.

**1.03 QUALITY ASSURANCE**

- A. Where Contractor is required to provide design services or certification of the design, the specified product, equipment or system shall comply with the specified criteria.
  - 1. Contractor shall submit a written request for clarification when specified criteria is incomplete or insufficient.
- B. Manufacturer's name, make, model number and other designations provided in the contract documents are to establish the significant characteristics, including but not limited to, type, function, dimensions and physical properties, performance, and appearance for the purpose of evaluating comparable products. Contractor shall verify product, equipment or system proposed meets or exceeds the requirements as specified or shown on the Drawings.

**1.04 PROJECT HANDLING**

- A. Schedule delivery to minimize the time goods are kept in storage.
- B. Deliver goods to Site in manufacturer's original packaging.
- C. Inspect the goods to determine if there is visible damage to the packaging.
  - 1. The packaging shall be removed in a manner that will allow resealing for storage.

2. If packaging cannot be removed and reused, the goods shall be repackaged per the manufacturer's recommendations.
- D. Goods that are susceptible to damage by the environmental or project conditions, including but not limited to, switchgear, motor control centers, panelboards, instrument control panels, fixtures shall be stored in a controlled environment per the manufacturer's recommendations. If no such area is available at the time such equipment is received, such space shall be provided by the Contractor at no expense to the Owner.
- E. Where construction is in roads or streets, that portion of the right-of-way not required for public travel may be used for temporary storage purposes unless otherwise prohibited. Materials shall not be stored in areas where such storage creates a hazard. Any other additional space required for construction or storage of materials and equipment shall be obtained by the Contractor at his expense.
- F. The Contractor shall confine his equipment, the storage of materials and equipment, and the operations of his workers to areas permitted by law, ordinances, permits, and the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.

#### **1.05 GUARANTEE**

- A. Manufacturer's warranty, extending beyond one-year after substantial completion for the specified product, equipment or system shall be provided to the Owner and endorsed by the manufacturer.
- B. Requirements for warranties extending beyond one-year after substantial completion are described in individual Sections of these specifications.
- C. Manufacturer's limitations and disclaimers shall not relieve the Contractor from warranty obligations under the Contract Documents.

### **PART 2 PRODUCTS**

#### **2.01 SHOP PAINTING**

- A. Non-galvanized ferrous surface shall be painted.
- B. Shop painting of ferrous surfaces shall be as follows:
  1. Surfaces shall be thoroughly cleaned of dirt, grease, oil, rust, scale, or other foreign substances. All metal surfaces shall, as a minimum, be abrasive blasted in accordance with SSPC-SP6, Commercial Blast Cleaning.
  2. Surfaces shall receive a shop coat of a primer compatible with the finish coating to be used by the Contractor.

#### **2.02 GALVANIZING**

- A. Where galvanized metal is indicated, unless otherwise specified, galvanizing shall conform to ASTM A123 (Hot Dip Galvanized). Threaded parts and hardware shall be galvanized in conformance with ASTM A153.

**2.03 REGULATORY REQUIREMENTS**

- A. Materials, equipment, coatings, and chemicals in contact with potable water or water being treated for potable water use shall comply with the applicable NSF Standards.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Products shall be installed in accordance with the manufacturer's instructions and Contract Documents.
- B. Required appurtenances including but not limited to, anchors, grout, and leveling shims, shall be provided.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 01410  
LABORATORY SERVICES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The Contractor shall retain an independent laboratory.
- B. Testing, inspection(s) and quality control are required to certify compliance with the Contract Documents.
  - 1. The laboratory services do not relieve the Contractor from the responsibility of compliance with the Contract Documents
  - 2. Any test required by the Owner shall not relieve the Contractor from the responsibility of compliance with the Contract Documents.
  - 3. Any test required by the Owner shall not relieve the Contractor from the responsibility of supplying certificates from manufacturers or suppliers to demonstrate compliance with the Specifications.
- C. Specific testing, inspection(s) and quality control requirements are specified in the individual Sections of the specifications.
- D. Specific testing, inspection(s) and quality control requirements of any Federal, State or Local authorities are specified in the related sections of Work.
- E. Testing of materials or equipment for compliance with various national or technical society standards and ordinarily performed by manufacturers, and shop and field tests of equipment are not included under this Section but shall be performed by the Contractor or his supplier as specified elsewhere.
- F. Contractor may conduct material or field test(s), inspection(s) and quality control as they deem necessary.
  - 1. Should the Contractor, at any time, desire the Owner to consider the results of such testing, inspection(s), and quality control, such results shall be certified by an independent testing laboratory acceptable to the Owner. Any testing of this nature shall be conducted at the Contractor's expense.

**1.02 SUBMITTALS**

- A. Submittals of all required field and laboratory test results shall be made by the independent laboratory as soon as they are available to the Owner and Engineer directly.
  - 1. Statement of Compliance per 1.03

### 1.03 QUALITY ASSURANCE

1. The laboratory shall be a recognized and independent commercial laboratory with experience in conducting the required tests.
2. Laboratory shall certify compliance with ASTM E548, ASTM E329, and ASTM C1093 when masonry construction is part of the project scope. In lieu of ASTM certification, the laboratory may submit written documentation demonstrating experience and training relevant to the inspections to be performed. The documentation shall demonstrate experience with projects of similar complexity and quantity of inspections as the project herein.
3. Testing, inspection(s) and quality control shall be certified by a professional engineer specialized in the related field and in the state where the Site is located.

## PART 2 PRODUCTS

### 2.01 TESTS

- A. Aggregates, Bedding Material, and Special Backfill - For each type of material, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine compliance with the contract documents.
  1. Retests shall be performed until the Specifications are met.
  2. Retest shall be performed each time the source of material is changed.
- B. Selected Backfill - At the discretion of the Engineer, but in no case, more than one test for each 1,000 cubic yards or portion thereof, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine whether the material is suitable for backfilling purposes.
- C. Mix Designs:
  1. For each type of controlled density fill, concrete, and asphalt, the laboratory shall review, perform test(s).
  2. Review, perform test(s) and approve change in source of materials.
  3. The asphalt design shall be made in accordance with ASTM D1559, the Marshall Method of Mix Design and as specified.
  4. Approved mix designs shall include sieve analyses and suppliers' certificates for materials incorporated in the mix.
- D. Compaction Tests:
  1. For each type of backfill material, the laboratory shall determine the moisture-density curve according to ASTM D698.
  2. Using ASTM D2922 test methods, the laboratory shall determine the density of placed backfill.

- 3. Retests shall be performed if the compaction requirements stated in the individual Sections are not met.
- 4. The Engineer may at his discretion require the sand cone (ASTM D1556) or the balloon (ASTM D2167) tests for density and compaction to verify questionable results of the ASTM D2922 tests.
- E. The independent testing laboratory shall test and report the soil bearing capacity under all foundations and slabs on grade. The testing shall be conducted at regular intervals in all directions. The independent testing laboratory shall immediately notify both the Contractor and Engineer of any such test not meeting the presumed soil bearing capacity contained in the Structural Design Data on the Drawings.
- F. Asphalt and Concrete Quality Control Testing - Perform tests as indicated in Sections 02600 and 03300.
- G. Miscellaneous Tests - Perform all other tests requested in the individual Sections of the Specifications.

## **2.02 RESERVED**

## **2.03 EQUIPMENT**

- A. Provide all necessary equipment to extract and store samples and perform the required tests.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. The Contractor shall provide the source of all materials requiring testing and shall arrange access for the independent laboratory to obtain representative samples and perform required tests at the material source. The information shall be supplied in advance to allow time for testing and reporting. Concrete information shall be supplied at least 45 days prior to the first concrete placement.
- B. Contractor shall coordinate activities to accommodate the required quality assurance/control.
  - 1. Contractor shall not compromise the requirement for quality assurance /control in order to maintain the schedule.
- C. The laboratory shall conduct tests on materials and in locations as directed by the Resident Project Representative.
- D. All tests shall be performed in accordance with the proper test methods mentioned above and in the individual Sections. Results shall be compared to the required values included in the individual Sections.

**3.02 PREPARATION**

- A. Contractor shall prepare all Work to be tested in accordance with the testing procedures as directed and required by independent laboratory, regulatory agency, or Owner and Owner's representative.

**3.03 PROTECTION**

- A. Contractor shall at the completion of testing, repair damage to construction in accordance with these specifications.
- B. Contractor shall be responsible for the protection regardless of the responsibility for quality assurance/control.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 01500  
MAINTAINING TRAFFIC**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing of all labor, materials, equipment and services necessary for maintaining and protecting vehicular and pedestrian traffic.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. The Contractor shall submit the name, address, and telephone number of a local individual who will be responsible for maintaining traffic facilities when the Contractor is not working.
    - b. Traffic control or maintenance plans with governing authority(s) approval.
    - c. Detour routes with governing authority(s) approval.
    - d. Delivery and haul routes for contractor's activities outside the zone of influence.

**1.03 QUALITY ASSURANCE**

- A. The installation, maintenance, and operation of all traffic controls and traffic control devices shall conform to the requirements of the State Department of Transportation Manual of Uniform Traffic Control Devices for Streets and Highways, hereinafter called the MUTCD.
- B. If, in the opinion of the authority having jurisdiction over traffic in the affected thoroughfares, proper maintenance of traffic facilities and proper provisions for traffic control are not being provided by the Contractor, they may take the necessary steps to place them in proper condition, and the cost of such services will be deducted from any money which may be due or become due the Contractor.
- C. A traffic control conference, attended by Owner, Engineer, Contractor and governing authority, shall be held no later than 14 days prior to any traffic maintenance, placement of traffic control devices, lane closures, detouring of traffic or other activity that impedes the normal traffic flow.

## **PART 2 PRODUCTS**

### **2.01 TRAFFIC CONTROL DEVICES**

- A. Traffic control devices shall be provided with suitable supports of sufficient strength and stability.
- B. Faces of orange construction signs, barricades, vertical panels and drum bands shall be suitably reflectorized with sheeting.
- C. Traffic cones shall be a highly visible orange color.
- D. Pavement markings for traffic maintenance shall conform to the requirements of ODOT, the local authority and the MUTCD.

### **2.02 TEMPORARY TRAFFIC SIGNALS**

- A. The Contractor shall furnish, erect, maintain, and subsequently remove signal and signal controller equipment of a proper type and capacity to provide the required operation, and shall meet the general requirements of ODOT and the MUTCD.
  - 1. Any malfunctions or failures shall be corrected without delay. Temporary traffic signals not in use shall be covered or removed.
- B. The Contractor shall be responsible for the procurement of and payment for electric power for temporary traffic signals.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. The Contractor shall provide and maintain in safe condition such temporary facilities for vehicular and pedestrian traffic as may be necessary to provide safe vehicular and pedestrian ingress and egress for all property adjacent to the improvements. Such access shall be provided at all times unless workers or machinery are in the immediate area. Access shall be provided to all properties at the end of the Work day.
- B. When the street or highway under construction is being used by vehicular traffic including periods of suspension of the Work, the Contractor shall maintain that portion of the street or highway being used to ensure that it is smooth, free from holes, ruts, ridges, bumps, and dust.
- C. The Owner will enter upon that portion of a project, where the Contractor is responsible for maintaining through traffic on part or the entire project, to place abrasives at its own expense, as may be considered advisable.
  - 1. The Contractor shall be responsible for the removal of abrasives placed, for which no claim for additional compensation shall be allowed nor shall the Contractor be relieved in any way of his obligation for maintenance of traffic.
- D. The Owner will provide for the necessary maintenance of public streets or highways which are used as detour beyond the Work limits of the contract.

### 3.02 TRAFFIC CONTROL

- A. Barricades, vertical panels, and cones shall be protected by adequate advance warning construction signs.
- B. Equipment and material stored on the highway shall be marked at all times. At night, any such material or equipment stored within rights-of-way and easement(s) shall be clearly outlined with dependable lighted devices.
- C. Contractor shall provide any other lights, barricades, etc., that may be needed for the protection of pedestrian traffic in all areas where materials are stored.
- D. Road Closed - When a highway is permitted to be closed to traffic, the Contractor shall provide, erect, maintain, and subsequently remove approved traffic control devices, barricades, and suitable and sufficient red or yellow lights.

### 3.03 TRAFFIC MAINTAINED

- A. Where the street or highway under construction is being used by vehicular traffic, including periods of suspension of the Work, the Contractor shall furnish and maintain pavement markings, lights, warning signs, road construction traffic-maintained signs, and end construction signs, barricades, temporary guardrail, and such other traffic control devices, and flaggers as may be necessary to maintain safe traffic conditions within the Work limits.
- B. Existing signs and traffic control devices within the Work limits shall remain in use during the construction period. If the Contractor needs to relocate or modify permanent signs and other traffic control devices as a consequence of his work, he shall provide suitable supports and may modify the devices with prior approval of the Engineer and the concurrence of the maintaining agency. Routine maintenance of permanent traffic control devices will remain the responsibility of the maintaining agency.
- C. The function of existing Stop or Yield signs shall be retained at all times although their position may be adjusted. Existing signs that must be relocated laterally shall be placed in accordance with the MUTCD.
- D. When an existing signal operation must be interrupted for a period, the Contractor shall provide a temporary traffic control method.
- E. The Contractor shall obtain the approval of the Owner and Engineer before closing a traffic lane or establishing a one-way traffic operation.
- F. Flaggers:
  - 1. Whenever one-way traffic is established, at least two flaggers shall be used and signs, cones, barricades, and other traffic control devices shall be erected by the Contractor in accordance with the MUTCD. The Contractor shall maintain positive and quick means of communication between the flaggers at the opposite ends of the restricted area.
  - 2. Flaggers shall be equipped according to the standards for flagging traffic contained in the MUTCD. At night, flaggers' stations shall be adequately illuminated.

3. The Contractor may, in lieu of flaggers, or supplementing them, furnish, install, and operate a temporary traffic signal or signals, for the purpose of regulating traffic.

### **3.04 SNOW AND ICE REMOVAL**

- A. The state and local authority responsible for snow and ice removal will be responsible for removals during the construction provided the following:
  1. The project area is open to public access.
  2. In the opinion of the state and local authority the project area is accessible with their equipment.
  3. In the opinion of the state and local authority the street surface will not cause damage to their equipment or their equipment will not cause damage to the street.
- B. The Contractor shall be responsible for snow and ice removal during construction when:
  1. The project area is closed to public access.
  2. When Limited access is provided for local traffic but area is closed to through traffic.
  3. The project area pavement has removed or damaged to the extent that the state and local authority's equipment will no longer effectively remove snow and ice or will cause damage to project area.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 RESTORATION OF PAVEMENT SURFACES OUTSIDE THE ZONE OF INFLUENCE**

- A. Contractor shall restore all damaged pavement surfaces in streets used by the Contractor for moving materials and equipment to and from the construction area and streets used for bypassing or detouring traffic around the construction area.
- B. Materials used in replacing damaged areas of the road shall be as specified in Section 02600 of these Specifications.
- C. The pavement shall be restored with pavement of the same type and thickness as the existing pavement, in accordance with Section 02600 of these Specifications.

### **4.02 ROAD CLOSURES & DETOURS**

- A. The following stipulations are proved relative to the proposed work planned in the roadway as part of the project.
  1. Ford Road – Both lanes will be closed east of the intersection of Ford Road and White Road and west of the intersection of Ford Road and Simmons Road. Westbound thru traffic will be rerouted to Simmons Road to State Route 795 to White Road. Eastbound thru traffic will be rerouted to White Road to State

Route 795 to Simmons Road. The duration of the detour is not to exceed 30 days.

- B. The Contractor shall be responsible for obtaining the necessary approvals and permits from the City of Perrysburg, Perrysburg Township and ODOT relative to road closures and detour routes required for the Work.
- C. The Contractor shall be responsible for submitting the necessary detour notification application to ODOT District 2 no less than 14 days prior to the start of work. The detour application is attached at the end of this section.
- D. The detour route will be signed and maintained by the Contractor including all signage as required by the Ohio MUTCD and as shown on the attached page titled Figure 6H-8 Road Closure with Off-Site Detour.
- E. The Contractor will be responsible for erecting and maintaining point of closure signage as shown on the attached sheet, MT-101.60.

#### **4.03 DRIVEWAY ACCESS**

- A. The Contractor shall maintain driveway access for residences located on the south side of Ford Road within the limits of the project.
- B. The Contractor will be permitted to close driveways during roadway planing and resurfacing.
- C. The Contractor will be required to notify residents ahead of closures of their driveways.

END OF SECTION



### **Notes for Figure 6H-8—Typical Application 8**

#### **Road Closure with Off-Site Detour**

**Guidance:**

1. Regulatory traffic control devices should be modified as needed for the duration of the detour.
2. If the road is opened for some distance beyond the intersection and/or there are significant origin/destination points beyond the intersection, the ROAD CLOSED and DETOUR signs on Type III Barricades should be located at the edge of the traveled way.

**Option:**

3. If the road is closed a short distance beyond the intersection and there are few origin/destination points beyond (for example, a few residences), the Type III Barricade shown in the figure may be moved to the center of the traveled lanes.

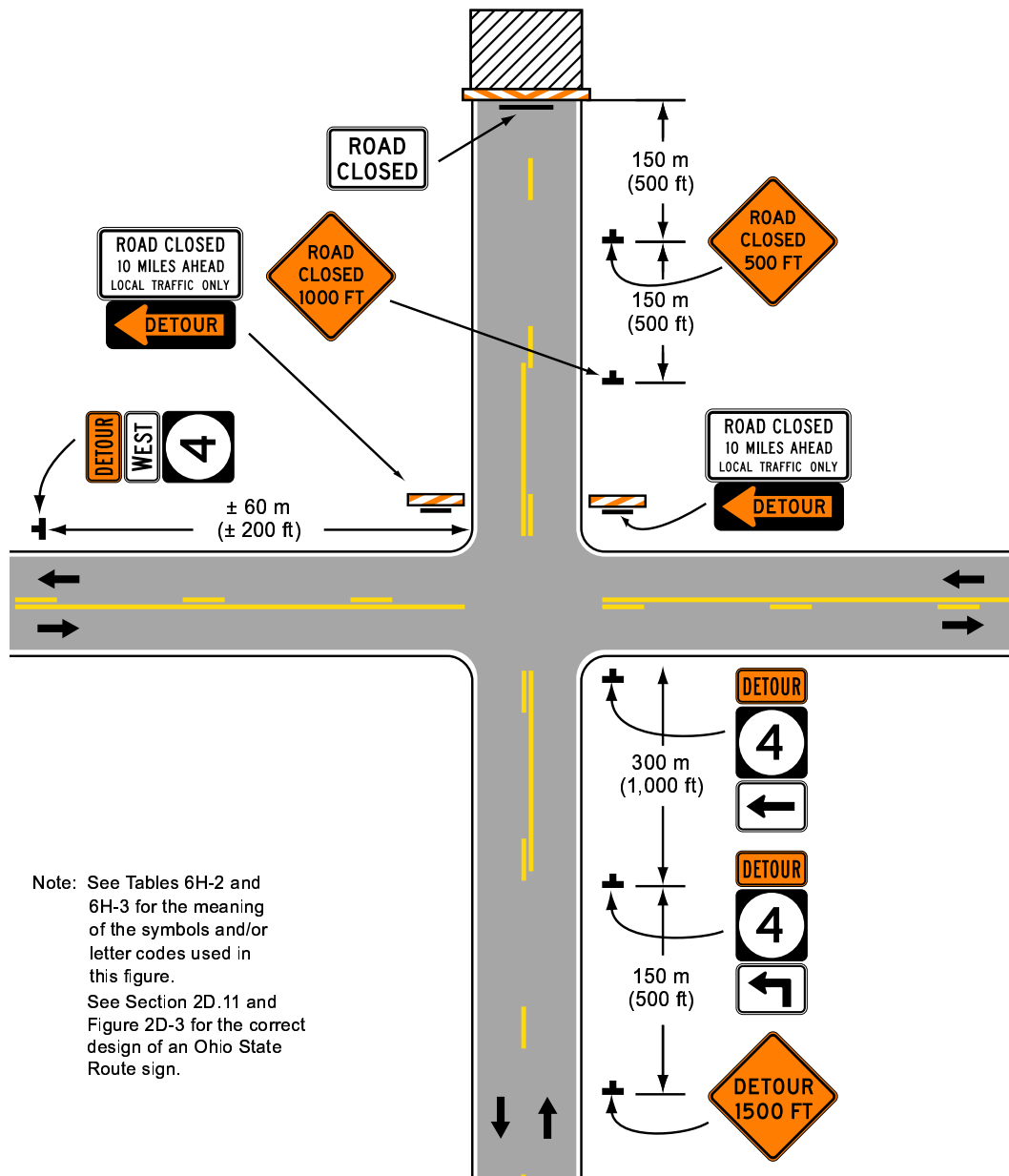
**Standard:**

4. **If the barricades are located as in Item 3 above, the ROAD CLOSED and DETOUR signs shall be placed only on the barricade centered in the lane of travel of traffic approaching the closure. The barricade centered in the lane of travel of departing traffic shall not be signed. The barricades in adjacent lanes shall be offset longitudinally from each other an adequate distance in order to permit traffic to travel around the barricades (the barricade in the road user's lane located in advance of the barricade located left of the center line).**

**Option:**

5. A Route Sign Directional assembly may be placed on the far left corner of the intersection to augment or replace the one shown on the near right corner.
6. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
7. Cardinal direction plaques may be used with route signs.

**Figure 6H-8. Road Closure with Off-Site Detour (TA-8)**



Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.  
See Section 2D.11 and Figure 2D-3 for the correct design of an Ohio State Route sign.

**Typical Application 8**



NOTES:

BARRICADE USE

- 1A. Barricades shall be NCHRP 350 compliant and shall be erected according to details shown. When the road is closed to traffic, barricades shall be used to effectively close the entire roadway, including the paved or aggregate shoulder.
- 1B. Barricades along adjacent lanes may be offset from each other as shown, with drums used to close the resulting gap. Maximum drum spacing shall be 5'.

BARRICADE REFLECTORIZATION AND COLOR

- 2A. In construction or maintenance areas, all rails of the barricades shall be reflectorized with orange and white reflectorized Type G sheeting in 6" wide alternate stripes which slope downward toward the center line of the road at an angle of 45 degrees. All three rails of the barricade shall be striped on both sides. Legs and feet shall be either all white or may display the natural color of the material used.
- 2B. Barricades used in permanent or semi-permanent application shall differ only in that they shall use red and white stripes.

SIGNS

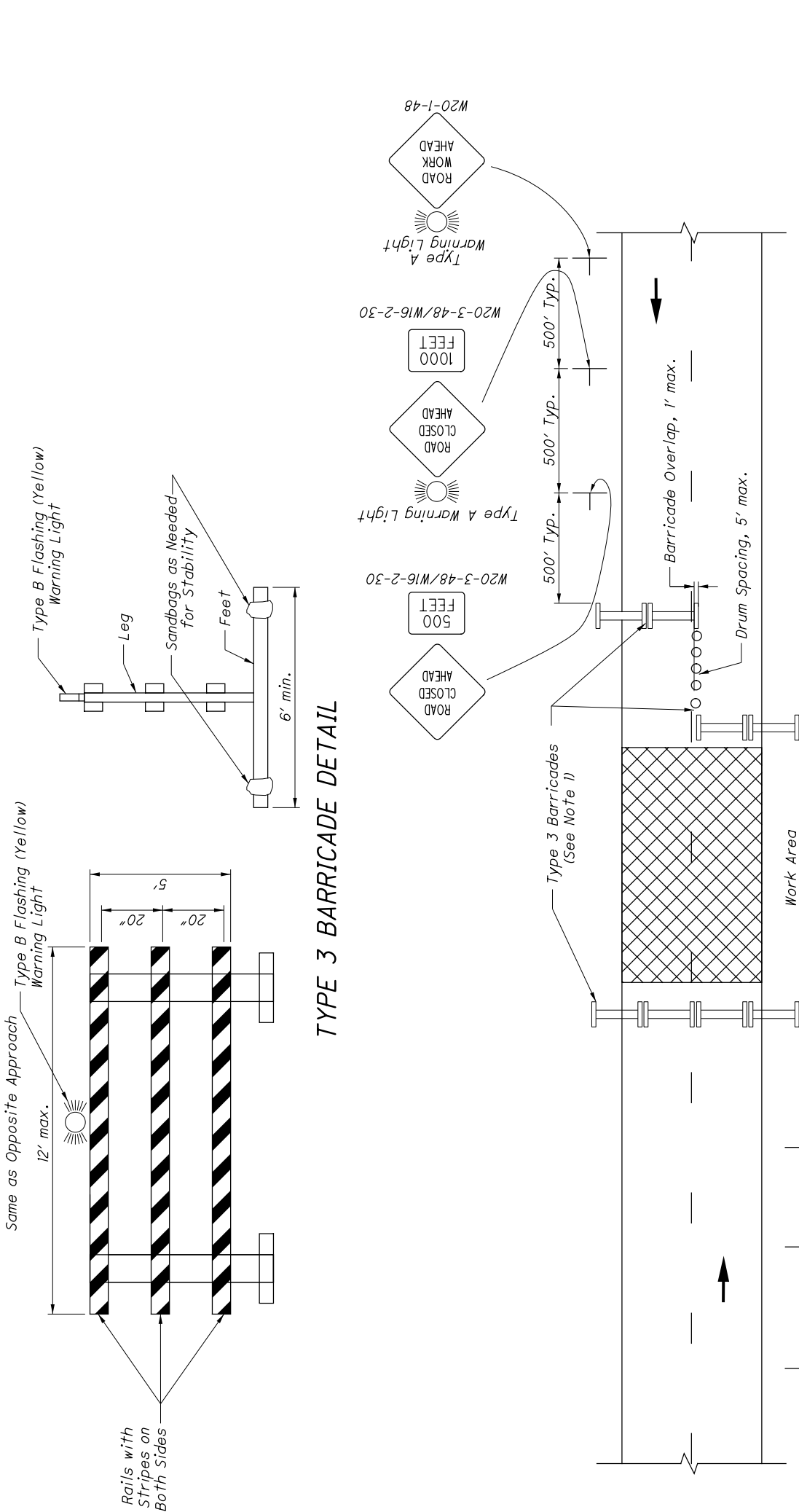
- 3A. Where the road is closed to traffic by the erection of barricades, ROAD CLOSED (R11-2) signs shall be mounted laterally as shown.
- 3B. The advance warning signs shown on this drawing are intended for use when the traveled way is brought to an end with no direction given to traffic. Where traffic has been directed from the permanent roadway at or just in advance of the barricades, advance signing should be provided as shown in Standard Construction Drawing MT-95.70 or Ohio Manual of Uniform Traffic Control Devices Figure 6H-7 as appropriate.
- 3C. Advance warning signs approaching a lane closure, as shown on these plans, shall consist of Two ROAD CLOSED AHEAD (W20-3) signs with distance plaques placed about 500' and 1000' from the closure, and a ROAD WORK AHEAD (W20-1) sign placed about 1500' from the closure. The signs shall be placed on both sides of the roadway for multi-lane divided highways or when required by the plans.

FLASHING WARNING LIGHTS

- 4A. Type A flashing warning lights are required on the ROAD WORK AHEAD (W20-1) sign and on the first ROAD CLOSED AHEAD (W20-3) sign.
- 4B. Type B flashing warning lights shall be provided on Type 3 Barricades, one light per each closed lane. Each light shall be conspicuously visible at all distances up to 1000' under normal atmospheric conditions. The light shall be in operation at all times during the period the highway is closed.

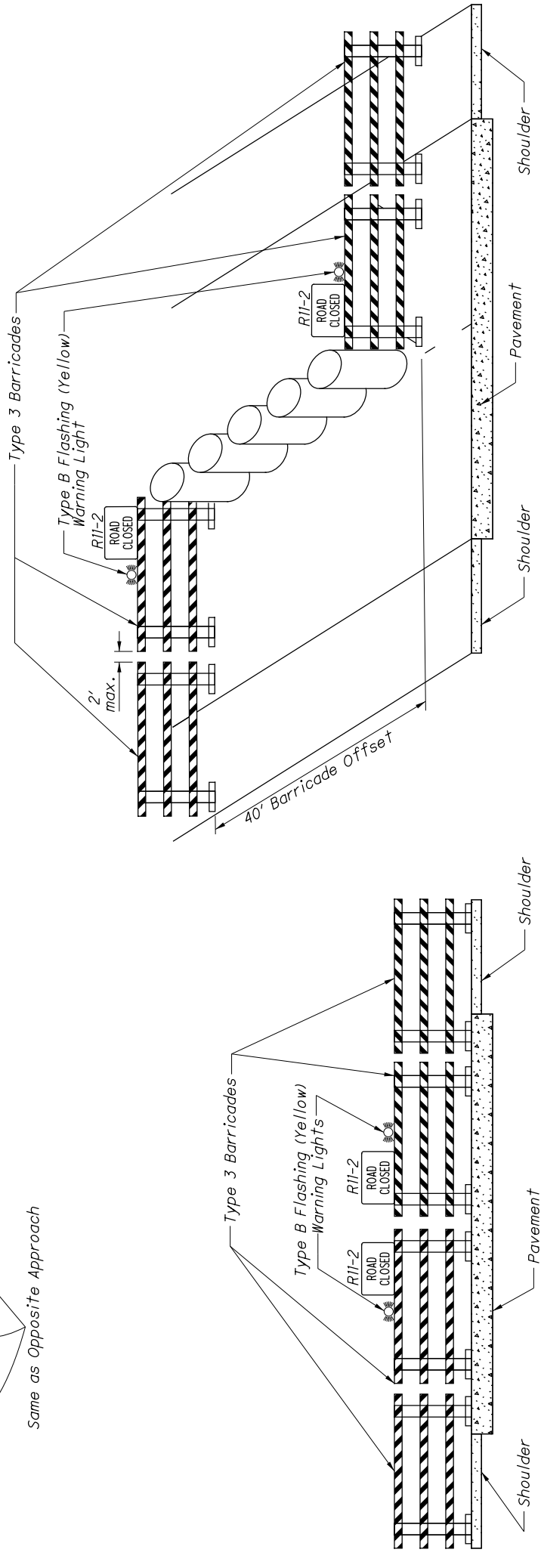
OPERATION ON 2-LANE, 2-WAY ROADWAYS

- 5A. Where the barricade runs across the entire roadway without longitudinally offsetting sections, the Contractor will normally open only the left side of the barricade as necessary to allow the construction vehicle to enter, and then shall immediately close it. The entire barricade will not normally be opened at the same time. The Contractor shall assign an employee to assure that the barricade is closed at the end of each workday.
- 5B. Where the sections of the barricade are offset from each other with drums provided to close the gap (see note 1B), the Contractor may move the drums as necessary to allow the construction vehicle to enter, and then shall immediately replace the drums. The Contractor shall assign an employee to assure that the drums are in place at the end of each workday.



TYPE 3 BARRICADE DETAIL

ADVANCE WARNING SIGNS FOR CLOSURE



BARRICADE CLOSURE PROFILE

BARRICADE CLOSURE OFFSET OPTION



**SECTION 01565  
TEMPORARY RESTORATION AND MAINTENANCE  
OF PAVEMENTS, CURBS AND WALKWAYS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes temporary restoration and maintenance of pavements, curbs, and walkways.
- B. Restoration:
  - 1. The Contractor shall promptly restore as herein specified all curbs, walks, driveways, and roadways affected by the Work done under this Contract as soon as any sufficient portion thereof has been completed. Such temporary restoration shall be maintained in satisfactory condition until permanent restoration work replaces the temporary Work.
- C. Maintenance:
  - 1. All temporary pavement, sidewalks, and other pavements affected by the Contractor's operations shall be maintained by the Contractor at his expense in a suitable and safe condition for traffic until permanent replacement is to be made.
  - 2. This Section includes maintenance in or along streets in which construction is taking place; streets used for moving materials and construction equipment to and from the construction area; and streets used for bypassing or detouring traffic around the construction area.

**PART 2 PRODUCTS**

**2.01 PAVEMENT MATERIALS**

- A. Pavement materials shall be in conformance with Section 02600 and the ODOT CMS of these Specifications unless otherwise shown on the Drawings.

**PART 3 EXECUTION**

**3.01 CONSTRUCTION OF TEMPORARY PAVEMENT, CURBS AND WALKS**

- A. Preparation of Subbase - Before laying any pavements, sidewalks, or curbs, the trenches shall be compacted and all resulting holes and depressions shall be filled and tamped solid.
- B. Curbs - All curbs required to be reset temporarily shall be placed in their original position or as directed but the Contractor will not be required to set them in concrete.
- C. Sidewalks - All sidewalks disturbed shall be temporarily restored immediately upon the placing of the backfill either by relaying the old sidewalk pavement, placing 4 inches of aggregate base, laying a pavement of wooden planks 2-inch-thick, suitably fastened, and

flush with the adjacent sidewalk, or otherwise as directed. Permanent sidewalks shall be replaced as soon as possible.

### **3.02 SEASONAL LIMITATIONS FOR TEMPORARY PAVEMENT CONSTRUCTION**

- A. Weather limitations for placing asphalt materials shall conform to ODOT CMS. When weather limitations prevent the placing asphalt materials, the Contractor shall place 8 inches of aggregate base and maintain it until seal coat can be applied.
- B. When time restrictions are not in effect, the Contractor shall prepare the base and immediately place temporary or permanent pavement surface.

### **3.03 MAINTENANCE OF TEMPORARY PAVEMENTS**

- A. All existing temporary pavement and sidewalk shall be maintained by the Contractor at his own cost and expense in a suitable and safe condition for traffic until permanent replacement is to be made, or the Work finally accepted. Any depressions which develop shall be acceptably repaved when directed. Spots in the pavements which show signs of deficient bitumen or raveling shall be repaired by hand, and if deemed necessary, pavement shall be reconstructed in part or in whole as directed.

### **3.04 SEASONAL LIMITATIONS FOR MAINTENANCE OF BITUMINOUS PAVEMENT**

- A. During that time of year when asphalt concrete cannot be placed in conformance with ODOT Specifications, the Contractor shall remove loose material from holes and fill depressions in the pavement with temporary pavement as required to maintain the road surface in a condition acceptable to the Owner.
- B. As soon as weather conditions permit, the Contractor shall remove the temporary pavement and permanent repairs as specified and shown on the plans.

### **3.05 PERFORMANCE**

- A. If, in the opinion of the Engineer, proper maintenance of traffic facilities and proper provisions for traffic control are not being provided by the Contractor, the Engineer may take the necessary steps to place them in proper condition, and the cost of such services will be deducted from any money which may be due or become due the Contractor.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 TEMPORARY PAVEMENT**

- A. Temporary pavement placed on the following roads during periods when permanent pavement cannot be placed or in locations that will remain in place for over 30 days shall include the specified permanent base and either a minimum of 3 inches of cold patch material (ODOT 441) or a layer of polyethylene sheeting and a minimum of 3 inches of concrete as specified in Section 02600.

END OF SECTION

**SECTION 01568  
POLLUTION CONTROL**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the requirements for pollution control.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Dust palliatives shall conform to ODOT Item 616.

**PART 3 EXECUTION**

**3.01 OHIO GENERAL REQUIREMENTS**

- A. The Contractor is responsible to obtain and pay for NPDES Permit for storm water discharge.
- B. The Contractor is responsible for following an erosion control plan in accordance with the requirements of the Clean Water Act, 33 USC Section 1251 et seq. and the OWPCA, ORC 6111.01 et seq. and related rules. The Contractor warrants and agrees that it is equipped to limit water pollution for its activity according to applicable Federal and State standards.
- C. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
- D. The Contractor shall perform Work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems, and to prevent dust attributable to his operations from entering the atmosphere.
- E. Excess soil that is stockpiled shall be removed or regraded within 15 days of the completion of construction.

**3.02 STREETS, SIDEWALKS AND DRIVEWAYS**

- A. Streets, haul roads, and detours and bypass roads shall be swept by automatic self-contained sweepers.
- B. Excessive dirt on pavements shall be removed by means of hand shoveling or appropriate mechanical equipment and the area swept as directed above.
- C. Sidewalks and driveways shall be cleaned by means of shovels and hand brooms or appropriate mechanical equipment.

- D. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with calcium chloride dust palliative.
- E. The Contractor shall comply with the above requirements on a daily basis. If the Contractor fails to perform the above Work in a satisfactory manner, all Work, except cleanup operations, shall be stopped until the Contractor has complied with the above requirement.

### 3.03 EROSION AND SEDIMENT CONTROL

- A. The Contractor shall initiate appropriate vegetative practices on all disturbed areas to remain dormant (undisturbed) for more than 45 days within seven days.
  - 1. Such practices may include: temporary seeding, permanent seeding, mulching, matting sod stabilization, vegetative buffer strips, phasing and protection of trees.
- B. Permanent or temporary soil stabilization shall be applied to disturbed areas within seven (7) days after final grade is reached on any portion of the Site.
- C. When seasonal conditions prohibit the application of temporary or permanent seeding, non-vegetative soil stabilization practices, such as mulching and matting, shall be used.
- D. A stabilization construction entrance shall be provided to reduce vehicle tracking of sediment. The paved street adjacent to the Site entrance shall be swept a minimum of daily, or as needed, to remove any excess mud, dirt, or rock being tracked from the Site.
  - 1. Dust and sediment along any street due to construction on this Site is to be swept a minimum of once at the end of the day or as necessary to prevent a build-up of dust and soil on the pavement surface.
- E. Dump trucks hauling from the construction site shall be covered with a tarpaulin.
- F. No more than 200-feet of trench shall be open at any given time. Trench opening, laying of pipe, and backfilling should occur so as to minimize the amount of disturbed area.
- G. The Contractor shall minimize the width of his work area.
- H. Existing trees, shrubs, and other ground cover vegetation shall be preserved where possible. Tree removal will be limited to that necessary for construction and will be limited further to the permanent easement wherever possible. No tree removal will be permitted outside the temporary easement.
- I. Storm water runoff and natural stream flow shall be intercepted or diverted when originating upgrate away from the construction site so as to minimize the amount of flow over the construction site.
- J. All dewatering flows are to be settled in siltation basins or directed through filters before discharge to stabilized sites, such as stream or storm sewers, and not onto exposed soils, stream banks, or any other sites where the flow could cause erosion.
- K. When construction occurs near storm sewer inlets, erosion control measures such as inlet filters or hay bales shall be used to prevent silt from entering the storm sewers.

- L. The clean-up and disposal of excess excavated material shall be done as soon as practical after laying of the pipe. However, clean-up work shall not fall behind the pipe laying more than 800-feet. Should the Contractor not keep his clean-up within the aforementioned distance, Work shall stop until the clean-up work is accomplished.

### **3.04 OHIO SEDIMENT CONTROL**

- A. Contractor shall control erosion and trap sediment from all sites remaining disturbed for more than 14 days. Such practices shall include among others, sediment traps, sediment basins, silt fences, and storm drain inlet protection. Silt Fence fabric shall be ODOT Item 712.09 type C Geotextile Fabric.
- B. Timing - Sediment control structures shall be functional throughout earth-disturbing activity. Sediment ponds and perimeter sediment barriers shall be implemented as the first step of grading and within seven days from the start of grubbing. They shall continue to function until the upslope development area is restabilized.
- C. Settling Ponds - Concentrated storm water runoff from disturbed areas flowing at rates which exceed the design capacity of sediment barriers shall pass through a sediment settling pond. The facility's storage capacity shall be 67 cubic yards per acre of drainage area.
- D. Sediment Barriers - Sheet flow from runoff from denuded area shall be intercepted by sediment barriers. Sediment barriers, such as sediment fences or diversions directing runoff to settling facilities, shall protect adjacent properties and water resources from sediment transported by sheet flow.
- E. Other erosion and sediment control practices shall prevent sediment-laden water from entering drain systems, unless the storm drain system drains to a settling pond. These practices shall divert runoff from distributed areas and steep slopes where practicable and stabilize channels and outfalls from erosive flows.

### **3.05 RESERVED**

### **3.06 RESERVED**

### **3.07 PROHIBITED CONSTRUCTION ACTIVITIES**

- A. Disposing of excess or unsuitable excavated material in wetlands or floodplains, even with the permission of the property owner.
- B. Locating stockpile storage areas in environmentally sensitive areas.
- C. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, any surface waters, or outside the easement limits.
- D. Pumping of sediment-laden water from trenches or other excavations directly into any surface waters, any stream corridors, any wetlands, or storm sewers; all such water will be properly filtered or settled to remove silt prior to release.

- E. Discharging pollutants such as chemicals, fuels, lubricants, bituminous materials, raw sewage and other harmful waste into or alongside of rivers, streams, impoundments, or into natural or man-made channels leading thereto.
- F. Permanent or unspecified alteration of the flow line of any stream.
- G. Damaging vegetation outside of the construction area.
- H. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.
- I. Open burning of project debris without a permit.
- J. Discharging injurious silica dust concentrations into the atmosphere resulting from breaking, cutting, chipping, drilling, buffing, grinding, polishing, shaping or surfacing closer than 200 feet to places of residences or places of human occupation.
- K. Storing construction equipment and vehicles and/or stockpiling construction materials on property, public or private, not previously specified on the Drawings or not authorized by the Owner or Engineer for such purpose.
- L. Running well point or pump discharge lines through private property or public property and rights-of-way without the written permission of the property owner and the consent of the Engineer.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)**

- A. The Drawings show recommendations for pollution prevention measures to be provided. The measures shown on the Drawings shall be considered the minimum level of pollution prevention.
- B. The Contractor shall adhere to the SWPPP in accordance with OEPA Guidelines.
- C. The SWPPP shall be updated and maintained throughout the Work.
- D. A copy of the SWPPP shall be available at the Site.
- E. The Owner has not submitted a Notice of Intent (NOI) for the Work as the disturbed area is less than 1 acre. The Contractor is not required to apply for coverage as a co-permittee.

END OF SECTION



**SECTION 01580  
PROJECT SIGN**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the requirements of a project sign.
- B. The Contractor shall provide and erect a project sign readable from both sides at a location designated by the Owner or Engineer.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with all requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The detailed dimensional drawing(s).
    - b. Project sign lettering, logos, and information layout.

**PART 2 PRODUCTS**

**2.01 SIGN MATERIALS**

- A. The sign shall be of 3/8-inch exterior-type, high-density, overlaid plywood approximately 8 feet wide by 4 feet high.
- B. The sign shall be bordered with 2-inch by 6-inch studs with mitered corners. The border shall have 3/4-inch deep groove in its interior face for mounting of the plywood.
- C. Sign shall be supported above grade with nominal 4-inch by 4-inch wolmanized posts. The height of the sign and post shall be as shown on the drawings.
- D. The sign and posts shall have one coat primer and two finish coats, white, as background. Border and lettering shall be royal blue.
- E. The sign shall resemble and provide the information shown on the Drawings. The information shown on the Drawings, for the project sign, is subject to change. Contractor shall coordinate with the Owner and Engineer for correct information.

**PART 3 EXECUTION**

**3.02 INSTALLATION**

- A. The Contractor shall install the sign at a location designated by the Owner.
- B. Contractor shall ensure that the sign is not creating any traffic hazard or obstruction motor vehicles and pedestrians.
- C. Installation shall be in accordance with all federal, state, and local codes and ordinances.

- D. Project sign shall be removed upon substantial completion unless otherwise directed by the Owner.
- E. Project sign shall be removed without destroying or compromising the integrity, information, and supports. Project sign shall be delivered to the Owner upon removal, unless otherwise directed.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 PROJECT SIGN LAYOUT**

- A. Project sign information layout shall be as shown on the following page and as directed.
- B. A sample of the project sign layout shall be submitted to for review as a shop drawing.
- C. Information to be included on the Project Sign:
  - 1. Owner: Northwestern Water & Sewer District
  - 2. Contractor: TBD
  - 3. Engineer: Jones & Henry Engineers, Ltd.
  - 4. Other Funding Sources: Ohio EPA Division of Environmental and Financial Assistance.

END OF SECTION





**SECTION 01800**  
**CONSTRUCTION SURVEY WORK**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing of all labor, materials, equipment, and services necessary for the completion of Construction Survey Work in accordance with the Contract Documents.
- B. This Work consists of the layout of all lines and grades shown on the Drawings or as altered or modified by the Engineer, control survey and of miscellaneous survey work related to construction of the project.

**1.02 PROJECTION**

- A. The Contractor shall protect and preserve the established reference points and monuments.
- B. Whenever monuments are encountered in the line of Work, whether shown on the Drawings or not, the Contractor shall notify the Engineer in writing at least 24 hours in advance of moving same, and under no circumstances is such a stone or other monument to be removed or disturbed by the Contractor or by any of his men without a written order of the Engineer and only when a registered surveyor representative of the Owner is present.

**1.03 REPLACEMENT OF LOST SURVEY POINTS**

- A. Whenever a reference point or monument is lost or destroyed or requires relocation, the Contractor shall, at his own expense, accurately relocate and replace all such points so lost, destroyed, and moved.

**1.04 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. Layout Sheets including, but not limited to, Benchmarks both temporary and permanent and Pipeline layout staking.
    - b. Field Notes and survey log.
    - c. Profile over Proposed Tunneled, Jacked, or Bored Pipe.
    - d. Certified Survey of Tunneled, Jacked, or Bored Pipe.

- B. Contractor shall provide the Engineer and Resident Project Representative, no later than five working days prior to installation, all Logs, reports, field notes, drawings and documentation as specified shown on the Drawings or directed.
- C. No pipeline or related Work shall be considered for payment until all logs, reports field notes drawings and documentation as specified, shown on the Drawings or directed has been submitted to the Engineer or Engineers representative.

## **PART 2 PRODUCTS**

### **2.01 CONSTRUCTION STAKING**

- A. All construction points shall be marked with a wooden hub and nail or a PK nails in concrete and asphalt pavements and walks.
- B. All points located in areas of heavy underbrush, inaccessible or limited site distance shall be identified with a wood lath extending a minimum of 3 feet above the ground.
- C. All points located in paved surfaces shall be clearly marked with paint. Contractor shall obtain written permission from owner to use paint for marking.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. The Contractor shall provide field forces necessary to lay out the location, alignment, elevation, and grade of the Work shown on the Drawings and in conformance with the control points and benchmarks shown on the Drawings.
- B. The Contractor shall use competent personnel and suitable equipment for the layout of the Work required. If the layout Work involves more than a few simple distance and elevations from established reference points, the Contractor shall employ a Registered Surveyor to supervise the layout Work.
- C. Contractor shall furnish the necessary labor to assist the Engineer in checking the installation, if required.

### **3.02 EXISTING CONNECTION POINTS**

- A. The Contractor shall verify critical elevation points of the existing utilities prior to commencing installation of Work. Critical points shall include all points where new Work connects to existing utilities and existing utilities that could be conflicts with Work. All data shall be provided to the Engineer before commencing Work.

### **3.03 RIGHTS-OF-WAY AND EASEMENTS - RESERVED**

### 3.04 PAVEMENT

- A. The Contractor shall establish a layout for location and grade on both sides of the road and 5-feet off the edge of the pavement or back of curb. Layout line shall consist of stakes set at station intervals necessary for the topography and environment to assure conformance to planned line and grade. Stakes shall be set at a minimum every 50-feet, at all vertical and horizontal points of curvature and points of tangent, and at all vertical high or low points.
- B. Stakes for line and grade of pavement and curb shall be set at station intervals necessary for the topography and environment, not to exceed 50-feet, and at low and high points of vertical curves to assure conformance to planned line and grade.

### 3.05 PIPE IN OPEN CUT

- A. The Contractor shall utilize a laser beam for establishing line and grade when installing pipeline in open-cut construction. To maintain control during pipeline installation and to obtain the required field data for the record documents (G.C. 6.19) the Contractor shall establish construction and layout stakes. These stakes shall be based on the contract documents and the survey control data as provided by the Engineer.
- B. The construction staking shall be placed along the pipeline route at and at location of new manholes, valves, deflections both vertical and horizontal and as specified, shown on the Drawings or as directed. All construction layout stakes shall be offset at a minimum of 10-feet and at a right angle to the pipe line route. Layout shall be referenced to the downstream manhole or valve, in addition it may reference survey of baseline stationing.
- C. Contractor shall provide to the Engineer, no later than five working days prior to the installation of the pipeline, all information of the completed construction layout staking. This information shall include but not be limited to stationing, elevations, control points, project coordinates, offset direction and distance for all deflections both horizontal and vertical, manholes and all other points as specified, shown on the Drawings and directed by the Engineer.
- D. The grade of pipe in open-cut, whether placed by laser beam or other approved methods, shall be checked using surveying equipment. The Contractor shall have a surveyor's level and level rod on the Site at all times when pipeline and appurtenances are being installed. The level rod shall be equipped with an attached "shoe" extension on the bottom for placing on the pipe invert. The pipe invert elevation shall be checked at a maximum of 50-feet intervals or more often as directed by the Engineer. Checks will be performed by the Contractor and results, including but not limited to layout station shall be recorded in contractor's field log.
- E. The Contractor shall furnish all equipment and labor and check his alignment from the offset stakes. Contractor shall record all information in the log.
- F. Any inspection or checking of the Contractor's layout by the Engineer shall not relieve the Contractor of his responsibility to secure the proper dimensions, grades, and elevations of the Work.

**3.06 RESERVED**

**3.07 RESERVED**

**3.08 LOCATION OF STRUCTURES AND UNDERGROUND PIPING**

- A. The location of new structures and underground utilities shall be based on the dimensions, coordinates, and requirements shown on the Drawings or specified.
- B. If it is stated on the Drawings or specified that the location and/or elevation of the new structure or underground piping shall depend on the location of existing underground or otherwise hidden facilities, those existing underground or hidden facilities shall be located by the Contractor prior to his determination of the location and/or elevation of the new facilities. This requirement shall override any other specific location dimensions or coordinates shown on the Drawings for that structure or piping.
- C. If the location or elevation determined by the Contractor, in accordance with the above requirements, appears to cause conflicts with existing structures or utilities or appears to potentially cause functional issues with either the existing or new structures or utilities, the Contractor shall notify the Engineer immediately.
- D. In no case, shall coordinates or other location information be extracted or interpolated from the electronic CAD files that may be provided to the Contractor by the Owner or Engineer without the specific approval of the Engineer.

**3.09 CURB AND GUTTER ELEVATIONS**

- A. In locations where the existing curb and gutter shall be removed as part of the Work, the Contractor shall be responsible for reconstructing the existing curb and gutter to match existing alignment, elevations and grades. The Contractor shall be responsible for collecting existing curb and gutter elevation information prior to commencing the Work.

**3.10 BENCHMARKS/VERTICAL CONTROL**

- A. Benchmarks have been set for survey and construction reference purposes.
- B. The Contractor shall protect and transfer these benchmarks as needed to complete the Work.

**3.11 HORIZONTAL CONTROL**

- A. The centerline stationing provided is not based upon physical control points found or established as part of the design.
- B. The Contractor shall establish additional horizontal control as necessary.



#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 REGISTERED SURVEYOR**

- A. The Contractor shall employ the services of a registered surveyor for the initial layout and staking of the project. The Registered Surveyor shall be utilized at any time when reestablishing control points, elevations and on any redesign or extension of the Work. All survey Work shall be as specified, shown on the drawings or as directed.

##### **4.02 PRESSURE PIPE ELEVATIONS**

- A. Any deviation from the plan pipe elevations shall be brought to the attention of the Engineer, to permit the Engineer to evaluate the impact of the elevation modification upon air valve release placement.
- B. The force main elevations are intended to provide controlled grades to permit the force main to expel air at air release valves. Deviation from the elevations provided may affect the performance of the force main, and any changes in grade should be reviewed by the Engineer.

##### **4.03 WORK LIMITS**

- A. The Contractor's Surveyor shall stake the limits of R/W, easements and property lines in the work area.
- B. Any stakes lost during the work shall be reset at the direction of the Owner or the Engineer.

##### **4.04 CONSTRUCTION BENCHMARKS**

- A. In areas where vertical control benchmarks have not been provided, the Contractor shall set temporary benchmarks at convenient locations.
- B. Any benchmarks lost during the work may be replaced if so directed by the Engineer.

END OF SECTION



**SECTION 01810  
VIDEO RECORDING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Under this Section the Contractor shall furnish all personnel, transportation, recording equipment, power, and materials to produce color video records of existing topography along all pipeline routes and designated haul roads, in designated residences, and as directed.

**1.02 SCHEDULE OF WORK**

- A. Unless otherwise directed in writing by the Engineer, video recording shall be scheduled in conformance with the following:
  - 1. No recording shall be started on any portion of the Work until that portion of the Work is under Contract unless otherwise directed by the Owner.
  - 2. Recording shall not precede excavation for construction by more than three months.
  - 3. Video recording shall be performed only when foliage is visible on trees, except as authorized by the Engineer.
  - 4. Video recording shall not be performed when more than 10% of the ground is covered with snow or leaves, unless authorized by the Owner.
- B. Before proceeding with the work, the video recording, Contractor shall consult with the Engineer concerning the following:
  - 1. Scheduling recording to precede construction.
- C. All recording shall be completed on a section of Contract before the Contractor starts excavation or places material or equipment in that section.
- D. In areas where public utilities are to be relocated or replaced, a second video recording shall be made after the public utility has concluded their work but before the Contractor commences operations.
- E. The Owner shall obtain permission for the recording crew to enter private property not included in an easement. The Contractor shall give the Owner sufficient prior notice to obtain the permission.

**1.03 DEFINITIONS**

- A. Video Recording - Zone of Influence - Shall include producing video records as specified herein for the zone of influence. The zone of influence shall be defined as all surface area within street rights-of-way or easements in which project is to be installed or

within areas 50 feet on each side of a proposed utility centerline, whichever is greater, and additional features in contiguous areas as specified or directed.

- B. Video Recording of Buildings - Entering - Shall include moving video equipment into buildings or residences (including attached or separate garages) designated by the Engineer for the purpose of recording existing conditions therein.
- C. Video Recording of Building - Panels - Shall include video recording of designated panels of buildings. Panel as used herein shall mean the full surface of a room wall, ceiling, or floor or the outer side of a building not viewable in any zone of influence recording.

#### **1.04 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Provide a minimum of four copies of the video.

### **PART 2 PRODUCTS**

#### **2.01 VIDEO RECORDING**

- A. Displays - All video shall, by electronic means, display (visible on the playback viewer) continuously and simultaneously generated transparent digital information which shall include the date and time of recording, as well as the corresponding planned station numbers. The date information shall contain the month, day, and year. The time information shall consist of hours, minutes, and seconds, separated by punctuation marks. Below the stationing, periodic transparent alpha/numeric information shall appear. The information shall consist of the name of the project, name of area covered, direction of travel, viewing side, and any other pertinent data.

#### **2.02 VIDEO OUTPUTTING**

- A. Video recording shall be a digital file format such as MPEG, MP3, MP4, Wave or WMV or other current standard file formats as approved by Engineer.
- B. The electronic file organization shall reasonably match the project stationing with file names including the station number and street names.
- C. The electronic files shall be stored on a single solid-state memory device, such as a DVD disc or jump/thumb drive, external hard drive. Solid state memory devices shall have a USB for connection to a computer. The memory volume on the storage device shall be adequate to store the electronic video files in an unzipped capacity along with any associated or embedded data files.

#### **2.03 AUXILIARY LIGHTING**

- A. Auxiliary lighting shall be used wherever necessary to ensure clarity of picture.

### **PART 3 EXECUTION**

#### **3.01 PERSONNEL**

- A. The Work shall be performed by competent personnel with knowledge of the procedures and methods to produce satisfactory records as specified herein.

#### **3.02 PRODUCTION**

- A. Recording shall be composed in such a manner that Filming shall, in general, proceed in the direction of the project stationing.
- B. Recorded Contents:
  - 1. Video recordings shall be supported by appropriate audio description simultaneous with the visual coverage.
  - 2. All houses or buildings and other readily recognizable objects as required shall be identified visually and audibly in such a manner that they can be referenced to the stationing of the project. Objects selected shall be at intervals not exceeding 100 lineal feet and shall include all houses and buildings identified by house numbers.
  - 3. Within the zone of influence, the recording shall include but not be limited to all sidewalks, driveways, ditches, parkways, lawns, inlets, culvert pipe ends, trees, shrubs, fences, houses, and buildings that could conceivably be affected by the Contractor's operations. The video shall call attention to existing cracks or uneven areas in walks and driveways, damaged lawns, trees or shrubbery, broken or missing inlet castings, deteriorated fences, and, where feasible, broken or plugged culvert pipes.
  - 4. Within street rights-of-way, the recording shall include but not be limited to all pavement, curbs and inlets, mailboxes, traffic signs, and street signs. The video shall call attention to damaged mailboxes, signs, curbs and inlet castings. Damaged areas in pavements over proposed project or in pavements scheduled for resurfacing need not be referred to.
  - 5. Video recording for designated residences shall include documentation of surface conditions inside and outside of the building prior to starting project construction.
- C. Control of Picture Quality - The camera carrier shall travel at a low speed to ensure against blur or distortion of the recorded pictures. A maximum rate of 48-feet per minute is recommended.

#### **3.03 OWNER REVIEW**

- A. As the video recording work progresses, the Contractor shall deliver completed sections to the Owner and Engineer. The Owner and Engineer shall review the recordings and determine if they are acceptable for clarity and coverage. The recording may be rejected

if the picture is of poor quality (i.e., blurred, distorted, too light, too dark, improper color), insufficient coverage, or does not meet specified requirements.

- B. The area of rejected recording shall be rerecorded by the Contractor and reinserted in the electronic file in the proper sequence.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 ADDITIONAL AREAS TO BE VIDEO RECORDED**

- A. The Contractor shall provide preconstruction video inspection of the following, in addition to those areas specified herein:
  - 1. The existing pump station interior & exterior parking lot.
  - 2. Ford Road proposed sewer and force main alignment.
  - 3. Ford Road from White to Simmons Road.

END OF SECTION

**SECTION 01820  
VIDEO RECORDING OF UNDERGROUND INFRASTRUCTURE**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the requirements for video documentation of underground facilities.
- B. The Contractor shall provide personnel, transportation, recording equipment, power, and materials, to produce color video records of existing or new underground pipelines, structures, designated service pipes and as directed.
- C. The Contractor shall provide traffic control, flow control, bypass pumping and cleaning of underground pipelines, structures and designated service pipe in order to produce video documents.

**1.02 SCHEDULE OF WORK**

- A. Before proceeding with the work, the video recording contractor shall consult with the Engineer concerning the following:
  - 1. Scheduling recording to precede construction.
- B. The Owner will obtain permission for the recording crew to enter private property not included in an easement. The Contractor shall provide a schedule of locations 30 days in advance of Work. The Contractor shall coordinate access with Owner and adhere to the schedule.

**1.03 DEFINITIONS**

- A. Video recording shall include producing video records of the area within the underground infrastructure as designated and as specified herein.

**1.04 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Provide a minimum of two copies of the video.
  - 2. Information for the Record:
    - a. The Contractor shall submit, prior to starting Work, at his own expense, a sample color USB flash or USB hard drives meeting the contract requirements and upon request, must submit at least three letters of reference for the video firm pertinent to the performance and satisfactory completion of color video projects from various municipalities.

## **PART 2 PRODUCTS**

### **2.01 VIDEO RECORDING**

- A. Picture Quality - Video output from camera(s) shall be produced at a minimum of 720 by 480 resolution. Camera(s) shall also produce optimum color imagery with a minimum of 20-foot-candles of illumination.
- B. Displays - All video shall, by electronic means, display (visible on the playback viewer) continuously and simultaneously generated transparent digital information which shall include the date and time of recording, as well as the corresponding planned station numbers. The date information shall contain the month, day, and year. The time information shall consist of hours, minutes, and seconds, separated by punctuation marks. Below the stationing, periodic transparent alpha/numeric information shall appear. The information shall consist of the name of the project, name of area covered, direction of travel, viewing side, and any other pertinent data.

### **2.02 VIDEO OUTPUTTING**

- A. Video recording shall be a digital file format such as MPEG, MP3, MP4, Wave or WMV or other current standard file formats as approved by Engineer.
- B. The electronic file organization shall reasonably match the project stationing with file names including the station number, street names and manhole numbers with distances measured from entry to exit manholes. The system shall start at the lower end of sections of the planned system and proceed upstream, completing one section before starting another.
- C. The electronic files shall be stored on a single solid-state memory device, such as a jump/thrum drive, external hard drive. The solid-state memory device shall have a USB for connection to a computer. The memory volume on the storage device shall be adequate to store the electronic video files in an unzipped capacity along with any associated or embedded data files.

### **2.03 AUXILIARY LIGHTING**

- A. Auxiliary lighting shall be used wherever necessary to ensure clarity of picture.

## **PART 3 EXECUTION**

### **3.01 PERSONNEL**

- A. The Work shall be performed by competent personnel with knowledge of the procedures and methods to produce satisfactory records as specified herein.

### **3.02 PRODUCTION**

- A. Recording shall be composed in such a manner that:
  - 1. Filming shall, in general, proceed in the direction of the planned stationing.



- B. Recorded Contents:
  - 1. Readily recognizable objects shall be identified visually in such a manner that they can be referenced to the planned stationing. Objects selected shall be at intervals not exceeding 100 lineal feet and shall include all house leads/taps identified by measured distance.
  - 2. The recording shall include but not be limited to all inlets, culvert pipe ends, house leads or taps. The video shall call attention to existing cracks or uneven areas, or missing pipe.
- C. Control of Picture Quality - The camera carrier shall travel at a low speed to ensure against blur or distortion of the recorded pictures. A maximum rate of 30-feet per minute is required.
- D. Depth of flow in section being inspected shall be no greater than 25%.

### **3.03 OWNER REVIEW**

- A. As the video recording work progresses, the Contractor shall deliver completed sections to the Owner and Engineer. The Owner and Engineer shall review the recordings and determine if they are acceptable for clarity and coverage. The recording may be rejected if the picture is of poor quality (i.e., blurred, distorted, too light, too dark, improper color), insufficient coverage, or does not meet specified requirements.
- B. The area of rejected recording shall be rerecorded by the Contractor and reinserted in the electronic file in the proper sequence.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 POST CONSTRUCTION SEWER INSPECTION**

- A. The Contractor shall conduct a video recording of the inspection of new storm and sanitary sewers after the installation is complete as specified herein.
- B. The Owner and Engineer shall be present for all video inspection during the initial recording.
- C. Final acceptance, by Owner and Engineer, of sewer installations shall be based upon the video inspection of the sewers.

END OF SECTION



**SECTION 02100  
CLEARING AND GRUBBING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes grubbing, scalping, and otherwise clearing of the construction site in accordance with the Drawings and as specified herein or ordered.
- B. This Work includes the removing and disposing of all trees, stumps, vegetation, and debris as necessary to accommodate new construction or to recontour the Site, and the preservation of all vegetation and other objects designated to remain.

**1.02 RESERVED**

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Paint required for cut or scarred surfaces of trees or shrubs designated to remain shall be a suitable asphaltum base paint.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Clearing and grubbing shall be performed only after the Site has been surveyed and staked as required and in accordance with Section 01800.

**3.02 PREPARATION**

- A. The Contractor shall protect and preserve all land survey monuments or property corners along the line of his work.
  - 1. Where monuments, irons, or property corners are disturbed or removed due to operations under this Contract, the Contractor, at his own expense, shall employ the services of a registered land surveyor to establish, reset or replace such monuments, irons, or property corners.
- B. The Contractor shall not damage or destroy trees or shrubs nor remove or cut them without authorization by the Owner. All trees and shrubs except those ordered to be removed shall be adequately protected by the Contractor. No excavated material shall be placed so as to damage such trees and shrubs.
  - 1. Trees and shrubs damaged by the Contractor shall be replaced with new stock of similar size and age, or with other stock size and age satisfactory to the Owner, at the proper season, and at the sole expense of the Contractor. Scarred surfaces shall be treated as indicated in Part 2.

- C. When or where any direct or indirect damage is done to public or private property resulting from Contractor's operations, such property shall be restored by the Contractor, at his expense, to a condition equal or better than that existing before such damage was done or the Contractor shall make good such damage in manner acceptable to the owner of the property.

### **3.03 CLEARING AND GRUBBING**

- A. Only those trees and shrubs shall be removed that are in actual interference with excavation or grading work and such removal shall be subject to approval by the Engineer. The Engineer reserves the right to order additional trees or shrubs removed at no additional cost if, in his opinion, they cannot be maintained or have been damaged by the Contractor's operations.
- B. All trees, stumps, vegetation, and debris not designated to remain shall be cleared and/or grubbed, except for special treatment as follows:
  - 1. In locations to be seeded, stumps, roots, and other protruding obstructions shall be removed to a minimum of 6 inches below the final ground surface.
  - 2. Undisturbed stumps, roots, and non-biodegradable solid objects 3 feet minimum below proposed subgrade or embankment surfaces will not require removing providing they do not extend more than 6 inches above the existing ground surface.
- C. The clearing and grubbing shall extend no more than 10 feet beyond the top of the backslope and/or toe of embankment, or edge of the pipe to be constructed.
- D. At all times, the Contractor shall remain within the property lines and/or easement areas.
- E. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with Section 02200.

### **3.04 SCALPING**

- A. Areas of excavation or embankment shall be scalped of brush, roots, sod, grass, crop residue, decayed vegetable matters, and other organic materials.
- B. Scalping depth shall be only as required to remove the above. Scalping of topsoil is not included under this Section.

### **3.05 DISPOSAL OF DEBRIS**

- A. Debris resulting from the clearing and grubbing operations shall be disposed of at designated spoil sites in a legal manner, in full compliance with applicable codes and ordinances.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 TREE REMOVAL**

- A. All trees to be removed shall be removed between October 1 and March 31.

- B. A tree is defined as a live, dying or dead plant with a minimum diameter of 3 inches with snags at 4-feet above the ground surface and a minimum height of 12-feet above the ground surface.
- C. Large clusters of trees have not been individually marked and removals in such areas are noted as "clear and grub", with work to be performed in accordance with the requirements of these specifications.

**4.02 TREES OR BRUSH TRIMMING**

- A. Trees or brush scheduled for trimming shall have only branches or foliage in conflict with the clear passage of equipment or work removed with the prior approval of the Engineer.
- B. Limbs or branches shall be removed back to a branch greater than 3-inches in diameter or the main tree trunk.
- C. Trimming shall be performed in a manner to prevent damage to the portion of the tree remaining.

**4.03 CLEARING AND GRUBBING LIMITS**

- A. The Contractor shall strictly adhere to the cleaning and grubbing limits shown on the plans.
- B. A meeting shall be held on site with the Contractor, Owner and Engineer prior to commencing clearing and grubbing.

END OF SECTION



**SECTION 02110**  
**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes demolition of existing structures and removal of pavement, piping, and equipment necessary to clear space for new construction and/or to rehabilitate existing construction.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. The Contractor shall submit, as specified, a copy of a signed permit from the owner of the property upon which the debris, removed under this Section, will be disposed.
    - b. Dust and noise control measures
    - c. Record documents, in accordance with the General Conditions, and photograph or video recording indicates the location of, but not limited to, the following existing, new, and abandoned:
      - 1) Utilities.
      - 2) Mechanical.
      - 3) Electrical.
      - 4) Structural.
      - 5) Any embedded items.
    - d. Inventory and documentation list for removed and salvaged materials for the Owner.

**1.03 QUALITY ASSURANCE**

- A. Contractor shall execute the Work in compliance with all federal, state, and local codes. Any removal or demolition shall not leave the Owner in violation of any such regulations or codes unless approved by the Owner and Engineer.

**1.04 PROTECTION**

- A. Structures shall be removed in such a manner as not to damage any portions of the existing structure which are to remain in place.

## **PART 2 PRODUCTS**

### **2.01 FILL MATERIAL**

- A. Fill material shall be in accordance with Section 02200.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Demolition work extending beyond the limits as specified, shown on the Drawings, or as required, will be considered unauthorized. The Contractor, at no additional cost to the Owner, shall repair said damage to a condition equal to or better than existed prior to commencement of the Work.
- B. Existing structures and equipment which are damaged in appearance or function by performance of demolition work shall be replaced or repaired, at Owner's discretion and to an approved condition, by the Contractor at no increase in Contract Price.

### **3.02 PAVEMENTS, SIDEWALKS, CURBING AND SIMILAR STRUCTURES**

- A. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint per ODOT 202. Sawed joints shall be straight, neat, and free from chipped or damaged edges.
- B. For removal of non-reinforced concrete, the minimum depth of saw cut shall be 3 inches.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel unless specified otherwise.
- D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

### **3.03 EXCAVATION OF RIGID PAVEMENT**

- A. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete per ODOT 202, wherever such excavation is required for the purposes of this Contract.
- B. Pavement shall be excavated to neat lines and, unless otherwise specified in Part 4 of this Section, only to widths required for trenches for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation. Concrete pavement and sub-base shall be cut with a concrete saw in conformance with Subsection 3.02.

### **3.04 MANHOLES, CATCH BASINS, INLETS AND SIMILAR STRUCTURES**

- A. Existing manholes, catch basins, inlets, and similar structures designated to be removed shall be completely removed.



- B. Manholes, catch basins, inlets, and similar structures designated to be abandoned shall be removed to an elevation of at least 3 feet below the finished subgrade or ground surface. The remaining void shall be filled with special backfill material compacted to 100% optimum density per ASTM D698 or controlled density fill, CDF if permitted by the Engineer. All sewer openings in manholes located on sewer lines that are not to be filled, shall be plugged with 8-inch minimum thickness masonry plug.
- C. Sewers designated to remain in service and connected to structures indicated to be removed or abandoned shall be rebuilt through the area with new pipe. Sewer flow shall be maintained between removal and replacement operations. Abandoned sewers shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.
- D. All castings or hydrants salvaged from abandoned or removed structures shall remain the property of the Owner, if requested by the Owner, and shall be cleaned and transported by the Contractor to a site designated by the Owner or incorporated in the Work where called for on the Drawings, scheduled, or so directed. If Owner decides salvaged materials are not wanted, the Contractor shall dispose of them at no additional cost to the Owner.

### **3.05 GROUT-FILLED ABANDONMENT OF PIPE, CONDUIT AND SIMILAR STRUCTURES**

- A. Ends of sewer designated to be abandoned shall be sealed with approved masonry bulkheads or factory caps and plugs.
- B. Contractor shall determine and modify, as necessary, the mix of the flowable fill material to satisfactorily fill the entire abandoned sewers and structures. ACI 229R-99 Table 5.1 provides examples of acceptable mix designs.
- C. Contractor may need to include fill holes and vent pipes to assure thorough filling. The locations of grout tubes, vents and inspection ports for grout filling pipes to be abandoned shown on the Drawing shall be considered the minimum number. The Contractor may choose to provide more grout tubes, vents, and inspection ports at no additional cost.
- D. Quantities of flowable fill material used to fill the conduits shall be monitored continuously during the placement.
- E. Bulkheads shall be installed as shown on plans and as needed by the Contractor's method to completely fill the abandoned sewers.
- F. Sites disturbed by the grout-filled abandonment work shall be restored as part of this Work.

### **3.06 GUARDRAIL AND FENCE**

- A. Where so required by the Drawings, existing guardrail and fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.
- B. Wood posts and other materials not considered salvageable by the Owner shall be disposed of by the Contractor.

**3.07 RESERVED**

**3.08 EQUIPMENT REMOVAL**

- A. All equipment, valves, piping, fittings, and miscellaneous steel structures that are removed shall remain the property of the Owner and shall be stored at a site selected by the Owner. The Owner reserves the right to require the Contractor to dispose of certain unwanted portions of removed equipment and materials. The Owner shall have the right to reject any or all materials removed during construction, and the Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner.
- B. See Drawings for removal of electrical equipment and appurtenances.
- C. The Contractor shall replace, at no cost to the Owner, equipment designated to be turned over to the Owner that is lost or damaged.

**3.09 PRIVATE SIGNS**

- A. Private and commercial signs shall be carefully removed and relocated as directed by the Owner.

**3.10 DISPOSAL OF DEBRIS**

- A. All debris resulting from demolition operations; i.e., broken concrete, masonry, pipe, miscellaneous metal, trees and brush, equipment, etc., shall be trucked from the Work site by the Contractor and disposed of at spoil sites in a legal manner, in full compliance with applicable codes and ordinances.
- B. The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely cleaned up.

**3.11 BACKFILLING**

- A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted in accordance with the requirements of Section 02200.

**3.12 RESERVED**

**3.13 USE OF EXPLOSIVES**

- A. The use of explosives for the Work of removal of structures and obstructions is PROHIBITED.

### **3.14 PIPING REMOVAL**

- A. At the location where pipe removal stops, the remaining pipe end shall be capped. The cap must be pressure tight and restrained from movement due to pressures inside the pipe.
- B. Piping removal includes, but not limited to, all hangers, stands, and anchoring devices.

### **3.15 OPENINGS AND PATCHING**

- A. The Contractor shall fill all openings created by equipment, piping, and conduit removals.
- B. The Contractor shall patch any marred surfaces created by equipment and piping removals.
- C. All filling and patching work shall be performed in accordance with the specifications.
- D. All anchor bolts shall be removed and holes filled or cut off flush.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 FORD ROAD PUMP STATION ABANDONMENT**

- A. The pump station shall be abandoned in accordance with the details provided on the Drawings and as specified herein. The existing dry and wet wells shall be filled with the specified CDF material.
- B. Equipment to be salvaged is identified herein.
- C. Materials and Equipment not specifically identified for salvage may be abandoned in place.
- D. The wet well shall be drained of all liquid and accumulated non-cementitious debris shall be removed.
  - 1. Solid debris removed from the wet well shall be disposed of at a landfill facility.
  - 2. Liquid containing sewage shall be disposed of at a wastewater treatment facility.
  - 3. The Contractor is asked not to dispose of liquid material into the new gravity sewer.
  - 4. The nature and composition of the debris in the wet well is unknown.
  - 5. The contractor shall consider the cost of all testing required to complete the disposal as part of the cost of work.
- E. The Contractor should consider the dimensional information provided for the existing structures as approximate. Should the Contractor require more accurate measurement during the bid phase, the Contractor (as a Bidder) should make arrangements with the Owner to visit the site and obtain their own measurements.

#### 4.02 SCHEDULE OF SALVAGED MATERIALS

- A. The following list of items once removed shall remain the property of the Owner and shall be delivered to the Owner-designated location.
  - 1. Pump Motors
  - 2. Valves in Dry Well
  - 3. Manhole Frame and Lid Castings
  - 4. Flow Meter and HMI Complete with Potted Cable
  - 5. Pump Control Panel (And Accessories)
  - 6. Telemetry Panel
  - 7. Generator Battery Charger
  - 8. Automatic Transfer Switch
  - 9. VFD and Telemetry Interface Panel
  - 10. Generator Alarm Annunciator
  - 11. Variable Speed Drives. Cabinets may be demolished.
  - 12. Dry Well Blower
  - 13. Chemical Feed Tank, Meter, Pump & Level Sensors
- B. The Contractor shall remove the noted existing electrical equipment including the following major components and accessories:
  - 1. Electrical wiring to be removed.
  - 2. Electrical Panels and Cabinets including structural supports and footings.
- C. Items shown for removal and not designated for salvage shall be disposed of by the Contractor.

#### 4.03 FORCE MAIN REMOVAL

- A. As shown on the Drawings, existing sanitary sewer, force main, accessories, and appurtenances shall be removed within limits shown on the Drawings or as specified.
- B. The removal shall include removal and disposal or aggregate backfill, pipe bedding, concrete thrust blocking and or control density backfill or concrete encasements.
- C. Existing pipe removed shall become the property of the Contractor and shall be properly disposed of in accordance with the requirements of this Section.
- D. At locations where the pipe removal is terminated, a water-tight sewer plug along with concrete thrust restraints shall be placed in the end of the pipe to remain.

#### 4.04 SANITARY SEWER & FORCE MAIN ABANDONMENT

- A. Select sections of pipe connected to the existing wet well are to be abandoned.

- B. These pipes shall be abandoned in accordance with Section 02110, 3.05.

**4.05 SEWER AND MANHOLE CLEANING**

- A. The Contractor is expected to clean all accumulated debris from portions of the collection system used for the bypass pumping operation.
- B. Sewers and manholes surcharged by bypassing operations shall be cleaned and television to confirm the condition of these facilities prior to returning the facilities to operation.
- C. The Contractor shall be responsible for disposal of debris removed as specified herein.
- D. The Contractor shall provide measures to prevent cleaning debris from entering the pumps station where damage could occur to the new equipment.

END OF SECTION



**SECTION 02200**  
**EXCAVATION AND BACKFILL**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all excavations and related Work for the construction of the designated structures, pipelines, and other incidental Work.
- B. Excavation includes the Work of making all necessary excavations for the construction of all Contract Work; of furnishing, placing, and use of sheeting, shoring, and sheet piling necessary in excavating for and protecting the Work and workers; of doing all pumping and fluming necessary to keep the excavation free from water; of providing for uninterrupted flow of existing streams, treatment plant processes, drains and sewers; of damming and cofferdamming where necessary; of supporting and protecting existing structures, pipes, conduits, sewers, culverts of all types of materials of construction, of supporting and protecting railroad tracks, posts, poles, wires, fences, buildings, and other public and private property adjacent to the Work; of removing and replacing existing sewers, culverts, pipelines, and bulkheads where necessary; of removing after completion of the Work all sheeting and shoring not necessary to support the sides of excavations; of removing and disposing of all surplus excavated material or material under structures that does not meet the soil design bearing capacities; of doing all backfilling, of compacting backfill to limits specified or ordered by the Engineer; and restoring all property damaged as a result of the Work involved in this Contract.
- C. The Work includes obtaining and transporting suitable fill material from off-site when on-site material is not available.
- D. The Work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, or disposal of all surplus on other sites selected by the Owner.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Sieve Analysis (ASTM C136) - One test for each material source.
    - b. Submit a moisture density curve (ASTM D698) for each type of material used for backfill. Test shall be referenced to appropriate sieve analysis test. The maximum dry weight and optimum moisture content shall be indicated.
    - c. Controlled Density Fill Material - Design Mix and Certified Test Results.

- d. Test results for conformance with specified "Compaction Requirements":
  - 1) Retests shall be referenced to the corresponding failing test.
- 2. Information for the Record:
  - a. Details of the proposed method of installation and construction of dewatering wells.
  - b. Schedule of the proposed sequence of dewatering well construction.
  - c. Dewatering logs.
  - d. Submit method for abandoning dewatering well.

## **PART 2 PRODUCTS**

### **2.01 TOPSOIL**

- A. Soil stripped from the Site shall consist of loose, friable, loamy topsoil without admixture of subsoil or refuse. It shall be reasonably free from peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The stockpiled soil shall be subject to the approval of the Engineer.
- B. Topsoil provided shall be in accordance with ODOT 653 and be loose, friable, loamy soil without admixture of subsoil or refuse. In order for the topsoil to be considered loamy the fraction of topsoil, passing a No. 10 sieve, shall contain not more than 40% clay. Topsoil shall contain not less than 4% nor more than 20% organic matter as determined by loss on ignition of oven-dried samples to constant weight at 212 degrees F.
- C. Excess material shall be removed from Site, unless directed otherwise by Owner or Engineer.

### **2.02 SELECTED BACKFILL**

- A. Selected backfill shall be clean excavated soil. It shall be free of rock and foreign debris of any kind and shall be tested in accordance with ASTM C136 sieve screen analysis and ASTM D2487 soil classification. The material's use as selected backfill shall be approved by the Engineer.
- B. Engineer may waive material testing of selected backfill. Such waiver shall apply only to the designated location and the source of the selected backfill. Such waiver shall not apply to excavated soil from locations not so designated.

### **2.03 SPECIAL BACKFILL MATERIAL**

- A. Special backfill material shall conform to ODOT 304.

### **2.04 AGGREGATE BEDDING MATERIAL**

- A. Aggregate bedding material shall be well-graded durable crushed gravel, crushed stone or meeting the graduation requirements of ODOT Table 703.01-1.



- B. Aggregate bedding material shall be as follows:
  - 1. For PVC, HDPE or plastic pipe, bedding material shall be No. 8 (nominal size 3/8-inch to sieve No. 8).

## **2.05 LOW STRENGTH MORTAR BACKFILL (LSM)**

- A. Low strength mortar backfill shall be a cement base fill material that can be deposited in a fluid state. It shall be composed of portland cement and approved filler material, sand and water. The mixture shall have a compressive strength of 100 psi minimum and 500 psi maximum.
- B. LSM material shall be in accordance with ODOT Item 613, Type 1 or Type 2.
- C. The Contractor shall select and submit a mix design appropriate for the proposed work.

## **2.06 RESERVED**

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Construction Through Highways:
  - 1. Permits - The Owner will obtain permits required for open cut construction through highways. Contractor shall be responsible for compliance with and furnishing any item required by permit such as Bond Security.
  - 2. Notification - The Contractor shall give written notice to appropriate officials of the affected Department of Transportation, City, or County at least five days, not including weekends and holidays, before starting construction under highways and as required under other roadways.
  - 3. Contractor shall comply with standard permit conditions of controlling authority and special provisions noted in Part 4 of this Section.
- B. Test Pits:
  - 1. The Contractor shall perform exploratory test pits as may be necessary or ordered by Engineer in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines, and conduits which are likely to be encountered and shall make acceptable provision for their protection, support, and maintenance in operation. Vacuum excavation (pot hole) may be used if adequate information can be obtained by such method. No additional payment shall be made for test pits.
  - 2. Conflicts with existing utilities not located, as specified, far enough in advance of construction, shall not be considered as a basis for delay claims or additional payment.

### 3.02 REMOVING AND REPLACING TOPSOIL

- A. Removal
  - 1. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed: The Contractor may elect to strip soil and stockpile unless the Contract Documents direct stripping and stockpiling prior to excavation.
  - 2. General excavation, other than trench excavation: The Contractor shall remove, and stockpile the top 12 inches of the existing soils from all areas of construction including, but not limited to, excavation and embankment areas, stockpile sites, construction yard, storage areas, etc.
- B. Replacing stockpiled soil and topsoil
  - 1. Trench excavation areas disturbed as a result of trenching operations and which are to be restored with grass or other plantings shall be free of peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The surface shall be mechanically conditioned after removal of debris. After surface is prepared, it shall be covered with topsoil or stockpiled soil material to a minimum depth of 4 inches. Topsoils and stockpiled soil material shall meet the requirements specified herein and be tested.
  - 2. General excavation areas which are to be restored with grass or other plantings shall be free of peak, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris, wood products and construction debris including loose stone. The surface shall be mechanically conditioned after removal of debris. After surface is prepared it shall be covered with stockpiled soil and then have a minimum of 4 inches of topsoil placed.
- C. The Work shall be in accordance with applicable portions of ODOT items 652 and 653.

### 3.03 GENERAL EXCAVATION

- A. All necessary excavation shall be performed to accommodate the completion of all Contract Work.
- B. The Drawings show the horizontal and the lower limits of structures, pipelines, sewers and other utilities. The methods and equipment used by the Contractor when approaching the bottom limits of excavation and when trimming the bottom of the excavation to a smooth surface shall be selected to prevent disturbing the soil below the bottom limits of excavation.
- C. Excavation which is carried below the bottom limits shall be classified as Unauthorized Excavation, unless said excavation has been authorized by the Engineer prior to each occurrence.
- D. Unauthorized excavation shall be filled with CDF material to the bottom limits. Under circumstances where structural integrity is not a factor, the Engineer may allow the filling of unauthorized excavation with pipe bedding material or special backfill material compacted to 100% density, as specified under compaction requirements.

E. Sheeting, Shoring, and Bracing:

1. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all existing adjacent and neighboring structures and utilities from damage by settlement.
2. Sheeting, shoring and bracing shall be arranged so as not to place a strain on portions of completed Work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built Work and adjacent and neighboring structures and utilities.
3. Sheeting, shoring and bracing shall be removed or cut-off at the time of backfilling to avoid problems with finish grade or future excavation.

F. Construction Sheeting Left in Place:

1. The Contractor shall furnish, install, and leave in place, construction sheeting and bracing when specified or when indicated or shown on the Drawings.
2. Construction sheeting and bracing, placed by the Contractor to protect adjacent and neighboring structures and utilities, may be left in place if desired by the Contractor. All such sheeting and bracing left in place, shall be included in the cost for excavation.
3. Any construction sheeting and bracing which the Contractor has placed to facilitate his work may be ordered, in writing by the Engineer, to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of his responsibility under the Contract.

G. Removal of Water:

1. The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work and shall keep said excavations dry until the structures to be built or pipelines to be placed therein are completed. No water shall be allowed to rise over or come in contact with concrete or masonry until the concrete and mortar has attained a satisfactory set, except in cases where the concrete has been tremied into place with the approval of the Engineer. Water shall not be allowed to rise above the bottom of the bedding stone prior to placing pipe. In waterbearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation free of water and in compliance with government regulations.
2. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures and in compliance with all regulations.

### **3.04 TRENCH EXCAVATION**

- A. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed shall provide adequate space for workers to place and joint the pipe properly. The trench shall be kept to a minimum width. The width of trench at the top of the pipe shall comply with the limits specified or shown on the Drawings.
- B. Excavation shall be to the depth necessary for placing aggregate bedding material under the pipeline, sewer, conduits and other utilities as shown on the Drawings. If over excavation occurs, the trench bottom shall be filled to grade with compacted aggregate bedding material.
- C. The amount of trench open at any one time in advance of completed Work shall be limited to the minimum necessary for conducting laying operations.
- D. In general, backfilling shall begin as soon as the pipeline, sewer, conduits and other utilities are in a condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe condition.

### **3.05 EXCAVATION OF UNSUITABLE MATERIAL**

- A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as required by the Engineer. The Engineer may rely upon the independent laboratory retained on this Project when determining unsuitable soil conditions, removal and backfill. Such excavation shall be conducted at a time when the Engineer and independent laboratory are present and shall not exceed the vertical and lateral limits prescribed by both.
- B. The voids left by removal of unsuitable material shall be filled with special backfill, or CDF material or as prescribed by the independent laboratory and as approved and ordered by the Engineer. Special backfill or pipe bedding shall be installed as described in this Section and shall be compacted as specified in 3.08, C.

### **3.06 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL**

- A. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and materials excavated that are in excess of that required for backfilling and for constructing fills and embankments as shown on the Drawings, shall be disposed of by the Contractor at his expense and at sites provided by him as may be required, except that the Owner reserves the right to require the Contractor to deposit such surplus at locations designated by the Owner within a five-mile radius of the Work.
- B. No surplus excavated material of any class shall be deposited in any stream or watercourse or be dumped on public property without the consent of the Owner. All spoil areas shall be left smooth, level, with drainage to a water course and proper erosion and runoff control shall be used.

### 3.07 BACKFILL AND COMPACTION

- A. Pipe and Conduit Bedding - Unless otherwise directed, pipe, conduits and other utilities shall be installed in specified aggregate bedding material as shown on the Drawings and as specified.
- B. Backfilling Under Existing Pipeline, Sewer, Conduits and Other Utilities - Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with aggregate bedding material tamped in place in 6-inch layers to the required density. The aggregate bedding shall extend outward from the spring line of the conduit a distance of 2-feet on all sides and thence downward at its natural slope.
- C. Backfilling with Selected Backfill - Unless otherwise specified or directed, material excavated in connection with the Work may be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification for selected backfill. No material shall be used for backfilling that contains stones, rock, or pieces of masonry greater than 12 inches, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl. No large pieces of rock or masonry shall be deposited closer than 24 inches from the completed outside surface of any structure or pipe.
- D. Backfill Immediately - All trenches and excavations shall be backfilled immediately after completion of construction therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in unbackfilled excavation during construction or after pipe has been placed.
- E. House Leads and water services shall not be backfilled until the pipe ends are referenced and the Engineer has measured the pipe for payment from mainline to termination and photographed as needed.
- F. Backfilling around and over structures, pipelines, conduits and other utilities comprising the Work shall be carefully done by hand and tamped with suitable tools of approved weight when within 2 feet of structures, pipeline, conduit and other utilities. Selected backfill or, where specified, shown on Drawings, or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6 inches in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.
- G. Backfilling may be done by machinery after the backfill has been placed and compacted beyond 2 feet horizontally of structures, pipelines, conduits and other utilities and to a minimum depth of 1 foot above the tops of any buried structures, pipelines, conduits, and other utilities. The backfill material shall be deposited in horizontal layers, not thicker than one foot, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case, will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

- H. Backfilling Under Pavement and Walks - Where existing or new pavement, driveway, parking lot, curb and gutter, or walk is over an excavation, special backfill material shall be used to backfill the entire excavation from the bedding to surface. The material shall be placed and compacted to the required density in accordance with one of the following methods:
  - 1. The backfill material shall be deposited in 6-inch horizontal layers and each layer shall be thoroughly compacted to the proper density by approved compaction method before a succeeding layer is placed.
  - 2. No method of compaction which alters the gradation of the special backfill material or prevents compaction testing by standard testing methods shall be used.
- I. Backfilling with Controlled Density Fill Material (CDF) - Where called for on the Drawings, specified, or ordered, CDF material shall be used in lieu of special backfill or bedding material specified herein. Before placing CDF material, the Contractor shall take required measures to protect the Work against flotation.
- J. Backfilling Under Structures - Where structural slabs, mats or footings are to be placed on a backfilled area, special backfill material shall be used unless otherwise noted on the Drawings. The backfill material shall be placed in 6-inch horizontal layers and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. Where backfill is to be placed on undisturbed side slopes steeper than one vertical to six horizontal, steps shall be formed into the slope before each layer of the backfill is placed. These steps shall be cut vertically at no more than 2-foot intervals and shall have a horizontal dimension of not less than 3-feet.
- K. Prior to backfilling under structures, the natural subgrade shall be evaluated at regular intervals in each direction by the independent testing laboratory to determine that the subgrade can obtain the design bearing capacity given by the "Structural Design Data" table on the Drawings. If the subgrade cannot obtain the design bearing capacity then the testing laboratory shall submit a remedy to the Engineer for approval and for the Contractor to perform.
- L. Clay Trench Bulkheads - Where trenches are dug through areas of lateral groundwater seepage or in areas below the groundwater table, the Contractor shall, if required by the Drawings, construct bulkheads within the trench at ordered intervals. Bulkheads shall consist of native clay soil or other fines.

### **3.08 COMPACTION REQUIREMENTS**

- A. In areas to be filled, after the top 12-inches of soil is stripped, then the undisturbed subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D698 (Standard Proctor) prior to placing of fill.
- B. Backfill placed under areas receiving concrete slabs, mats, footings, or within the interior of buildings shall be compacted to not less than 100% of maximum dry density per ASTM D698.

- C. Backfill placed around structures where other structures, pipelines, or slabs are to be constructed shall be compacted to not less than 100% of maximum dry density per ASTM D698.
- D. The material used to construct embankments and fills in locations other than under pavements, walks, structures, or slabs and around and over pipelines, shall be compacted to not less than 95% of maximum dry density per ASTM D698.
- E. All other backfill, including backfill around and over pipelines, and backfill around structures not covered in Paragraphs B. and C. above, shall be compacted to not less than 95% of maximum dry density per ASTM D698.
- F. The bottom of excavations upon which concrete slabs or structures are to be placed shall be compacted to obtain 100% maximum dry density per ASTM D698 in the top 12 inches.
- G. All soil subgrade which will provide bearing support for pavements or curbs, shall be compacted to a width of 6 inches beyond the back of curb and to a depth of 12 inches below the bottom of excavation to a density of not less than 100% of maximum dry density per ASTM D698. All fill below the subgrade shall be compacted to not less than 98% of maximum dry density, unless specified otherwise.
- H. Subgrade under the driveways and walks shall be compacted to a depth of 6 inches below the subgrade surface to density of not less than 100% of the maximum dry density determined by ASTM D698.
- I. Subgrade under structures shall be compacted to a depth of 12 inches below bottom of excavation surface to a density of not less than 100% of the maximum dry density determined by ASTM D698.

### 3.09 COMPACTION TESTS

- A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.
- B. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.
- C. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

**3.10 RESERVED**

**3.11 RESERVED**

**3.12 SHAFT CONSTRUCTION**

- A. This paragraph covers construction of shafts; whether shown on the Drawings, required by governing agencies or desired by Contractor. Construction shafts and appurtenances are temporary structures and are considered as means and methods used by the Contractor in completing the Work and therefore, are the responsibility of the Contractor. The following describes the minimum requirements of the construction shafts.
1. Design, fabrication, and erection of shafts shall be in accordance with, but not limited to, the Bureau of Mines, OSHA, NFPA.
  2. Contractor shall comply with requirements of applicable permits and governing agencies.
  3. Shaft liners shall be utilized and material selection shall be Contractor's responsibility.
  4. The Contractor shall be responsible for any settlement of structures, utilities, street surfaces, railroad tracks; damage to structures, pavement, sidewalk, curbing surface improvements, or public and private utilities in the vicinity of the shaft and shall repair or have repaired any damage caused thereby.
  5. The excavation for the shaft shall be kept to the outside perimeter of the shaft liner or timbers and any voids that might occur due to over excavation, sloughing, rock displacement, etc. shall be filled with CDF, Grout or Class B concrete to avoid any settlement/shifting of the overburden.
  6. Pipes, conduits and their trenches (which can conduct water) discovered during excavation of shaft shall be redirected or relocated, permanently or temporarily, to avoid settlement, undermining of surrounding area and water infiltration into shaft.
  7. Drainage - The Contractor shall minimize groundwater entering the shaft by installing additional sheeting, grouting, or other methods as required to prevent movement of soil that may impact structures, utilities, street surface, railroad tracks, sidewalks, curb, or any other facilities in the vicinity. The Contractor shall furnish, install, and maintain all facilities for collecting, conveying, and disposing of water in shafts in an acceptable manner and in compliance with applicable regulations until the completion of the Work. The pumps and power supply to the pumps shall be the responsibility of the Contractor. Effective and continuous control of water during the placing of concrete will be required.
  8. Contractor shall design the shaft and appurtenances. Contractor's design of the shaft shall take into account additional loads that may be imparted on the shaft from construction equipment on the surface; lifting and hoisting; jacking and pushing operations, and adjacent structures.



9. Shaft size, if shown on the Drawings, is a recommendation based on the design intent. Should Contractor's operation require a shaft of a different size, it may be modified after reviewing it with the Owner and Engineer.
10. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings required for installation of pipe or structure. Concrete, reinforcement, and formwork requirements are specified in Division 3 of the specifications.
11. The Contractor shall have on hand at all times, sufficient machinery for emergencies that are likely to arise on Work of this character and such machinery shall be kept in good working order.
12. When operations within shaft or tunnel are not active, the shaft shall be covered or protected by fencing.
13. Contractor shall conduct operations and work as expeditiously as possible to minimize the length of time the shaft is open.
14. Ventilation - The Contractor shall keep the shaft air in a condition suitable for the health of the occupants. A sufficient supply of fresh air for the safety and efficiency of occupants shall be provided at all times. Ventilation shall also take into account the ventilation requirements of any spaces connected to the shaft such as tunnels.
15. Methods and procedures used shall conform to applicable OSHA standards including 29CFR Part 1926 Subpart S-Underground Construction, Caissons, Cofferdams, and Compressed Air.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 FIELD TESTING (MINIMUM REQUIREMENTS)**

- A. The laboratory shall perform the following field tests:
  1. Trench Backfill - One test for every 200 cubic yards of backfill material.
  2. Subgrade Compaction - One test for every 300 square yards of subgrade.
  3. If directed by the Engineer, additional tests shall be performed for any of the above.

##### **4.02 SITE GRADING**

- A. The site shall be graded to the elevation shown on the plans.
- B. Several landscape debris mounds exist on the site and the removal of landscape debris shall be performed prior to grading activities to avoid mixing landscape debris into the site grading.
- C. Existing topsoil may be stripped from the site and regraded as specified at the completion of the work.

**4.03 HAULING SPOIL MATERIAL**

- A. The Owner has not identified a site for the earth spoil material to be removed from the site.
- B. The Contractor shall identify a suitable site to haul the spoil material from this site.

**4.04 UNSUITABLE SUBGRADE MATERIAL**

- A. Known weak soils exist near the proposed invert of the wet well and the ground surface. The Contractor is reminded to review the soils report referenced in the Supplemental Conditions.
- B. Two pay items are provided for unsuitable soil remediation.
- C. The removal of spoil and landscape debris included in the project site preparation work shall not be measured as unsuitable material removal.
- D. The Owner reserves the right to require the Contractor to hire a licensed professional engineer in the State of Ohio to provide a professional recommendation regarding remedies for unsuitable materials encountered during the work. The Engineer provided by the Contractor shall be acceptable to the Owner. Payment for these services shall be made through the Allowance Item provided for such purposes.

**4.05 SUBGRADE SUPPORT MATERIALS FOR STRUCTURES**

- A. Geotextile Subgrade Stabilization / Separation Fabric shall be WINFAB 200B or approved equal in accordance with ODOT Item 712.09, Type D.
- B. Geogrid Subgrade Stabilization Material shall be Tensar TriAx TX160 geogrid or approved equal in accordance with ODOT Item 712.15.
- C. The subgrade support material shall be placed on the prepared subgrade surface in accordance with the manufacturer's recommendations.
- D. Subgrade support material will be installed in locations as directed by the Engineer.

**4.06 TEMPORARY ACCESS RAMP**

- A. The Contractor is expected to construct a temporary access ramp for the Wet Well construction.
- B. The excavation made for the access ramp may be backfill with excavated materials compacted to the requirements of 02200, 3.08, B (100-percent).

END OF SECTION

**SECTION 02550**  
**SANITARY SEWERS AND STORM SEWERS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing sanitary sewers and storm sewers.
- B. Reconstruction of existing sewers, house connections, and catch basin leads shall be in conformance with requirements of this Section.
- C. This Section shall include furnishing and installing all required pipe, bends or beveled pipe, tees, wyes, tee manhole base pipes, bulkheads and stoppers, jointing material, granular material for pipe bedding, concrete used for encasement or bedding, making watertight connections to existing and new sewers and existing manholes, catch basins and inlets, cleaning and testing sewers, removing temporary bulkheads, and other work incidental to the sewer installation unless specifically included under other Items.
- D. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating pipe and joint materials, physical dimensions, and joint details for each size, type, and class of pipe, fittings and specials furnished for the project compliance with specified standards.
    - b. Manufacturer's concrete design strength and reinforcing steel for RCP.
  - 2. Information for the Record:
    - a. Manufacturer's certification indicating that the pipe and joints meet specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.
    - b. Manufacturer's design calculations to verify basis of design.
    - c. Manufacturer's installation instructions.
    - d. The laboratory shall submit test certifications of pipe ordered tested under "Field Quality Control," of this Section.

## **PART 2 PRODUCTS**

### **2.01 SOLID WALLED PIPES**

- A. Polyvinyl Chloride Pipe (PVC):
  - 1. For pipe 15-inch diameter and smaller: Pipe, fittings, and jointing systems shall conform to ASTM D3034, except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall not exceed 35.
  - 2. For pipe 18 inch thru 24-inch diameter: Pipe, fittings, and jointing systems shall conform to ASTM F679 with a SDR 26 or PS 115 wall thickness.
  - 3. Joint systems shall be elastomeric seal (gasket) type. Seals shall conform to ASTM F-477 requirements. Joint materials and testing shall conform to ASTM D3212 requirements.
  - 4. All service connections shall be made using a wye and a bend. Tees shall be used only as directed by the Engineer. Tees and wyes shall be die cast or factory fabricated. All service pipe shall be SDR 35.
- B. Reinforced Concrete Pipe (RCP):
  - 1. Reinforced concrete pipe and specials for sewers other than sanitary or combined shall conform to ASTM C-76 Wall B (minimum) of classes designated on the Drawings.
  - 2. Reinforced concrete pipe joints shall conform to ASTM C-443 with gasket materials meeting the requirements of ASTM C-361.
  - 3. Reinforced concrete pipe for sanitary sewer shall be produced using a Type II (MS) cement in accordance with ASTM C-150.
  - 4. Reinforced concrete pipe shall be produced using Xypex C-1000 Admixture or approved equal.

### **2.02 RESERVED**

### **2.03 ACCESSORIES**

- A. Non-shrinking Mortar Material:
  - 1. Material for non-shrinking mortar used in pointing joints shall be Sauereisen F-100 Grout as manufactured by Sauereisen Cements Co., Pittsburgh, Pennsylvania; Five-Star Grout as manufactured by US Grout Corp., Old Greenwich, Connecticut; or equal.
- B. Flexible Pipe Repair Couplings:
  - 1. Flexible repair couplings shall be made of elastomeric polyvinyl chloride boot with series 300 stainless steel shield and clamps. Couplings shall be Strong Back RC series as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Logan Clay Pipe Co., Logan, Ohio; Mission Clay Products Corp., or equal.

- C. Flexible Watertight Joints:
  - 1. Flexible watertight joints used in connecting to existing sewers shall be a “boot” type sealed to the pipe wall with an internal expanding band and around the connecting pipe with an external adjustable band. Other types of applicable flexible joints may be submitted for approval.
- D. Granular Pipe Bedding Material:
  - 1. Granular pipe bedding material shall be as specified in Section 02200.

#### **2.04 REPLACEMENT DRAINS, SEWERS AND APPURTENANCES**

- A. Vitrified clay pipe sanitary sewers removed or damaged in completed the Work shall be replaced using pipe and joints as specified in this Section. Connections to existing sewers shall be as specified in this Section.
- B. Reinforced concrete pipe sanitary sewers removed or damaged in completing the Work shall be replaced using pipe meeting ASTM C76, Class IV, unless otherwise indicated and joints meeting ASTM C361. Reinforced concrete pipe storm sewers shall also be replaced with ASTM C76 Cl. IV RCP with joints equal to those of the pipe removed.
- C. Nonreinforced concrete pipe removed or damaged in completing the Work shall be replaced using pipe meeting ASTM C76 Class IV RCP.
- D. Driveway culverts removed or damaged in completing the Work shall be replaced with existing pipe, if undamaged, or new pipe and joints matching the existing, unless specified otherwise.

#### **2.05 RESERVED**

#### **2.06 SOURCE QUALITY CONTROL**

- A. Pipe Manufacturer’s Certification:
  - 1. The pipe manufacturer’s certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification and shall be signed by an authorized agent of the seller or the manufacturer.
  - 2. A test results report shall accompany that manufacturer’s certificate. The report shall compare test results to Specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION OF TRENCH**

- A. Trench excavation shall conform to requirements of Section 02200.
- B. For rigid pipes the width of trench at the top of pipe shall be as shown in the Trench Detail on the Drawings.
- C. Unless otherwise indicated minimum trench widths for flexible pipes shall meet the requirements of ASTM D2321 and the Trench Detail shown on the Drawings.
- D. Unless otherwise indicated all sewer trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of bedding material as shown on the Drawings and specified herein.

#### **3.02 RIGID PIPE INSTALLATION**

- A. Pipe trenches shall be excavated to the depth indicated on details to provide adequate depth of bedding and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Additional bedding material shall be placed and compacted in 6-inch layers to the height shown on the Drawings or as directed. Hand tampers shall be used for installing bedding material around pipes smaller than 36-inch diameter and mechanical hand tampers shall be used around pipes 36-inch diameter and larger unless otherwise directed by the Engineer. The remainder of the trench shall be backfilled as specified and called for on the Drawings.
- B. Concrete bedding and encasement in lieu of bedding material shall be installed as shown on the Drawings or specified.
- C. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. Pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings.
- D. Pipe shall be laid to lines and grades by use of a laser beam and checked in conformance with Section 01800. Pipes installed more than 0.04 feet above or below specified elevation shall be removed and reinstalled to grade.
- E. Where holes are cast in concrete pipe for handling, they shall be completely filled with non-shrinking mortar after the pipe is placed. A metal disc of proper size may be inserted near the bottom of the hole to retain the mortar until hardened. Wood plugs or rocks intended to plug the hole for retention of the mortar will not be permitted.

#### **3.03 FLEXIBLE PIPE INSTALLATION**

- A. Flexible pipe shall be installed in accordance with ASTM D2321. Bedding, backfill, and compaction shall meet the requirements of this Section and Section 02200.

- B. Concrete bedding and encasement in lieu of bedding material shall be installed as shown on the Drawings or specified.
- C. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. Pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings.
- D. Pipe shall be laid to lines and grades and checked in conformance with Section 01800. Pipes installed more than 0.04-feet above or below specified elevation shall be removed and reinstalled to grade.
- E. Temporary internal supports shall be used as recommended by the pipe manufacturer. Pipes with 48 inches or larger diameter shall have, as a minimum, struts temporarily inserted at the ends of the pipes. Struts shall be in the vertical position when the pipe is installed in the trench. Struts shall remain in place until after the trench has been completely backfilled.

#### **3.04 RESERVED**

#### **3.05 PIPE JOINTS**

- A. O-Ring and Chemically Welded Joints - Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.
- B. Flexible Plastic Gasket Joints - Materials used for gaskets shall be as specified in this Section. Cross section size of gaskets and method of installation shall conform to the manufacturer's recommendations.
- C. Non-shrinking Mortar Joints - Where specified or shown on the Drawings, joints of concrete pipe sewers shall be thoroughly pointed full inside circumference with a non-shrinking mortar in conformance with the material manufacturer's instructions. The mortar shall be tightly packed and the interior face of the joint shall be left smooth and continuous with the interior face of the pipe. Pointing shall not be done until the backfill over the pipe is placed and compacted.

#### **3.06 CONNECTIONS TO EXISTING SEWERS**

- A. Unless indicated otherwise new pipe connections through the side of existing sewers shall be made as follows:
  - 1. Vitrified clay pipe, plain concrete pipe, and asbestos cement pipe, 15-inch diameter and smaller, and larger diameter at the option of the Contractor, shall

be connected by removing a section of the existing sewer and inserting connecting fittings using specified flexible repair couplings.

2. Reinforced concrete pipe and larger sizes of asbestos cement pipe and plain concrete pipe, unless otherwise shown on the Drawings, shall be connected by coring the existing sewer pipe wall and inserting a flexible watertight joint to receive the new pipe.
3. Polyvinyl chloride pipe, ABS pipe, and ABS truss pipe shall be connected in conformance with the manufacturer's recommendations as approved by the Engineer.
4. Connections shall be made in conformance with the jointing materials manufacturer's recommendations and as directed by the Resident Project Representative.

### 3.07 FIELD QUALITY CONTROL

- A. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the Contractor's laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. The Contractor shall pay for tests on the first sample. Should the sample fail to meet specifications, retests shall be conducted by the Contractor's laboratory in conformance with the specifications and shall be at no additional expense to Owner.
- B. The pipe manufacturer may supply the most current test record for each pipe size to be used on project. The test record shall be no more than 1-year from the date of production of the pipe for this project. If the current test record is older than one year, a new test shall be run at the discretion of the Engineer.
- C. Deflection of PVC, PE and ABS Composite Piping Sewers:
  1. Vertical Ring Deflection - Before final acceptance of sewer lines, all sections of sewer pipe 8 inches and larger specified diameter shall be measured for vertical ring deflection by the Contractor and witnessed by the Resident Project Representative. Maximum deflection under full load shall not exceed 5% of the ASTM designated average inside diameter as determined by the laboratory for the specified piping.
  2. Failures - Should a pipe exceed the allowable deflection; the Contractor shall replace those pipes and retest the section.
  3. Equipment used in testing shall be go-no-go pull through gauges of a type approved by the Engineer. A metal or plastic gauging ring of diameter equal to 95% of the specified average inside pipe diameter shall be furnished with each gauge.
  4. The Contractor shall furnish testing equipment and personnel and perform the required tests. Tests must be witnessed by the Resident Project Representative.
  5. Use of mechanical pulling devices is not permitted.



6. Deflection testing shall not be performed until the completed and accepted trench backfill has been in place for at least 30 days.
- D. Field Inspection:
1. Individual sections of pipe may be rejected at any time because of defective joints, dimension variations, fractures, cracks, chips, or blisters exceeding the permissible tolerances.
  2. Rejected pipe shall be so marked with a lumber crayon or paint and shall be removed from the job site before the end of the following work day.

### 3.08 TESTS FOR INFILTRATION AND EXFILTRATION

- A. Preparation:
1. Before sections of sewers may be tested for infiltration or exfiltration, all house leads from it shall be constructed to limits called for and plugged or capped and all trenches backfilled and compacted to required minimum density.
  2. Sewers to be tested shall be clean and free from construction debris. Sand, dirt, concrete, or other materials shall be completely removed in a manner that will not damage the sewer pipe.
  3. Pipe joints shall be watertight. The Contractor shall repair manholes and pipe joints as required to stop leaks.
  4. Where sewers are above the groundwater table, the Contractor may flood the trench or air test the sewer to find and repair leaks prior to exfiltration tests.
  5. The materials and methods for repairing leaks shall be submitted to Engineer: for approval before beginning Work. Chemical grouting of pipes is not acceptable.
- B. Inspection:
1. After a sewer has been cleaned and all repairs made as specified, the sewer shall be inspected and approved by the Resident Project Representative before conducting infiltration or exfiltration tests. Sewers shall be approved before any connections are made to or final surface restoration can begin.
  2. Sewers shall be inspected using audio-video recording in accordance with the requirements of Section 01820.
  3. The Contractor shall furnish all lights, cameras, carts, television, and other equipment and labor required to audio-video record the new sewers or any repaired sewer.
  4. The Resident Project Representative may require the Contractor to conduct a television inspection of smaller sewers that appear defective or do not pass infiltration tests.
- C. Test Sections:

1. The maximum length of a sewer test for infiltration or exfiltration section shall be 900 lineal feet. Every manhole shall be included in one (minimum) test section.
2. The Contractor shall furnish and install bulkheads, sewer plugs, weirs, water level tubes, lighting, and other equipment required to conduct the tests in locations and as indicated by the Resident Project Representative.
3. Infiltration in accordance with ASTM C969:
  - a. Where the groundwater level is above the top of the pipe, the sewer shall be tested for infiltration.
  - b. The Contractor shall plug or bulkhead the sewer to isolate the test section and install a weir in the pipe at the outlet manhole. The weir shall be direct reading of an approved design calibrated to read gallons per day.
  - c. Where the groundwater level is below the top of the sewer pipe and the trench can be flooded and the level maintained above the pipe (minimum 2 feet of head at the highest point in the pipe being tested) for test period, the Contractor may test the pipe for infiltration.
4. Infiltration in accordance with ASTM C1103 (Precast Concrete Pipe)
  - a. Pipes 36-inches in diameter and smaller shall be vacuum tested at the factory. The Engineer may request to witness vacuum testing at the factory and should be notified 14 days in advance of the scheduled date for testing.
  - b. For precast concrete pipe with a diameter larger than 36-inches, the joint acceptance test per ASTM C1103 may be utilized. The proper joint gaps for the installed pipe shall be achieved by the installed pipe. Any joint gaps wider than the manufacturer's recommendations shall be pointed in the field with a nonshrink grout.
  - c. ASTM C1103 is only acceptable for use if the groundwater level (pressure) is equal to or less than the test pressure.
    - 1) If the groundwater level (pressure) is above the test pressure and the joint is not leaking, then the joint is acceptable in accordance with ASTM C969.
  - d. If groundwater level is below the test pressure test the joints in accordance with ASTM C 1103. Air or water are acceptable in accordance with industry practices and the ASTM C1103.
    - 1) The air pressure required for the test shall not exceed 5.0 psig.
5. Allowable Leakage:
  - a. The test in each section shall be continued for at least 24 hours and, if its measured leakage during that period exceeds 100 gallons per inch of diameter per mile of pipe, the Contractor shall locate the points of

leakage and make necessary repairs, continuing the Work until leakage is reduced to the permissible maximum as specified.

- b. The amount of infiltration allowed for storm sewers shall be limited to reasonable seepage, except that, if specified, the total in any section shall not exceed the amounts allowed for sanitary sewers as hereinafter specified.
  - c. All visible leaks shall be repaired whether they are less than the allowable leakage. Moisture or visible beads of water on a joint will not be considered a visible leak.
6. Repairs
- a. If a joint fails to achieve the required test pressure, acceptable methods may be chemical grout injection or the installation of a sectional liner.
  - b. The repaired joint may be retested if the repair method manufacturer warrants that the repair will not be damaged by the testing.

### **3.09 LOW-PRESSURE AIR ACCEPTANCE TESTS FOR PVC SEWER PIPES**

- A. The Contractor may perform low-pressure air acceptance tests for PVC Sewer Pipes 24 inches in diameter or smaller. Test shall be made in accordance with ASTM F1417-Plastic Gravity Sewer Lines; ASTM C924-Concrete (Circular) Sewer Pipe with Gasket.
  - 1. If the air pressure required for the test is greater than 5.0 psig, the low-pressure air acceptance test shall not be used.
- B. The Contractor shall furnish all equipment, materials, and labor, and conduct the tests under observation of the Resident Project Representative.
- C. Safety:
  - 1. The air test may be dangerous if the line is improperly prepared. All plugs shall be installed and braced in such a manner to prevent blowouts. No one shall be allowed in manholes during testing.
  - 2. Pressurizing equipment shall include a regulator set at the maximum pressure.
- D. Line Preparation:
  - 1. Sewers to be air tested shall be prepared and inspected as specified herein for infiltration and exfiltration tests.
  - 2. Where porous pipe materials are used, the pipe walls may be wetted to temporarily reduce the porosity of the material.
  - 3. All pipe outlets shall be plugged, braced, and the joints restrained adequately to prevent blowouts.
  - 4. Testing shall be performed prior to the connection of any lateral taps to the sewer segment.
- E. Test Procedure:

1. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater above the invert of the pipe.
2. When a constant pressure of 4.0 psig greater than the average pressure of any groundwater above the pipe is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes to permit temperature equalization.
3. When temperatures have been equalized and the pressure stabilized at 4.0 psig greater than the average back pressure of any groundwater above the pipe, the air supply shall be shut off or disconnected.
4. Decrease the pressure in the sealed line until the continuous monitoring pressure gauge reads 3.5 psig greater than the average back pressure of any groundwater above the pipe. When this pressure is reached, timing shall commence with a stop watch.
5. Determine the time, as shown on the stop watch, required for the pressure in the sealed line to drop 1.0 psig.
6. The time required for the pressure in the test section to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM F1417, the section fails. The table below has been reprinted from ASTM F1417 for Contractor's information.

Pipe Diameter, Inches	Minimum Time, Min.: Sec.	Length for Minimum Time, Feet	Time for Longer Length, Sec. (L=Ft)
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470L
24	22:40	99	13.674L

Note: Minimum time applied to all lengths less than or equal to the length shown.  
For more information, see ASTM F-1417, Table 1.

F. Air Pressure Adjustment for Groundwater:

1. In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately, 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the groundwater level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube.

2. The air pressure correction, for the groundwater pressure above the pipe, shall be calculated as follows: Subtract the average invert elevation from the measured groundwater elevation. Multiply the elevation difference by 0.433 psi/feet to compute the pressure difference. Add the pressure difference to the test pressures stated in the test procedure.

### 3.10 ADDITIONAL TESTING EXCEPTIONS, REQUIREMENT AND LIMITATIONS

- A. Low-pressure air tests are only required for new sanitary sewers installed between two manholes.
- B. Deflection and low-pressure air testing is not required for repair sections of sanitary or storm sewers.
- C. All new or repaired sections of sewers will be televised for acceptance in accordance with the requirements of Section 01820.
- D. The Contractor shall provide a means for directly measuring the groundwater elevation at the time of testing.

### 3.11 CLOSED CIRCUIT TELEVISION INSPECTION

- A. All new or repaired sewer sections shall be televised for acceptance in accordance with Specification Section 01810.

## PART 4 SPECIAL PROVISIONS

### 4.01 PIPE SCHEDULE

- A. The following letter designations are used in the Piping Schedule:

Material Designation:

DIP - Ductile Iron Pipe  
HDPE - High Density Polyethylene  
PVC - Polyvinyl Chloride  
RCP - Reinforced Concrete Pipe

- B. Storm Sewer Schedule

Size	Thickness Class	Material	Spec Section	Remarks
4" – 12"	SDR 35	PVC	2.01A	New Storm Sewers and Repairs to Existing Storm Sewers
All Others	As Specified	PVC	2.04	Repairs to Existing Storm Sewers
12"	Class IV	RCP	2.01 B	Type B locations

C. Sanitary Sewer Schedule

Size	Thickness Class	Material	Spec Section	Remarks
12"	SDR26	PVC	2.01A	Sanitary Sewer
48"	Class IV	RCP	2.01B	Sanitary Sewer
4" – 10"	SDR 35	PVC	2.01A	Drains

- D. Schedules are not guaranteed to be complete. All piping shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.

**4.02 TESTING REQUIREMENTS**

- A. Low-pressure air tests are only required for new PVC sanitary and storm sewers installed between two new manholes or structures. Storm sewer pipes that daylight shall be tested.
- B. Deflection and low-pressure air testing is not required for repair sections of sanitary or storm sewers.
- C. All new or repaired sections of sewers and culverts will be televised for acceptance in accordance with the requirements of Section 01820.
- D. Concrete sanitary sewers shall be tested for leakage using one of the methods listed in Section 3.09.

END OF SECTION

**SECTION 02551  
PRECAST CONCRETE STRUCTURES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing precast concrete structure sections of types and at locations shown on the Drawings and scheduled.
- B. This Section includes removing existing structures, additional excavation to widen and deepen trenches for structures construction, furnishing and installing concrete of indicated strength, portland cement mortar, reinforcing steel, precast concrete integral base sections, bottom riser sections, transition sections, and riser sections, flat slab tops and grade rings, pipe opening with flexible pipe connections, pipe for drop connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, forming channels through bottoms, making watertight connections to new and existing sewers, and other work incidental to construction and testing.
- C. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, joint details, reinforcing steel, and layout for each size and type of structure(s) components furnished for the project.
    - b. Manufacturer's certification indicating that the precast structure components and joints meet specifications for each production run for each size and type furnished.
  - 2. Information for the Record:
    - a. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Structural Design
  - 1. Provide structural design calculations and drawings sealed by a professional engineer registered in the state where the project resides.
  - 2. Design structures to withstand the lateral forces induced by exterior soil and interior water pressures. Interior water elevation shall be taken at the top of the

structure. Exterior soil pressure shall include AASHTO H20 vehicle surcharge pressure and hydrostatic pressures from groundwater and floodwater.

3. Design top slab to support the specified loads in PART 4.
4. Design bottom slab to withstand groundwater and floodwater buoyancy pressures.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS OR PRODUCTS OR EQUIPMENT**

- A. Precast concrete sections, integral base sections, and flat slab tops shall be designed by an Engineer licensed in the state of the project and conforming to ASTM C913 and ASTM C890. The design shall be adequate to support traffic or non-traffic loads as specified in Part 4.
- B. All joints in the walls and bottom of precast tanks and vaults shall be tongue and groove type with a preformed butyl rubber joint sealant placed in the joint prior to assembly of the joint. This joint material shall provide a permanent flexible non-shrinking watertight seal and shall meet the requirements of ASTM C990. After assembly of the joint, a 12-inch-wide band of permanent flexible water barrier wrap shall be applied to the exterior surfaces centered on all wall joints and any buried top slab joints. This barrier wrap shall meet the requirements of ASTM E1745, C877, and C990. The barrier wrap shall be bonded to the concrete with a brush or roller applied adhesive surface primer formulated for use with the barrier wrap material.
- C. There shall be no opening or penetration within 6 inches of any joint on precast structure. Section heights shall be adjusted as required.
- D. Precast integral base and top sections shall be of monolithic construction.
- E. Holes required in the structure shall be cast and formed during fabrication. Field cutting of holes is not permitted without Engineer's approval.
- F. Additional concrete reinforcing steel and dowels shall be installed as shown on drawings to resist the buoyant forces. Concrete shall be as specified below.

### **2.02 ACCESSORIES**

- A. Manhole Steps - Manhole Steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod. Steps shall be M. A. Industries Model PS-1, or equal.
  1. Specified manhole steps shall be factory installed to provide a continuous ladder of 16-inch Center-to-Center rung spacing. Steps shall be placed in the forms and cast in wall or placed immediately after removal from casting and carefully mortared in place with non-shrink mortar to insure a watertight joint. Step installation shall be in compliance with OSHA regulations. If the outer surface of the wall is pierced the patch shall be completely covered with a bituminous sealer.



- B. Manhole frames and covers shall be as shown on the Drawings and in conformance with requirements of Section 05540.
- C. Floor doors shall be the size and type as shown on the Drawings and as specified in Section 08320.
- D. Mortar:
  - 1. Mortar used for the structures herein specified shall conform to ASTM C270 Type S, containing no masonry cement. The mortar shall be composed of one-part portland cement to two parts sand by volume.
  - 2. Non-shrinking Mortar - Materials for non-shrinking mortar shall be Sauereisen F-100, Five-Star, or equal.
- E. Cast-in-Place Concrete:
  - 1. All cast-in-place concrete used for forming channels in structure bottoms shall be Class A as specified in 03300.
  - 2. All concrete used for supporting precast concrete structure bases shall be Class B as specified in 03300.
- F. Flexible Joints - Joints for precast pipe openings shall be "Res-Seal" type as manufactured by Price Brothers Company, "Kor-n-seal" as manufactured by National Pollution Control Systems, Inc., or equal.
- G. Wall Sleeves shall be used as indicated on the drawings and in conformance with Section 15210.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Location and type of precast concrete structure installed shall be as shown on the Drawings or directed.
- B. Construction shall be in conformance with details shown on the Drawings and as specified.
- C. Excavation for structure construction shall be prepared as specified, shown on the Drawings and as directed in Section 02200.

#### **3.02 INSTALLATION OF INTEGRAL BASE SECTIONS**

- A. Base sections shall be placed on a minimum 6-inch thick bedding material under the entire area of the structure base. Bottom sections placed on bedding shall be a minimum of 6 inches thick. Base section shall be level and plumb. Structures that are not plumb and level shall be removed and reset as specified.

#### **3.03 FORMING STRUCTURE BOTTOMS**

- A. The bottoms of all structures shall be channeled or fillets placed as shown on the drawings to conduct flow in the planned direction.

### **3.04 PRECAST CONCRETE RISER SECTIONS**

- A. Sections 32 inches in height or less shall be incorporated into the structure immediately below the top.
- B. Structure joints shall be pointed and lifting holes filled with non-shrink nonmetallic mortar.

### **3.05 INSTALLATION OF CASTING FRAMES AND COVERS**

- A. Frames and covers shall be installed to grades shown on the Drawings or as directed.
- B. Adjustment of castings shall be made using specified precast grade rings and portland cement mortar joints or preferred bitumen seals.
- C. Each pressure tight manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.
- D. The maximum depth of adjustment below any manhole casting shall be 16 inches and the minimum depth of adjustment shall be 4 inches.
- E. In concrete pavement, separate frame from pavement with 1/2-inch-thick premolded mastic joint material extending from the base of the frame to the top of the frame.

### **3.06 FLOOR DOORS**

- A. Contractor shall coordinate with precast manufacturer to have floor doors cast as an integral part of the top section with proper coatings at metal/concrete interface. Provide drain piping as needed for floor door channels.

### **3.07 FIELD QUALITY CONTROL**

- A. Field Inspection:
  - 1. Individual sections may be rejected at any time because of defective joints, dimension variations, fractures, cracks, honeycombing, chips, or blisters exceeding the permissible tolerances as set by ASTM C913.
  - 2. Rejected sections shall be so marked with a lumber crayon or paint and shall be removed from the job site before the end of the following work day.
- B. Correction of honeycombing, chips, blisters and filling lifting holes shall not be performed without prior approval from the engineer.
- C. Field cutting of the precast sections shall not be performed without prior approval from engineer.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 ACCESSORIES**

- A. Flexible Joints - Joints for precast pipe openings shall be "A-LOK X-CEL" as manufactured by A-LOK Products, Inc., "Kor-n-seal" as manufactured by National Pollution Control Systems, Inc., or equal in accordance with ASTM C923.
- B. Pipe for Manhole Drops - Pipe for manhole drops shall conform to specifications of Section 02550 for the required size and type shown on the Drawings.
- C. Sewer Drop Bowls shall be as specified in Section 066882.
- D. Joint Wrap - Polyolefin backed exterior joint wrap used to cover the exterior side of joints shall be ConSeal CS212; Riser Wrap by Pipeline Seal & Insulator, Inc. or equal. Minimum width shall be 12 inches. Joint wrap shall include the use of brush or roller applied adhesive surface primer formulated for use with joint wrap. Seal shall meet the requirements of ASTM E1745, C-877, and ASTM C990.
- E. Chimney seal shall be applied to the exterior of all manholes and shall cover the joint at iron casting, adjusting ring and lap over manhole riser/top section. Seal shall be HDPE heat shrink as manufactured by Pipeline Seal & Insulator, Inc. (Riser-Wrap) and CCI Pipeline System (Wrapid Seal), or equal.
- F. Chimney seals which are installed on the interior of manholes will not be acceptable.
- G. The specified accessories shall be used for existing structures to be modified as well as new structures included in this project.

### **4.02 CONCRETE ADMIXTURES**

- A. Crystalline Waterproofing Admixture
  - 1. The Contractor shall provide crystalline waterproofing admixture to precast concrete sanitary sewer manholes sections as indicated on the drawings and as specified herein.
  - 2. The admixture shall be Xypex Admix C-500 or C-1000 (reduced set) or approved equal. Requests for equal materials shall demonstrate the same or superior performance to the specified materials.
  - 3. Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction, and shall protect the concrete from deterioration due to harsh environmental conditions.
  - 4. The manufacturer of the crystalline water proofing shall provide the type of material and the dosage rate for the application. Admixture must be added to concrete mix at time of batching. The actual dosage in the mix design shall be certified at the time of application.

5. Manufacturer shall coordinate with the concrete batch facility and other admixture suppliers to ensure compatibility with the concrete mix design, other admixtures and concrete properties. The addition of the crystalline water proofing shall not reduce the concrete strength or compromise the ASTM specifications or other quality standards governing the concrete mix.
6. The admixture shall include a red oxide colorant to permit visual inspection of the cured precast section.
7. Concrete containing Xypex Admix shall be moist cured in accordance with ACI Reference 308, "Standard Practice for Curing Concrete."

#### 4.03 LADDER SAFETY POST

- A. Furnish and install a ladder safety post in the precast meter chamber structure at the location shown on the plans. The ladder safety post shall be pre-assembled from the manufacturer for installation by the precast manufacturer or the Contractor.
- B. Performance Characteristics:
  1. Tubular post shall lock automatically when fully extended.
  2. Safety post shall have controlled upward and downward movement.
  3. Release lever shall disengage the post to allow it to be returned to its lowered position.
  4. Post shall have adjustable mounting brackets to fit manhole rung spacing up to 14" (356mm) on center and clamp brackets to accommodate manhole diameter.
- C. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
- D. Material of construction: Aluminum.
- E. Balancing spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.
- F. Hardware: All mounting hardware shall be Type 316 stainless steel.
- G. Finishes: Factory finish shall be safety yellow powder coat steel.
- H. Manufacturer shall be Bilco Company (LU-1) or approved equal. Equals will be considered based upon equal performance and usage capabilities.

#### 4.04 PRECAST STRUCTURE SCHEDULE

Description	Loading	Top	Admixtures	Protective Coatings	Access
Meter Chamber	300 psf	Flat	None	None	Floor Doors
MH1 Base Section	See Plans & Specifications	Flat	Section 4.02	See 02552.4.02	Manhole Barrel Sections Per Section 02252

796-7552.002  
2021

Northwestern Water & Sewer District  
Ford Road Pump Station Improvements

Description	Loading	Top	Admixtures	Protective Coatings	Access
-------------	---------	-----	------------	------------------------	--------

END OF SECTION



**SECTION 02552  
PRECAST CONCRETE MANHOLES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing precast concrete manholes, including drops and manhole stacks of types and at locations shown on the Drawings and scheduled.
- B. This Section includes removing existing structures, additional excavation to widen and deepen trenches for manhole construction, furnishing and installing concrete of classes called for, portland cement mortar, reinforcing steel, precast concrete pipe integral base sections, bottom riser sections, transition sections, and riser sections, eccentric cones, flat slab tops and grade rings, flexible manhole connections, pipe for drop connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, joint wrap installing, forming channels through manhole bottoms, making watertight connections to new and existing sewers, and other work incidental to manhole construction and testing.
- C. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, pipe openings, precast section arrangement, adjusting rings, castings, and joint details for each size and type of manhole components furnished for the project. Shop Drawing shall incorporate the planned elevations and details.
    - b. Manufacturer's certification indicating that the manhole components and joints meet specifications for each production run for each size and type furnished.
  - 2. Information for the Record:
    - a. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Buoyancy Design

1. Manufacturer shall submit buoyancy design calculations adequate for water levels as shown in the soils report for all manhole structures. The calculations shall be signed and sealed by a professional engineer licensed in the state where the project resides.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Type of Manhole Sections:
  1. Manhole Stacks - Manhole stacks shall mean 4-feet diameter manholes used for access to reinforced concrete manhole chambers and precast manhole riser tee sections.
  2. Type I Manholes - Type I manholes shall mean 4-feet diameter manholes with precast integral base sections for sanitary sewers and either precast integral base sections or precast bottoms for storm sewers. Pipe connections to manholes shall be made with flexible water tight joints. Type I manholes are intended for installation of pipes 18-inch diameter and smaller unless noted otherwise.
  3. Type II Manholes - Type II manholes shall mean manholes with 5-feet diameter precast integral base sections. Pipe connections to manholes shall be made with flexible water tight joints. Type II manholes are intended for installation of 21-inch through 30-inch diameter pipes unless noted otherwise.
  4. Type III Manholes - Type III manholes shall mean manholes with precast integral base sections or precast bottoms that are larger than 5-feet diameter. The diameter of the bottom riser sections shall be as shown on the Drawings. Pipe connections to manholes shall be made with flexible water tight joints. Type III manholes are intended for installation of pipes where the additional wall area is needed for installation on flexible joints and of 36-inch through 48-inch diameter pipes unless noted otherwise.
  5. Type IV Manholes - Type IV manholes shall mean manholes with cut-outs in the bottom riser sections installed on cast-in-place or precast concrete bases. The diameter of the bottom riser sections shall be as shown on the Drawings. Pipe connections above bottom riser section shall be made with flexible water tight joints. Type IV manholes are intended for installation on sewers 48-inch diameter and larger and on existing pipes where identified on Drawings.
  6. Type S Manholes - S following manhole type shall mean the designated type manhole constructed with a precast flat slab top in lieu of a precast cone.
- B. Precast concrete pipe manhole sections, integral base sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM C 478. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.



- C. Joints shall be tongue and groove type with a gasketed seal type conforming to ASTM C443.
- D. The standard length of riser sections shall be 48-inch. Lengths of 32-inch or 16-inch shall be used to meet required dimensions and as specified.
- E. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be pre-formed or cored by the manufacturer, except "cut-out" openings may be made in bottom riser sections for Type IV manholes. Cut-out openings shall be made immediately after the pipe is removed from the casting form. All cored openings for sewer pipe connections shall have flexible joints.
- F. Precast integral base sections shall be of monolithic construction. Base flat slab floors or integral floors shall have a minimum thickness of 6-inch for risers up to and including 48-inch in diameter and 8-inch for larger diameters. A layer of reinforcement shall be placed above the midpoint, and shall have a minimum area of 0.12 square inch/linear feet in both directions.
- G. Manhole sections shall be constructed with no pipe connection within 6 inches of a joint in the structure.
- H. Manhole sections shall be clearly marked and identified with the manhole number, section placement order, casting date, trademark, name of the manufacturer, and location of the production plant.

## 2.02 CONCRETE ADMIXUTRES

- A. Crystalline Waterproofing Admixture
  - 1. The Contractor shall provide crystalline waterproofing admixture to precast concrete sanitary sewer manholes sections as indicated on the drawings and as specified herein.
  - 2. The admixture shall be Xypex Admix C-500 or C-1000 (reduced set) or approved equal. Requests for equal materials shall demonstrate the same or superior performance to the specified materials.
  - 3. Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction, and shall protect the concrete from deterioration due to harsh environmental conditions.
  - 4. The manufacturer of the crystalline water proofing shall provide the type of material and the dosage rate for the application. Admixture must be added to concrete mix at time of batching. The actual dosage in the mix design shall be certified at the time of application.
  - 5. Manufacturer shall coordinate with the concrete batch facility and other admixture suppliers to ensure compatibility with the concrete mix design, other admixtures and concrete properties. The addition of the crystalline water

proofing shall not reduce the concrete strength or compromise the ASTM specifications or other quality standards governing the concrete mix.

6. The admixture shall include a red oxide colorant to permit visual inspection of the cured precast section.
7. Concrete containing Xypex Admix shall be moist cured in accordance with ACI Reference 308, "Standard Practice for Curing Concrete."

## 2.02 ACCESSORIES

- A. Manhole Steps - Manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod. Steps shall be M. A. Industries Model PS-1, or equal.
- B. Specified manhole steps shall be factory installed to provide a continuous ladder of 16-inch Center-to-Center rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with non-shrinking mortar to ensure a watertight joint. Manhole step installation shall be in compliance with OSHA regulations. If the outer surface of the pipe wall is pierced the patch shall be completely covered with a bituminous sealer.
- C. Manhole frames and covers shall be as shown on the Drawings and in conformance with requirements of Section 05540.
- D. Mortar:
  1. Mortar used for the structures herein specified shall conform to ASTM C270 Type S, containing no masonry cement. The mortar shall be composed of one-part portland cement to two parts sand by volume.
  2. Non-shrinking Mortar - Materials for non-shrinking mortar shall be Sauereisen F-100, Five-Star, or equal.
- E. Cast-in-Place Concrete:
  1. All cast-in-place concrete used for concrete bases and for forming channels in manhole bottoms shall be Class A as specified in Section 03300.
  2. All concrete used for supporting precast concrete manhole bases shall be Class B as specified in Section 03300.
- F. Reinforcing Steel - Reinforcing steel used in cast-in-place concrete shall meet the requirements of Section 03200.
- G. Flexible Joints - Joints for precast pipe openings shall be "A-LOK X-CEL" as manufactured by A-LOK Products, Inc., "Kor-n-seal" as manufactured by National Pollution Control Systems, Inc., or equal in accordance with ASTM C923.
- H. Pipe for Manhole Drops - Pipe for manhole drops shall conform to specifications of Section 02550 for the required size and type shown on the Drawings.
- I. Joint Wrap - Polyolefin backed exterior joint wrap used to cover the exterior side of joints shall be ConSeal CS212; Riser Wrap by Pipeline Seal & Insulator, Inc. or equal.

Minimum width shall be 12 inches. Joint wrap shall include the use of brush or roller applied adhesive surface primer formulated for use with joint wrap. Seal shall meet the requirements of ASTM E1745, C-877, and ASTM C990.

- J. Chimney seal shall be applied to the exterior of all manholes and shall cover the joint at iron casting, adjusting ring and lap over manhole riser/top section. Seal shall be HDPE heat shrink as manufactured by Pipeline Seal & Insulator, Inc. (Riser-Wrap) and CCI Pipeline System (Wrapid Seal), or equal.
- K. Chimney seals which are installed on the interior of manholes will not be acceptable.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Location and type of manholes installed shall be as shown on the Drawings or directed.
- B. Construction shall be in conformance with details shown on the Drawings and as specified.
- C. Excavation for manhole construction shall be prepared as directed in applicable paragraphs of Section 02200.

#### **3.02 INSTALLATION OF INTEGRAL BASE SECTIONS**

- A. The manhole base may be placed on 6 inches compacted granular bedding material.

#### **3.03 INSTALLATION OF BOTTOM RISER SECTIONS (WITHOUT INTEGRAL BASE)**

- A. Unless otherwise called for on the Drawings or directed, precast bottom riser sections shall be placed with cast-in-place reinforced concrete bases.
- B. The base shall be of Class A concrete 12-inch thick minimum placed on undisturbed earth or a minimum 6-inch-thick aggregate stone cushion. Reinforcing shall be as shown on the Drawings.
- C. The cut-out riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section. The sewer pipe shall be bedded in concrete monolithic with the base to the first joint each way from the manholes.
- D. On straight runs the Contractor may carry the pipe through the manhole and break out the top half after the fill concrete has set. In all cases the pipe shall extend through the manhole wall to the inside face.

#### **3.04 CHANNELING MANHOLE BOTTOMS**

- A. The bottoms of all manholes shall be channeled to conduct flow in the planned direction. The channel walls shall be formed or shaped to the full height of the crown of

the outlet sewer in such a manner to not obstruct maintenance of flow in the sewers and shall match inverts of connection pipe at the manhole wall.

- B. Manholes which do not have integral base or channels precast with base section, as approved by Engineer, shall have channels formed and placed in the field with Class A concrete.

### **3.05 PRECAST CONCRETE RISER SECTIONS**

- A. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the eccentric cone section or the flat slab top.
- B. Riser section joints shall be pointed and lifting holes filled with non-shrinking mortar.
- C. Riser section exterior joints shall be wrapped and sealed with joint wrap as specified herein. Concrete shall be primed a minimum of two times. The first coat shall be allowed to fill concrete depressions and bug holes. Contractor shall follow manufacturer recommendations.
- D. Contractor shall protect joint wrap from damage during back filling and other related work.

### **3.06 INSTALLATION OF MANHOLE FRAMES**

- A. Manhole frames and covers shall be installed to grades shown on the Drawings or as directed.
- B. Adjustment of manhole castings shall be made using specified precast grade rings and portland cement mortar joints or preferred bitumen seals.
- C. Each manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.
- D. The maximum depth of adjustment below any manhole casting shall be 16 inches and the minimum depth of adjustment shall be 4 inches.
- E. In concrete pavement, separate frame from pavement with 1/2-inch thick premolded mastic joint material extending from the base of the frame to the top of the frame.
- F. Manhole castings located in pavement areas shall be installed with the top of the casting 1/4 inch below the finished grade of the adjacent pavement surface.

### **3.07 CHIMNEY SEAL**

- A. Installation of chimney seal shall be after casting has been adjusted to final grade. Chimney seal shall cover all joints at manhole top including, but not limited to, iron casting, adjusting rings and manhole riser.
- B. Chimney seal shall be installed per manufacturer recommendations. Chimney seal shall provide a water tight seal.

### 3.08 MANHOLE TESTING

- A. Each manhole shall be tested in accordance with ASTM C1244 'Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.' in the presence of the Engineer
- B. All lift holes shall be plugged with an approved non-shrink grout before testing.
- C. All pipes entering the manhole shall be plugged and braced to prevent being drawn into the manhole.
- D. Testing shall be by drawing a vacuum on the manhole using equipment specifically designed for such testing. A test head with necessary gauges and connections shall be placed at the inside of the top of the cone section and sealed in accordance with the manufacturer's instructions. A vacuum of 10 inches of mercury shall then be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop to 9 inches. The test shall be successful if the time measured is greater than the required time based on the following chart:

	Diameter (in)				
	48	60	72	84	96
Depth (ft.)	Time (sec.)				
<4	10	13	16	20	23
6	15	20	25	29	34
8	20	26	33	39	45
10	25	33	41	48	56
12	30	39	49	58	67
14	35	46	57	67	78
16	40	52	67	77	89
18	45	59	73	86	100
20	50	65	81	96	111
22	55	72	89	105	122
24	59	78	97	115	133
26	64	85	105	124	144
28	69	91	113	134	155
30	74	98	121	143	166

- E. If the test is unsuccessful, necessary repairs shall be made and retesting shall proceed until a satisfactory test is obtained.
- F. If a manhole is constructed of different diameters, the largest diameter shall be used to determine the time required for testing.
- G. The Contractor may perform testing after completely backfilling the manhole, and the following modification to the testing procedure shall be followed.
  - 1. Determine depth of water table and depth of manhole being tested.
  - 2. Using above depths, calculate the hydrostatic head above the lowest manhole connection.
  - 3. Adjust test pressure according to the following table:

External Hydrostatic Head (ft)	≤12	13	14	15	16	17	18	19	20	21	22
Vacuum Pressure (in Hg)	10	9	8	7	6	5	4	3	2	1	0

4. If hydrostatic head above the lowest manhole connection is equal to or greater than 22 feet, vacuum testing must be completed before backfilling.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 MANHOLE VACUUM TESTING**

- A. Vacuum testing is required for new manhole sections installed as part of the Work.
- B. Vacuum testing is not required for the doghouse style manhole

##### **4.02 MANHOLE PROTECTIVE COATING**

- A. Contractor to provide a protective coating to existing precast concrete manholes as indicated on the Drawings and as specified herein.
- B. The system should cause the precast concrete manhole to become sealed against the penetration of liquids from any direction, and shall protect the precast concrete from deterioration due to corrosive wastewater environments.
- C. The protective coating is intended to provide infiltration and corrosion protection. Acceptable protective coatings are as follows:
1. OBIC Products – OBIC Armor 1000F
- D. The manhole sealant protective coating system shall consist of a spray-able multi-component (layer) flexible-sealant, solvent free modified polymer or VOC free two component polyurea that chemically and permanently fills voids in concrete and damaged bricks within the manhole structure.
- E. The manufacturer of the protective coating shall provide the type of material and dosage for the application. The installation equipment provided by the manufacturer shall be specifically designed for the actual dosage amount to apply the liner system.
- F. Manhole Installation Procedure:
1. The Contractor shall monitor the atmosphere for hydrogen sulfide, methane, low oxygen or other gases. The Contractor shall provide approved flow control equipment, surface preparation, and installation and testing equipment.
  2. Preparation and Cleaning of Interior Surfaces - The Contractor shall clean all interior surfaces to be free of grease, loose bricks, mortar, unsound concrete and other materials by water blasting, wet or dry sandblasting, acid washing or other mechanical methods as approved by the Engineer. The Contractor may be required to employ degreasers or concrete cleaners to properly prepare the manhole interior surface to receive the manhole primer and liner material. Following the cleaning, the manhole interior surfaces shall be thoroughly rinsed to remove any residue from the cleaning operation. The manhole interior

surface shall be dried and at a proper temperature to receive the primer and liner material.

3. Manhole Patching - all non-leaking holes, missing bricks, missing mortar, unsound concrete, delaminated concrete, cracks and spalls shall be repaired, repointed or filled using a pre-mixed, non-shrink, cement based patching mortar consisting of hydraulic cement, graded silica aggregates, polymer, special plasticizing and accelerating agents formulated specifically for vertical or overhead use. The manhole patching material shall contain no chlorides, gypsums, plasters, iron particles, aluminum powder or gas forming agents and shall not promote corrosion of steel that the grout material may come into contact with.
  - a. Set time - less than 30 minutes per ASTM C191.
  - b. One hour compressive strength - minimum of 200 psi per ASTM C109.
  - c. Ultimate compressive strength - minimum of 5,000 psi per ASTM C109.
  - d. Bond strength - minimum of 1,700 psi per ASTM C882.
  - e. Patching materials shall be compatible for use with the protective coating system.
4. Manhole Grouting – All leaking holes, missing bricks, missing mortar, cracks or joints shall be grouted as specified in Section 02772.
5. Flow Bypassing - The Contractor shall provide all required flow bypassing around the manhole to be rehabilitated. The bypass shall be constructed by plugging the sanitary sewer upstream of the manhole and pumping flow into a downstream manhole or as approved by the Engineer. The pump and bypass piping shall be adequate capacity to handle the flow from the upstream sewer.
6. After completion of surface preparation, the Contractor shall perform the seven-point check list, which is the inspection for leaks, cracks, holes, exposed rebar, ring and cover condition, invert condition, and inlet and outlet pipe connection.
7. The Contractor's liner application procedures shall conform to recommendations of the manufacturer, including materials handling, mixing, environmental controls during application, safety and spray equipment. The liner shall be applied to entirety of the interior surfaces of the manhole including chimney, walls and benches.
8. Spray equipment shall be specifically designed to accurately ratio and apply the liner system.
9. Application of multi-component liner system shall be in strict accordance with manufacturer's recommendation. Acceptance of the liner shall be based upon the specified thickness. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.
  - a. Final installation of the polyurea coating shall be a minimum of 500 mils.

- b. The final installation of the calcium aluminate, fiber reinforced, wet shotcrete material shall be as recommended by the manufacturer.
- 10. The Contractor shall provide a final written report to Owner and Engineer detailing the location, date of report, and description of repair.
- 11. **The Contractor shall be aware of the 21-days cure time required prior to the application of OBIC to the interior of the new manholes. The curing time shall be included in the Contractor's project schedule for the work.**
- G. Protective Coating Limits:
  - 1. Protective Coatings for manholes shall be applied from the manhole frame down to the manhole bench.
  - 2. Invert channels need not be lined.

END OF SECTION



**SECTION 02555  
PRESSURE PIPE**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing pressure pipe of the materials, class, size, and length as shown on the Drawings, specified, or directed.
- B. Pressure pipelines constructed under this Section shall include but not be limited to water mains and sewer force mains.
- C. This Section shall include furnishing and installing all required pipe, fittings, specials, adaptors, closure pieces, tees, bends, joint restraints, granular pipe bedding material, concrete used for encasement or bedding, removing and relaying existing pressure pipe as required, providing temporary services and temporary blocking or harnessing, making connections to new and existing pressure pipe, installing temporary bulkheads and plugs, testing pipe, cleaning and sterilizing water mains, and other work incidental to the pressure pipe installation, unless specifically included under other Items.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawing indicating physical dimensions, joint details, fittings, and special details for each size, type, and class of pipe furnished for the project. Shop Drawings shall also note salient features of a specific pipe, i.e., concrete strength and reinforcing details.
  - 2. Information for the Record:
    - a. Manufacturer's certification indicating that the pipe and joints meet Specifications for each production run for each size, type, and class of pipe furnished.

**1.03 PRODUCT HANDLING**

- A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.

## PART 2 PRODUCTS

### 2.01 PRESSURE PIPE SPECIFICATIONS

- A. Ductile Iron Pressure Pipe (DIP):
1. Ductile Iron Pressure Pipe shall conform to ANSI A21.51 or AWWA C151 and shall be pressure class 350 psi for sizes 12-inch and below, and pressure class 300 psi for larger sizes unless otherwise specified herein.
  2. Pipe buried underground, unless otherwise specified, shall be jointed with rubber gasket (push-on) type joints and shall meet the requirements of AWWA C111 for push-on joints. The gasket shall be a single molded rubber ring fitted into a specially shaped recess in the bell forming a pressure tight seal. The spigot end of each pipe shall be marked to indicate when the pipe is "home."
  3. Ductile Iron pipe shall be used for all water mains larger than 16-inches in diameter up to 24-inches in diameter.
  4. Internal restrained bell joints, wherever shown or required, shall be mechanical joint with retainer glands, US Pipe TR Flex Joint System, US Pipe Field LOK Gasket System, or equal.
  5. Interior Coating
    - a. Force Mains
      - 1) Pipe interiors shall be lined on the interior of the pipe with Protecto 401 ceramic epoxy coating or approved equal.
      - 2) Pipes lined with ceramic epoxy coatings shall be labeled "for sewer only."
      - 3) Epoxy ceramic coatings are not recommended for sewers where chemical injection is planned.
      - 4) Lined pipes shall be handled from the exterior of the pipe only. Minor damage to the epoxy coating may be repaired in the field in accordance with the liner manufacturer.
      - 5) Major damage to the liner that cannot be repaired in the field shall result in the pipe segment being rejected and returned to the factory for recoating.
      - 6) Lined pipe using Field Lok or internal joint restraints shall not be homed to the bell shoulder to avoid damage to the liner.
  6. Exterior Coating - All buried ductile iron pipe shall be coated on the outside with a standard petroleum asphaltic coating, 1 mil thick, meeting AWWA C110, unless otherwise specified. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe. The coating materials, after drying 48 hours, shall impart no objectionable color, odor, or taste to water standing in contact with the coating for a minimum of 48 hours.

7. Where approved, the petroleum asphaltic material specified for interior lining may be used for exterior coating of pipe buried underground.
  8. Bronze wedges shall be used at all push-on joints (two per joint). The wedge shall be driven into the push-on joint to provide electrical conductivity between pipes
- B. Polyvinyl Chloride Pipe (PVC):
1. Medium Diameter – 4-inches to 16-inches
    - a. PVC pipe 4 inches to 12 inches in diameter shall meet the requirements of AWWA C900 or AWWA C909, and unless otherwise specified, shall be Pressure Class 235 (C909).
    - b. PVC pipe 14-inch diameter and larger shall meet the requirements of AWWA C909 and unless otherwise specified shall have a standard thermoplastic pipe dimension ratio (D.R.) of 18 or less.
    - c. Pipe OD shall be equivalent to ductile iron pipe OD for the same nominal pipe size.
    - d. Pipe shall have integral bell push-on type joints meeting the requirements of ASTM D3139.
    - e. Joints for pipe shall be push-on gasket style. Gaskets shall meet the requirements of ASTM F477 for high-head (50 feet of head or higher) applications.
    - f. Restrained Joints, where required or shown, shall meet the requirements of the UNI-Bell Plastic Pipe Association Performance Standard UNI-B-13, similar to EBAA Iron Sales, Inc., Series 2000 PV for mechanical joints and Series 1500 for push-on joints.
- C. RESERVED

## 2.02 PRESSURE PIPE FITTINGS

- A. Ductile Iron Pipe Fittings:
1. All Ductile Iron Pipe, PVC or PVCO pressure pipe shall utilize Ductile Iron Pipe fittings with mechanical joints as specified in this section.
  2. Mechanical joint fittings shall be ductile iron and conform to ANSI A21.10 or AWWA C110 and ANSI A21.53 or AWWA C153. All fittings shall have a pressure rating of 250 psi for all pipe sizes unless otherwise specified.
  3. Fittings shall have mechanical joints with retainer glands unless otherwise specified or shown. Retainer glands shall be ductile iron. The restraining mechanism shall impart multiple wedging actions against the pipe. Restraining devices shall be of heat treated ductile iron. Twist-off nuts shall be used to ensure proper actuation of the restraining device. The mechanical joint retainer gland shall be Ebac Iron, Inc., Series 1100 Megalug, or equal.

4. Mechanical joints
  - a. Mechanical Joints shall conform to ANSI A21.11 (AWWA C111), except as specified herein.
  - b. The mechanical joint retainer gland shall be Ebaa Iron, Inc., Series 1100 Megalug, or equal
  - c. Mechanical couplings, if required or permitted, shall be Dresser Style 38, or equal.
5. Bell Restraints
  - a. For new PVC Pipe Bell restraints shall be EBAA Iron Series 2800 Restrain Harnesses or approved equal.
  - b. For new Ductile Iron Pipe bell restraints shall be EBAA Iron Series 1700 MEGA Lug Harnesses or approved equal.

Split ring harnesses may be used on existing pipes where joint restraints are to be added, but split ring type harnesses are not permitted on new pipe installations.

## 2.03 ACCESSORIES

- A. Nuts and bolts for buried pipe shall be as follows:
  1. Nuts and bolts used in wall castings shall be of stainless steel Type 316.
  2. Nuts and bolts encased in grout on concrete pressure pipe shall conform to recommendations of the pipe manufacturer.
  3. Nuts and bolts used on buried pressure pipe and fittings in contact with earth shall be Cor-Blue coated low alloy steel and have a minimum yield strength of 45,000 psi complying with ANSI A21.11 and AWWA C111.
  4. All other nuts and bolts shall be low carbon steel in conformance with the chemical and mechanical requirements of ASTM A307, Grade B. Higher strength bolts will be acceptable.
- B. Tracing Wire shall be installed on all pipe.
  1. Direct Burial No. 12 AWG Solid (0.0808-inch diameter), 21% conductivity copper-clad annealed high carbon steel high strength tracer wire, 1150-pound average tensile break load, 45 mil, high molecular weight, high density polyethylene jacket complying with ASTM D1248, 30 volt rating. SoloShot™ extra high strength No. 1245 as manufactured by Copperhead Industries, LLC, or equal. Wire shall be secured to the pipe with tape at intervals not to exceed 10 feet.
    - a. Tracer wire installed on pipe by horizontal directional drilling shall be continuous without any splices.
    - b. Heat shrink splices are permissible only on tracer wire at pipe connection.

2. Tracer wires shall terminate inside all structures including but not limited to, air relief structures, valve box assemblies, indicated on plans. Tracer wire shall extend 4-feet above the opening on structures.
3. Tracer wire shall be tested for continuity after installation and considered acceptable when a continuous read is obtained between terminals.
- C. Utility Markers and Locator stations shall be installed as noted in Part 4 and on the drawings.
  1. Utility Markers shall be flexible above ground, impact resistant, UV stabilized fiberglass Reinforce composite material. Utility markers shall be a minimum of 3-3/4 inches wide and 66 inches long. Color shall be integral to the material and selected by the Owner.
  2. Locator stations shall be impact resistant, UV stabilized, and fiberglass reinforced composite material, 3 inches in diameter. Locator stations shall have a polycarbonate cap assembly with brass or stainless-steel terminal board for tracer wire. The cap assembly color shall be selected by the Owner.
  3. Utility markers and locator stations shall have a 3-inch-wide by 13-inch-long label readable from 100 feet. Label color shall be selected by the Owner. The wording of the label shall be as specified in Part 4.
  4. A polypropylene identification tape marked "buried sewer" shall be installed 24 inches above all water mains installed by open-cut methods. The tape shall be blue.

#### **2.04 POLYETHYLENE ENCASEMENT FOR DUCTILE IRON PIPE AND FITTINGS**

- A. Buried ductile iron pipe and fittings shall be encased in a loose wrapping of polyethylene film at the time of installation. The polyethylene material and method of installation shall meet the requirements of AWWA C105/A21.5.

#### **2.05 SOURCE QUALITY CONTROL**

- A. Pipe Manufacturer's Certification:
  1. The pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification and shall be signed by an authorized agent of the seller or the manufacturer.
  2. A test results report shall accompany the manufacturer's certificate, if requested by the Engineer. The report shall compare test results to Specification requirements.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Construction in Highway Properties

1. Construction in highway properties shall conform to the requirements of Section 02200.

### **3.02 PREPARATION OF TRENCH**

- A. Trench excavation shall conform to requirements of Section 02200.
- B. Unless otherwise specified or called for on the Drawings, the width of trench at the top of pipe 24 inches in diameter or less shall not exceed the outside diameter of the pipe or encasement, plus 9 inches on each side of the pipe measured to the face of the trench or to the back of the sheeting when used. For pipe having a diameter greater than 24 inches, the width of trenches at the top of the pipe shall not exceed the outside diameter of the pipe or encasement, plus 15 inches on each side of the pipe measured as specified above.
- C. Unless otherwise directed or called for on the Drawings, all sewer trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the Drawings.

### **3.03 PIPE INSTALLATION**

- A. All pipe fittings and specials shall be laid in accordance with the manufacturer's instructions, with AWWA C600, and as supplemented herein.
- B. Precautions shall be taken during construction to protect the pipe interiors, fittings, and valves against contamination. Pipe interiors shall be thoroughly cleaned of dirt and foreign matter before laying, by brushing, swabbing or other method approved by the Engineer, and means shall be provided to prevent entry of dirt during the progress of installation. Groundwater shall be kept out of the pipe at all times.
- C. Bedding and Backfilling:
  1. Bedding and backfilling shall be in conformance with Section 02200.
  2. At joints, enough depth and width shall be provided to permit working entirely around the pipe as needed to make the joints in the proper manner.
- D. Handling and Cutting:
  1. Suitable tools and appliances for cutting, handling, and laying of the pipes and special castings shall be used and care shall be taken to prevent damage to pipe coatings.
  2. Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The finished cut must be approved by the Engineer.
- E. Pipe Laying:
  1. Pipe and appurtenances shall be installed true to line, grade, and location; with joints centered, spigots home; pipe properly supported and restrained against movement; and all valve stems plumb.

2. All elbows, tees, plugs, etc., shall be properly anchored, blocked, or otherwise restrained to prevent movement of the pipe in the joints due to internal or external pressure.
  3. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug to the approval of the Engineer before leaving the Work for the night, and at other times of interruption of the Work. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.
- F. Pipe Jointing:
1. Gaskets - Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. The pipe is then forced "home" firmly and fully. In its final position, the joint between the pipes shall not be deflected more than 1/2 inch at any point.
- G. Anchoring Pipe:
1. Disjointing hydrostatic pressure at bends, plugs, tees, and wyes shall be counteracted by thrust blocks, restrained joints, or reinforced concrete anchorage as directed on the Drawings or specified.
  2. Thrust blocks shall be installed only where directed or specifically called for on the Drawings, unless otherwise specified. Installation shall be in conformance with Drawings.
  3. Approved joint restraints shall be installed in locations shown or scheduled on the Drawings.
  4. Reinforced concrete joint anchorage shall be installed in conformance with the Drawings.

### 3.04 PIPE PROTECTION

- A. Detectable marking tape shall be installed in the trench of each non-metallic pipe. The tape shall be installed directly above the force main at the depth recommended by the manufacturer. The tape shall extend the full length of the force main, and shall be imprinted with a continuous warning message repeated at least every 36 inches. The warning message shall state that a sewer line is buried below. The tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. The lamination bond shall be strong enough that the layers cannot be separated by hand. The tape shall be inductively located and conductively traceable using a standard pipe and cable locating device.

- B. Utility markers and locator stations shall be installed with 42 inches to 48 inches above ground.

### **3.05 FIELD INSPECTION**

- A. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered installed shall be removed and replaced with a sound one in a manner satisfactory to the Engineer at the Contractor's expense.
- B. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.

### **3.06 PRESSURE AND LEAKAGE TESTS**

- A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all lines unless otherwise directed by the Engineer.
- B. Tests shall be conducted on all pipelines or valved sections thereof as directed by the Engineer. Testing of pipelines laid in embankments or bedded in concrete shall be done prior to backfilling or placing concrete cover unless otherwise permitted by the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set. A maximum of 1,000 feet of pipe may be included in a test section. All valves shall be tested for leakage.
- C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The test pressure shall be maintained two hours minimum and additional time as required for thorough inspection to find any leaks or defects in the force main and appurtenances. The test pressure shall be 100 pounds per square-inch. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.
- D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water added to the pipe under test to maintain the required test pressure for a specified time.
- E. Pressure testing shall be performed in accordance with AWWA C600 and C605.

### **3.07 RESERVED**

## **PART 4 SPECIAL PROVISIONS**

### **4.01 UTILITY MARKERS/LOCATORS**

- A. Utility Markers or Location Station shall be installed along pipeline at all bends and valves.
- B. Utility Markers and Locator Stations labels shall have the following wording on the labels. "SANITARY"



#### 4.02 PIPING SCHEDULE

- A. The following letter designations are used in the Piping Schedule:

Material Designation:

DIP - Ductile Iron Pipe  
PVC - Polyvinyl Chloride

- B. Schedule:

Service	Size	Pressure Class Thickness Class	Material	Remarks
Force Main	16-inch	PC235	PVC	Open-Cut Construction (unless specified otherwise)
Force Main	16-inch	300	DIP	Open-Cut Construction under and to within 5-feet of the Pump Station Control Building

- C. Schedules are not guaranteed to be complete. All piping shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.
- D. This section applies to buried pipe only. See Section 15210 for flanged pipe inside structures.

#### 4.03 TESTING

- A. A pressure test at 100 psi is required for all new force main between the plug valves in the pump building to the proposed tapping valve.

#### 4.04 PERMANENT AND TEMPORARY BLOWOFFS/TAPS

- A. The Contractor shall provide all blowoffs and taps as necessary to properly exhaust air from test sections, flush and disinfect the new pressure pipe system.

#### 4.05 PRESSURE PIPE ELEVATIONS

- A. Elevations shown on the plans shall be checked as specified in this Section.
- B. Any deviation in the pipe elevations shall be brought to the Engineer's attention to permit the Engineer to evaluate the impact upon air release mechanism placements.

#### 4.06 PIPE FITTINGS

- A. Pipe fitting interiors shall be lined on the interior of the pipe with Protecto 401 ceramic epoxy coating or approved equal.

END OF SECTION



**SECTION 02557  
VALVES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing valves, valve boxes, floor boxes, extension stems, and appurtenances as specified, shown on the drawing.
- B. Valves in hydrant assemblies are included in this Item.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
  - 2. Drawings for Review:
    - a. Manufacturer's assembly drawings and parts list including model number and materials of construction.
  - 3. Information for the Record:
    - a. A certificate of compliance with AWWA C509, or AWWA C504 shall be submitted, if required by the Engineer.
    - b. Certification of NSF approval.

**PART 2 PRODUCTS**

**2.01 GATE VALVES**

- A. Gate valves shall be cast iron or ductile iron body, bronze mounted, AWWA C-509 or C 515 resilient seat, non-rising stem type with mechanical joint ends. Gate valve shall be Mueller A-2361, Mueller A-2362, Kennedy C-509 or C-515.
- B. Valves shall be furnished with an O-ring seal incorporating two rubber O-ring seals.
- C. Valves shall be designed for 200 psi working pressure and shall be shop tested at 300 psi pressure, with the pressure held on the valve for at least one minute.
- D. Valves shall open as specified with an arrow indicating the direction for opening. Wrench nuts shall be 2-inch square.
- E. Iron parts shall be painted before leaving the shop with two coats of acceptable high grade bituminous paint or epoxy paint.
- F. Bolts and nuts on buried valves 304 stainless steel or approved equal.
- G. Disc shall be rubber encapsulated ductile iron.

**2.02**

**2.03 RESERVED**

**2.04 RESERVED**

**2.05 INSERTING VALVE AND VALVE BOX**

- A. Inserting valves shall be full-body ductile iron castings. Inserting valves shall be RW Gates as manufactured by TEAM. All nuts, bolts and other metal hardware used on inserting valves shall be 316 stainless steel. Valves shall open in the counterclockwise direction.
- B. Inserting valves shall operate to fully shut off the flow in existing water mains.

**2.06 RESERVED**

**2.07 RESERVED**

**2.08 ACCESSORIES**

- A. Valve Boxes:
  - 1. All buried valves shall be provided with valve boxes. Valve boxes shall be standard, three-piece screw type, cast iron adjustable boxes, with tops of boxes set flush to finished grade. Valve boxes shall not be less than 5 inches in diameter and shall have a minimum thickness at any point of 3/16 inch. The cover shall have cast thereon an appropriate name for the kind of service for which the valve is used.
  - 2. A valve box shall be provided for each curb stop. At least three keys shall be furnished to operate curb stops.
  - 3. All parts of valve boxes, bases, and covers shall be coated by dipping in bituminous varnish.
  - 4. Extension stems shall be provided for buried valves when the operating nut is more than 5 feet below finished grade. Extension stem shall extend operating nut to within 16 inches of the ground surface, shall be provided with spacers which will center the stem in the valve box, and shall be equipped with a 2-inch square wrench nut. Extension stems shall meet the requirements of this Section.
- B. Extension Stems and Stem Guides:
  - 1. Unless otherwise specified, each extension stem shall be made of cold-rolled steel material and the same size as the valve stem of the valve it operates. Stem guides shall be made of cast iron and fully adjustable. The guide block shall be

bronze brushed where it contacts the extension stem. Stem guides shall be as manufactured by the Eddy Valve Co., Rodney Hunt, or equal.

2. All valves which are to be operated by tee-wrench shall have 2-inch square operating nut at the top of the extension stem.
3. Stems for operation of plug valves shall not be less than 1-1/4-inch diameter Schedule 80 galvanized steel pipe with intermediate steady guides. Weld socket for 2-inch valve nuts to bottom of extension stems and pin sockets to nuts with stainless steel plated 3/8-inch bolts. Provide a permanent lever or a 2-inch square operating nut at top of stems, in accordance with requirements of Drawings.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

A. Gate Valves:

1. Valves shall be installed in their respective positions, free from distortion and stress. Connecting joints shall be as specified in Section 02555.

B. Accessories:

1. Valve Boxes shall be installed in a plumb position and in alignment with the operating nut.
2. Extensions stems and stem guides shall be in alignment with operating nut and prevent binding and stresses on connecting pins.
3. When there is a change to the grade elevation, valve boxes new and existing shall be adjusted to the new grade elevation.

#### **3.02 INSERTING VALVES**

- A. The Contractor shall field verify the location and diameter of all existing water mains scheduled to receive an inserting valve.

### **PART 4 SPECIAL PROVISIONS**

#### **4.01 VALVES IN STRUCTURES**

- A. This section applies to buried valves specified with Mechanical Joint connections.
- B. See Schedule in Section 15250 for valves installed inside structures.

#### **4.02 EXTENSION STEMS**

- A. Extension stems shall be provided for all valves located more than 5-feet below final grade.

**4.03 VALVE OPENING DIRECTION**

- A. Valves shall open in accordance with the District's Specifications.
- B. The Contractor shall note that not all valves required for this work open in the same direction. District's Specifications shall be consulted.

**4.04 TAPPING SLEEVES AND VALVES**

- A. Tapping valves shall be Mueller T-2361, T-2362 or approved equal meeting the material requirements of gate valves as listed in section 2.01 of this specification.
- B. Tapping valves shall open in the counter-clockwise direction.
- C. Tapping valves 16-inches in diameter and larger shall be provided with a bevel-gear operator.
- D. Tapping sleeves shall be Mueller H-304 stainless steel tapping sleeve with test plug or approved equal.

END OF SECTION

**SECTION 02600  
PAVEMENTS, CURBING AND WALKS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the construction of sidewalks, curbing pavements, and berms of various designated types as shown or scheduled on the Drawings, specified or directed.
- B. This Section includes preparation of the base and subgrade construction of walks, curbs, pavements and base courses, adjustment of manhole castings, and valve boxes to conform to new pavement courses, and other work and materials incidental to the construction of pavements, curbing and walks.
- C. Existing curbs and walks of stone or concrete shall be replaced using concrete.
- D. This Section includes temporary and restoration of permanent pavement markings as they exist at the time of bidding unless otherwise shown on the Drawings, specified or directed.

**1.02 RESERVED**

**1.03 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturers' and suppliers' material certificates.
    - b. A sieve analysis (ASTM C136) shall be furnished for each material source.
  - 2. Information for the Record:
    - a. Delivery tickets from the asphalt and aggregate suppliers shall be given to the inspector at the unloading site. Tickets shall include (as a minimum) name of source, date, type of material, and weight.
    - b. Test results and certificates.

**PART 2 PRODUCTS**

**2.01 AGGREGATE BASE AND SURFACE COURES**

- A. The aggregate shall meet the requirements of ODOT Item 304 and Item 411, respectively.

**2.02 RESERVED**

**2.03 TACK COAT**

- A. The tack coat shall meet the requirements of ODOT Item 407.
- B. The tack coat material shall be RS-1 or SS-1, SH-1h, or CSS-1h, and shall meet the requirements of ODOT Item 702.04.

**2.04 RESERVED**

**2.05 ASPHALT CONCRETE BASE, INTERMEDIATE AND SURFACE COURSES**

- A. Bituminous Material - The asphalt cement shall meet the specified performance grade (design temperature) and shall meet the requirements of ODOT Item 702.01.
- B. Aggregate - The aggregate shall meet the requirements of ODOT Items 301.02 and 703.04 for asphalt concrete base and ODOT Item 703.05 for asphalt concrete.
- C. Design Mixes
  - 1. Bituminous aggregate base mix shall meet the requirements of ODOT Item 301.
  - 2. Asphalt concrete mix for intermediate course shall meet the requirements of ODOT Item 441.
  - 3. Asphalt concrete mix for surface course and overlays shall meet the requirements of ODOT Item 441.

**2.06 CONCRETE (CAST-IN-PLACE)**

- A. All concrete used for pavement, curbing driveways and sidewalk shall be as specified in ODOT Item 499 and 452.
- B. Reinforcing steel and dowel bars shall be as specified in ODOT Items 709.09, 709.10, 709.12, and 709.13
- C. Other materials required for placing concrete shall be as follows:
  - 1. Rubber-Asphalt Joint Sealer:
    - a. Hot Applied Sealer - ODOT Item 705.04.
  - 2. Preformed Elastic Joint Sealer - ODOT Item 705.11.
  - 3. Preformed Filler - ODOT Item 705.03:
    - a. Fiber Filler - ASTM D1751 (AASHTO M213).
    - b. Sponge Filler - ASTM D1752, Type I (AASHTO M153, Type I.
  - 4. Curing Materials:
    - a. Burlap Cloth - ODOT Item 705.5 (AASHTO M182, Class 2).



- b. Sheet Materials - ODOT Item 705.06.
- c. Transparent Membrane - ODOT Item 705.07 (ASTM C309 Type I Class B).
- d. White Membrane - ASTM C309 Type II Class B as modified by ODOT Item 705.07.

## **2.07 PAVEMENT MARKING**

- A. Contractor shall provide temporary and permanent pavement markings equal to those markings that existed on the paved surfaces prior to commencement of the Work unless otherwise shown on the Drawings, specified in Part 4, or directed.
- B. Pavement markings shall be in accordance with the requirements of ODOT Section 640.
- C. Pavement markings shall match existing or adjoining pavement markings.
- D. Pavement markings partially disturbed by construction shall be replaced entirely.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. All soil subgrade under pavements, driveways, curbs, curb and gutter, and walks shall be compacted in accordance with Section 02200.
- B. All service boxes, manholes, inlets and other structures shall be adjusted or reconstructed to the required grades in both new and resurfacing pavement areas.

### **3.02 PAVEMENT INSTALLATION**

- A. All construction shall be in conformance with applicable portions of ODOT Specifications, except as otherwise specified or called for herein.
- B. Unless otherwise directed by Engineer all aggregate bases which are to receive bituminous courses shall be primed as specified.
- C. A tack coat at a rate as specified shall be applied to all existing pavements which are to be overlaid, and between subsequent courses when directed by the Engineer.

### **3.03 TRANSITION JOINTS FOR BITUMINOUS CONCRETE PAVEMENT OVERLAY**

- A. Types of Transition Joints:
  - 1. Transition joints shall be either butt type or feathered type as directed by the Engineer.
  - 2. Butt joints shall be used on State and Federal roads and main thoroughfares and feathered joints used elsewhere unless otherwise specified.
  - 3. Butt Joints:

- a. When a butt joint is called for on the Drawings or specified, the old surface shall be cut back for at least 3 feet to a depth of at least 1 inch for the full width of the joint and pavement installed.
- b. A bituminous seal shall be placed on the finished surface at the junction of the new and old pavements.
- 4. Feathered Joint:
  - a. Feathered joints shall be constructed by manually raking the paving material to a smooth transition from the full depth material to the existing pavement surface.
  - b. Existing pavement surface shall be bond-coated to include the transition area.
  - c. Feathering shall be done by a workman skilled in the operation and shall be approved by the Resident Project Representative.

### **3.04 CURBING**

- A. Curbing shall be constructed in conformance with applicable portions of ODOT Item 609 and the ODOT Standard Construction Drawings.
- B. Place 1-inch dowelled expansion joints at inlets and at spring lines of street and driveway returns. If intersecting streets and driveways are more than 300-feet apart, place expansion joints at 300-foot intervals.
- C. Contraction joints shall be placed at approximately 10-foot intervals.

### **3.05 CONCRETE SIDEWALK**

- A. Sidewalk shall be constructed in conformance with applicable portions of ODOT Item 608.
- B. Unless otherwise indicated on the Drawings, concrete sidewalks shall be a minimum of 4-feet-0-inch wide and 4-inch thickness of concrete. Concrete walk removed and replaced shall be equal to the section removed.
- C. The surface of the walks shall be divided into equally spaced blocks at approximately 5-foot intervals. Expansion joint filler 1/2-inch thick shall be installed between the walk and any fixed structure, at all changes in direction or shape and at intervals of 20-feet maximum. The expansion joint filler shall be 1-inch thick where the walk is installed against the back of curb. The filler shall be recessed 1/2-inch from top of finished surface.
- D. Surface of new sidewalks shall be broomed to slightly roughen surface. On sections of sidewalk to be replaced, the surface texture shall match the adjoining.

### **3.06 CONCRETE DRIVEWAYS**

- A. Concrete driveways shall be constructed in conformance with applicable portions of ODOT Item 452.

- B. Dowelled contraction joints shall be placed at a maximum spacing of 20-feet. Lesser spacing shall be used on irregular areas as directed by the Engineer.
- C. Expansion joint filler 1/2-inch thick shall be installed at intervals of 24-feet maximum. One-inch expansion joint filler shall be installed between the driveway and any fixed structure.

### **3.07 BITUMINOUS AND AGGREGATE DRIVEWAYS**

- A. Bituminous driveways and parking lots shall be constructed as shown on the Drawings and indicated in Part 4 using materials specified for asphalt concrete pavements. Placement shall be in accordance with ODOT Item 401.
- B. Aggregate driveways and parking lots shall be constructed as shown on the Drawings using base aggregate meeting the requirements of ODOT Item 411.
- C. Replacement of bituminous or aggregate driveways and parking lots shall conform to Section 01565 and this Section but in no case, be inferior to that being replaced.

### **3.08 RESERVED**

### **3.09 INSPECTION**

- A. Laboratory services shall be in accordance with the requirements of Section 01410 and shall include:
  - 1. A compaction test on the subgrade, aggregate base, and each layer of asphalt shall be performed for every 300 square yards of material placed.
  - 2. Asphalt Concrete:
    - a. Quality Control Testing - A sample of the mix shall be taken for each 200-cubic yard of bituminous material or fraction thereof delivered to the project. An extraction test AASHTO T164-70 and a mechanical analysis AASHTO T30-70 shall be performed on the mix samples.
  - 3. Cast-in-Place Concrete:
    - a. The following tests shall be performed by an independent testing laboratory acceptable to the Engineer during progress of the work:
      - 1) Compression Tests Cylinders – Strength test shall consist of three cylinders molded and cured. Cast three cylinders for each 50 cubic yards, or fraction thereof, for each class of concrete placed on any one day, but at least three for each day. Test one cylinder at seven days and two at 28 days in accordance with ASTM C39.
      - 2) Slump Tests – ASTM C143. Slump shall be measured for first batch of each concrete class delivered in morning and afternoon, for each strength tests, and whenever consistency of concrete appears to vary.

- 3) Air Entrainment – ASTM C173 or C231. Perform one test for every second ready mix truck load.
- 4) Temperature – ASTM C1064. Perform with each slump test.

### 3.10 PROTECTION

- A. No heavy construction vehicle shall operate on any pavement, curbing or walk after it has been installed.
- B. Traffic shall be prohibited on newly installed asphalt pavement until it has cooled sufficiently to avoid marking.
- C. Asphalt Pavements:
  1. Bituminous mixtures shall be transported and placed in accordance with ODOT Item 401
- D. Concrete Pavements, Curbing and Walks:
  1. Concrete shall be mixed, transported, placed, and finished in accordance with the temperature and environmental requirements of ODOT Item 451 or 452 depending on the pavement type being placed.
  2. No concrete shall be mixed, transported, placed, or finished when the temperature of the base, subgrade, or air is below 40 degrees F or whenever, in the opinion of the Engineer, the temperature may fall below 40 degrees F within 24 hours after the concrete has been placed.
  3. The Contractor shall take such precautions as are necessary to protect the concrete from rain.
  4. The Contractor shall protect the concrete from freezing for no less than seven days or until such time that specimen beams have attained a modulus of rupture of at least 600 psi.

## PART 4 SPECIAL PROVISIONS

### 4.01 PROOF ROLLING OF NEW PAVEMENT AREAS

- A. Prior to the completion of roadway excavation down to the bottom of the subgrade material, the Contractor shall proof roll the subgrade to identify areas of weak subgrade materials. Proof rolling shall be performed in accordance with ODOT Item 204 unless an alternate method is approved by the Engineer.
- B. The presence of weak subgrade locations shall be marked by the Engineer. The Engineer may require additional excavation of the weak soils or the installation of a subgrade support material.
- C. Compensation for the additional excavation and backfill shall be measured and paid in accordance with the provided bid items.

**4.02 ROADWAY SUBGRADE SUPPORT MATERIAL**

- A. Subgrade support material shall be Tensar TriAx TX130S or approved equal. Equal materials shall meet the requirements of ODOT CMS 712.15.
- B. The subgrade support material shall be placed on the prepared subgrade surface in accordance with the manufacturer's recommendations.
- C. Subgrade support material will be installed in locations as directed by the Engineer.
- D. See Specification Section 02200 for support materials for structures.

**END OF SECTION**



**SECTION 02710  
FENCING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing of all materials, equipment, labor, and supervision necessary for the installation of new fencing as shown on the Drawings and to replace fencing damaged during construction in accordance with the Contract Documents.
- B. All work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturers' recommendations.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with all requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's product literature.
    - b. Materials of Construction.

**1.03 PROJECT HANDLING**

- A. Materials, including but not limited to post, barb wire, and fence fabric, shall be handled and stored in accordance with the manufacturer's recommendations and in such a manner as to prevent any damage to the finish coating.

**PART 2 PRODUCTS**

**2.01 FENCE FABRIC**

- A. Fence fabric shall be 2-inch mesh of carbon steel wire and shall be galvanized after weaving in accordance with ASTM A392 Class II or aluminum-clad in accordance with ASTM A-491 Class II.
- B. Wire shall be 9 gauge on 6-foot fabric and 9 gauge on 4-foot fabric.
- C. PVC-coated fences shall be galvanized materials and chemically cleaned. The PVC material shall be fused and bonded to the steel mesh.
  - 1. A minimum of 7 mils of black color compound shall be applied to the materials. Coating application shall be as recommended by the manufacturer.
- D. Fence fabric shall be attached to all post rails and tension wires with 12 gauge tie wire at a maximum of 15-inch centers. Tie wire shall be aluminum or galvanized steel.

**2.02 FENCE POST AND RAILS**

- A. Line posts shall be galvanized 2-3/8-inch O.D. Standard Schedule 40 Steel pipe with PVC Black Coating.
- B. Fencing 4 feet in height or less shall be provided with a top rail.

1. Top rails shall be galvanized 1-5/8-inch O.D. Standard Schedule 40 Steel pipe.
- C. Fencing greater than 4 feet in height shall be provided with a tension wire, in lieu of the top rail, unless otherwise specified in Part 4.
  1. Tension wire shall be 9 gauge braided wire rope stainless steel or galvanized. Tension wire shall support fence fabric taut to prevent fabric from sagging.
- D. Tension wire shall be provided at the bottom of the fence fabric on all fence systems, unless bottom rail is provided.
  1. Tension wire shall be 7 gauge braided wire rope stainless steel or galvanized.
  2. Bottom rails shall be identical to the top rails.
- E. Ends, corners, and pull posts shall be galvanized 2-7/8-inch O.D. Standard Schedule 40 Steel pipe.
- F. Posts for swing gates shall be sized by fence gate manufacturer for the gate width specified.
- G. All terminal, corner, and gate posts shall be braced to the next post using a brace rail and a galvanized 3/8-inch truss rod with tightener.

## **2.03 GATES**

- A. All gates shall be the same height as the adjacent fence. Barbed wire shall be included on all gates where the adjacent fence system has barbed wire installed.
- B. Gates shall be constructed on 1.90-inch O.D. (larger if required for strength) tubular steel frame, adequately reinforced and braced to prevent sagging.
- C. Gates shall be covered with fence fabric and post/support coatings similar to that of the adjacent fence.
- D. Gates shall include all hinges or rollers, hardware, catches and latching/locking mechanisms as specified herein or otherwise required for complete, functioning installation. All gate components shall be galvanized, aluminum-clad, or PVC-coated as specified in Part 4.
- E. Manually operated swinging double gates shall be designed to latch together at the center and lock in the closed position by means of a plunger rod and a suitable catch installed in the pavement.
  1. Latching mechanism shall be pad lockable.

## **2.04 ACCESSORIES**

- A. Three rows of barbed wire shall be provided. Each barbed wire row shall consist of two strands of twisted 12-1/2 gauge wire with 14 gauge, 4 point barbs spaced on 5-inch centers.
  1. Extension arms for supporting barbed wire shall be galvanized, inclined at 45 degrees, and shall be capable of supporting a weight of 250 pounds applied vertically at the tip.



- B. The Owner will provide one padlock for each gate specified shown on the Drawings or as ordered.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Permanent fencing may be installed for convenience of the Contractor prior to completion of work.
  - 1. Contractor shall be responsible for maintenance and repairs to keep the fence system like new during construction. The fencing system is subject to the Owner and Engineers approval at project completion and the entire system or any part thereof may be required to be replaced.

#### **3.02 PREPARATION**

- A. Final grading and maintenance strip shall be completed prior to the installation of the permanent fence system.

#### **3.03 INSTALLATION**

- A. The Contractor shall erect the fence, gates, and fence posts level and plumb as required, in accordance with manufacturer's recommendations and as shown on the Drawings.
- B. Line posts shall be spaced at intervals not exceeding 10 feet.
- C. Fence fabric shall be stretched taut, securely fastened to the posts, tension wire and top rail as specified and shown on the Drawings.
  - 1. Fence fabric shall be installed approximately 1 inch above the top rail.
  - 2. Fence fabric shall be installed approximately 2 inches above finish grade. Fence fabric when lifted shall not allow an opening greater than 5 inches.
  - 3. Fence fabric shall be stretched at a maximum of 30 feet and all terminal posts.
- D. All changes in fence alignment of 30 degrees or more and all abrupt changes in grade shall be made with corner posts.
- E. Foundations for post shall be sized by fence manufacturer.
  - 1. Foundations shall extend a minimum of 36 inches below finish grade.
  - 2. Concrete foundation shall have a minimum outside diameter of 3 times the embedded post O.D. and not less than 9 inches.
  - 3. Concrete foundation shall be crowned to shed water way from the embedded post.
  - 4. Concrete foundation shall be belled at the bottom.

**PART 4 SPECIAL PROVISIONS**

**4.01 FENCE SYSTEM**

Location	Height	Fence Fabric	Gate Type	Gate Size	Accessories
See Drawings	7 feet	PVC (Black)	Manual Swing Gate	Double Gate, Each gate shall be 15-feet wide	1, 2, 3, 4, and 5

ABBREVIATIONS

**Fence Fabric**

PVC	PVC Coated
Galv	Galvanized
AL	Aluminum Clad

**Gate Type**

Swing  
Sliding

**Accessories**

1. Barb Wire
2. Top Rail
3. Top Tension Wire
4. Latch/Lock
5. Bottom Tension Wire

END OF SECTION

**SECTION 02800**  
**SODDING, SEEDING AND MULCHING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes fine grading, placing sod, and seeding and mulching areas designated on the Drawings, specified, or ordered.
- B. The Work consists of fine grading; furnishing and placing topsoil; sod seed, mulching material; and fertilizer; and watering seeded or sodded areas until growth is established.
- C. The Contractor shall restore all grass areas damaged by his operations in construction of facilities included in the Contract.
- D. Unless otherwise specified herein or directed, Work shall be in conformance with ODOT Item 659 Seeding and Mulching, and Item 660 Sodding.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's project information for materials.
  - 2. Information for the Record:
    - a. Submit to Resident Project Representative:
      - 1) Invoices showing the weight, brand, and composite analysis of all fertilizer used on the Project.
      - 2) Bag tickets showing weight and composition of all seed used on the Project.

**PART 2 PRODUCTS**

**2.01 SOD**

- A. Sod shall conform to ODOT Item 660.02, unless otherwise specified in Part 4.

**2.02 SEED**

- A. Seed mixtures shall be in conformance with the requirements of ODOT Item 659.07 and ODOT Item 659.09 Class 1, unless otherwise specified in Part 4.

**2.03 FERTILIZER**

- A. Commercial fertilizers shall be from a dealer or manufacturer whose brands and grades are registered or licensed by the State of Ohio, Department of Agriculture. The content of nutrients shall be 12-12-12, unless otherwise approved by the Engineer.

**2.04 MULCHING MATERIAL**

- A. Mulching material shall be straw, wood fiber, or compost reasonably free of weed seed, and other foreign materials. Mulch shall meet the requirements of ODOT Item 659.13, and either Item 659.14, 659.15, or 659.16.

**2.05 MATTING MATERIAL**

- A. Matting material shall be in conformance with the requirements of ODOT Item 712.11 Type A or B.

**2.06 TOPSOIL**

- A. Topsoil furnished by the Contractor shall be as specified in Section 02200.

**PART 3 EXECUTION**

**3.01 FURNISHING AND PLACING TOPSOIL**

- A. Areas from which the top layer of soil has been removed or disturbed shall be recovered with a minimum of 4 inches of topsoil placed in conformance with ODOT Item 659.11.

**3.02 PREPARATION**

- A. The operation of finish grading and sowing shall not be performed when the ground is frozen or muddy.
- B. Areas to be Sodded:
  - 1. Preparation of areas to be sodded shall be in conformance with ODOT Item 660.04.
- C. Areas to be Seeded:
  - 1. Unless otherwise shown on the Drawings or specified in Part 4, all areas of disturbed soils on the Site shall be seeded.
  - 2. The area to be seeded shall be prepared in accordance with ODOT Item 659.
  - 3. Fertilizer shall be applied at a standard dry application rate of 10 pounds per 1000 square feet. Either dry or liquid fertilizer may be used and shall be distributed in an even pattern over the specified area, then thoroughly disked, harrowed, or raked into the soil to a depth of not less than 1 inch.

### 3.03 INSTALLATION

- A. Sodding:
  - 1. Sod shall be placed in conformance with ODOT Items 660.05 and 660.06.
  - 2. No sod shall be placed when the temperature is below 32 degrees F. No frozen sod shall be placed nor shall any sod be placed upon frozen soil. When sod is placed between the dates of June 1 and October 15, it shall be covered immediately with a straw mulch 1-inch thick, loose measurement.
- B. Seeding:
  - 1. The seed shall be mixed thoroughly and sown evenly at a rate specified in ODOT Item 659.09. The seed mixture may be sown dry or hydraulically unless directed otherwise in Part 4 of this Section.
  - 2. The seed mixture shall be applied when the soil is in a workable condition and shall be raked into a depth of approximately 1/4 inch.
  - 3. Seed shall be sown only between May 1 and October 15, unless otherwise permitted by the Engineer.
- C. Mulching:
  - 1. Within 24 hours after an area has been seeded, it shall be mulched in conformance with one of the following specified methods as designated in Part 4.
  - 2. Mulch:
    - a. Mulching with straw shall be in conformance with ODOT Item 659.14, except that in front of residences, the mulching material shall be kept in place by an approved non-tracking adhesive or other approved method in lieu of the specified asphalt emulsion. Mulching with wood fiber shall be in accordance with ODOT Item 659.15 and mulching with compost shall be in accordance with ODOT Item 659.16.
    - b. Matting shall be used as mulch on slopes greater than 3:1 and shall be placed in conformance with the applicable portions of ODOT Item 671.
- D. Seeded and sodded areas shall be watered and maintained as specified below until they are established.
  - 1. The seed bed shall be thoroughly watered, as soon as the seed is mulched.
  - 2. Water shall be applied by a hydro-seeder or water tank under pressure with a nozzle producing a spray that will not dislodge the mulching material.
  - 3. Water applications shall be made at rates and at frequencies necessary to establish the growth of grass to its full density and to a minimum height of 2 inches.
  - 4. The rate application shall be 120 gallons per 1,000 square feet.

5. The Contractor shall keep all sodded areas, including the subgrade, thoroughly moist for two weeks after sodding. After the two-week period, the Contractor shall water the sod as necessary to maintain its healthy condition until accepted by the Owner.
6. Matting areas shall be maintained until all Work on the Contract has been completed and accepted.
7. Seeded and sodded areas shall be maintained by the Contractor until acceptance by the Owner. The Contractor shall repair and restore any damaged areas. Repair of the damaged area shall be performed using the same materials and procedures as used for the original installation of the area.
8. The Contractor shall clean all surfaces coated with hydro-seeding overspray. Contractor shall be responsible for surface staining or damage caused by hydro-seeding and restoration damage or staining.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 02810  
TREES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes protection, removal, disposal, and replacement of trees encountered in construction of the Project as specified herein and directed.
- B. Trees planted in easements shall be included in this Section.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Trees shall be 7-foot tall Austrian Pine Trees or approved equal.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. The Owner will designate, mark, and record the location, size, and variety of trees within the Work limits that must be protected or removed and replaced.
- B. Any tree not included in the above damaged by the Contractor's operations to the extent that it must be removed shall be removed and replaced at the Contractor's expense.

**3.02 INSTALLATION**

- A. Planting shall be in accordance with the applicable portions of ODOT Item 661.

**3.03 PROTECTION**

- A. Should any of the planted trees die after final acceptance of the Work, but during the one-year maintenance bond period, such trees shall be replaced in kind and size as nearly as possible by the Contractor at his expense.

**PART 4 SPECIAL PROVISIONS**

None

END OF SECTION





**SECTION 03100  
CONCRETE FORMWORK**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes formwork for cast-in-place concrete.

**1.02 SUBMITTALS**

- A. None required.

**1.03 QUALITY ASSURANCE**

- A. Design, engineering, erection, bracing, and shoring of formwork shall be the responsibility of the Contractor.
- B. Formwork shall comply with pertinent provisions of the following codes, standards, and specifications:
  - 1. "Guide to Formwork for Concrete (ACI 347R)," American Concrete Institute.
  - 2. "Standard Tolerances for Concrete Construction and Materials (ACI 117)," American Concrete Institute.
  - 3. "Formwork for Concrete, SP-4". "American Concrete Institute."
- C. Formwork shall be designed in accordance with requirements of governmental agencies having jurisdiction, pertinent requirements of local building codes, "Building Code Requirements for Structural Concrete (ACI 318) and Commentary (ACI 318R)," and "Specifications for Structural Concrete (ACI-301)," American Concrete Institute.
- D. Formwork for liquid retaining structures shall also satisfy the requirements of "Environmental Engineering Concrete Structures (ACI-350)," American Concrete Institute.
- E. Formwork shall be constructed to tolerances specified in ACI 117.
- F. Regardless of specified tolerances, no portion of a structure shall extend beyond legal boundary of project.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Form facing material shall be "new or undamaged" condition and may be plyform, tempered concrete-form-grade hardboard, metal, plastic, or other material capable of producing the specified finish. Select the grade or class of material to satisfy the requirements of strength, stiffness and surface smoothness to produce the specified finish.

- B. Form Release shall be manufactured from Dayton Superior "Clean Strip J1EF", W.R. Meadows, Inc. "Duogard or Duogard II", L&M Construction Chemicals "Debond Form Coating", or equal.
- C. Arrangement of facing material shall be orderly and symmetrical, with number of seams kept to practical minimum.
- D. Facing material shall be supported by studs or other backing capable of preventing excessive deflection. Maximum deflection of facing material shall be 1/240 of span between supports but shall not exceed specified tolerances.
- E. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects shall not be used.
- F. Architectural Concrete: Maximum deflection of facing material between studs and deflection of studs and walls shall not exceed 1/400 of span between supports, but shall not exceed specified tolerances.

## **2.02 PERFORMANCE REQUIREMENTS**

- A. Formwork shall be designed to safely support vertical and lateral loads, until such loads can be safely supported by concrete structure. Loads shall be carried to ground by formwork and in-place construction of adequate strength.
- B. Formwork shall be designed for dead and live loads, weight of concrete, wind, construction loads including impact, and other loads which act or might act on formwork together with appropriate safety factors and load multipliers as recommended by ACI-347.
- C. Formwork shall be designed for pressure of concrete giving due consideration to rate of concrete placement, method of placement, method of consolidation, concrete mix design, temperature, and other factors pertinent to formwork design.
- D. Forms shall have sufficient strength and rigidity to maintain specified tolerances.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Forms shall be used to confine concrete and shape it to required dimensions, alignment, elevation, and position.
- B. Earth cuts shall not be used as forms for vertical surfaces unless specifically shown on the Drawings.
- C. Runways for moving equipment and materials shall be supported directly on formwork or structural member, and shall not rest on reinforcing steel.
- D. Openings shall be provided in formwork to accommodate Work of other trades. Openings shall be accurately located and cut.

### 3.02 PREPARATION OF FORM SURFACE

- A. Surfaces of forms and embedded materials shall be cleaned of accumulated concrete or mortar from previous concreting. Foreign material and contaminants shall be removed before concrete is placed.
- B. Before placing reinforcement or concrete, surfaces of forms shall be covered with acceptable coating material that prevents bond with concrete, VOC compliant, and does not stain concrete surface. No coating material shall be used if form liner is used.
- C. Form coating material shall not stand in puddles in forms, and shall not come in contact with reinforcement or hardened concrete against which fresh concrete is to be placed.

### 3.03 ERECTION

- A. Forms shall be sufficiently tight to prevent loss of mortar from concrete.
- B. Formwork shall be cambered to compensate for anticipated deflections from weight of fresh concrete and construction loads.
- C. Shores and struts shall be provided with positive means of adjustment capable of taking-up formwork settlement during concrete placement, using wedges or jacks.
- D. Formwork shall be securely braced and anchored against deflection and displacement.
- E. Wedges used for final adjustment of formwork shall be fastened in position prior to beginning concrete placement.
- F. Temporary openings shall be provided at base of column forms and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
- G. Wood forms for wall openings shall be constructed to facilitate loosening, if necessary, to counteract swelling of forms. Wood inserts for keyways, reglets, recesses and similar uses shall be kerfed to counteract swelling.
- H. At construction joints, form facing material shall overlap hardened concrete of previous placement by not more than 1 inch. Forms shall be held tight against hardened concrete to prevent offsets or loss of mortar, and to maintain true surface.
- I. Insert vibrator as needed to properly consolidate concrete. Provide openings in forms as needed to insert vibrators.
- J. Form ties and accessories:
  - 1. Form ties and accessories to be partially or wholly embedded in concrete shall be of commercially manufactured type. Nonfabricated wire is not permitted.
  - 2. Form ties shall be constructed so that ends can be removed to minimum depth of 1-1/2 inch without significant spalling of concrete. Form tie assemblies shall provide cone-shaped depressions 1-1/2-inch-deep and at least 1 inch in diameter at concrete surface to permit filling and patching.
  - 3. Ties shall be tight fitting or tie holes in forms shall be sealed to prevent leakage.

- 4. Single rod ties shall be furnished with tightly fitted washer at midpoint to prevent leakage along tie. Multiple rod ties do not require washers.
- 5. When tapered, ties are used, large end shall be placed on liquid side of tanks and water-retaining structures. Tapered ties shall be completely removed. The Contractor shall submit the methods and materials to be used to fill the voids thus formed for Engineer's review and approval.
- K. Chamfer strips shall be placed in corners of forms and at all exposed edges to produce a beveled edge on permanently exposed surfaces. Chamfers shall be 3/4 inch or as noted on Drawings. Chamfer strips shall be wood, metal, PVC, or rubber and shall be fabricated and installed to produce uniformly smooth and straight lines. Chamfer strips shall be mitered at changes in direction.
- L. Control joints shall be located and constructed as shown on Drawings.
- M. Dovetail slots for masonry anchorage shall be installed where shown on the Drawings or specified in Section 04200.

### **3.04 REMOVAL OF FORMS GENERAL**

- A. When repair of surface defects or finishing is required at early age, forms shall be removed as soon as concrete has hardened sufficiently to resist damage from removal operations.
- B. Top forms on sloping concrete surfaces shall be removed as soon as concrete has attained sufficient stiffness to prevent sagging.
- C. Wood forms for wall openings shall be loosened as soon as can be accomplished without damage to concrete.
- D. Ties shall be removed.

### **3.05 MINIMUM CONCRETE STRENGTH REQUIREMENTS FOR REMOVAL OF FORMS AND SHORING**

- A. Formwork for columns, walls, sides of beams and other elements not supporting the weight of concrete may be removed after curing for 24 hours.
- B. Formwork for columns, walls, sides of beams and other elements supporting the weight of concrete joists, elevated slabs and other elements may be removed after curing for seven days. These forms may be removed after three days of curing if concrete has attained 80% of the specified design compressive strength.
- C. Formwork and shoring used to support the weight of concrete beams, elevated slabs or other similar horizontal elements may be removed after 14 days of curing if concrete has attained 90% of the specified design compressive strength. Otherwise, these forms shall remain in place until either this strength is attained or 21 days have elapsed.
- D. Removal strength shall be determined by testing specimens field cured along with concrete they represent. Testing laboratory shall perform strength tests as specified in Section 03300. All concrete testing performed for the purpose determining the timing of formwork removal shall be accomplished at the Contractor's expense.

- E. Contractor is responsible for maintaining stability of the structure during construction when it is subjected to construction loads, wind loads and other loads after the forms have been removed.
- F. Concrete structures shall not be filled with water, backfilled against or subjected to their design loads until 28 days after the commencement of curing or until field cured test cylinder specimens have reached the specified design compression strength. In no case shall concrete structures be loaded prior to curing for their specified minimum curing periods.

**PART 4 SPECIAL PROVISIONS**

END OF SECTION



**SECTION 03150  
WATERSTOP**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes waterstop for cast-in-place concrete construction.
- B. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Product literature.
  - 2. Information for the Record:
    - a. Manufacturer's installation instructions.

**1.03 PRODUCT HANDLING**

- A. Store waterstops under tarps to protect from oil, dirt, sunlight and premature exposure to water.

**PART 2 PRODUCTS**

**2.01 PLASTIC WATERSTOP (TYPES A AND B)**

- A. Plastic waterstop shall be constructed of highest-grade virgin Polyvinyl Chloride (PVC) and shall conform to US Army Corps of Engineers specification CRD-C 572. Minimum tensile strength shall be 2000 psi.
- B. Waterstop shall have factory-installed hog rings along both edges at minimum 12-inch spacing.
- C. Type A waterstop shall be 9 inches wide by 3/8-inch nominal thickness ribbed waterstop with a 1/2 inch inside diameter center bulb, Greenstreak, Inc. No. 735, or equal. Type A waterstop with split flange shall be Greenstreak No. 727, or equal.
- D. Type B waterstop shall be 6 inches wide by 3/8-inch nominal thickness ribbed waterstop without center bulb, Greenstreak No. 679 or equal. Type B waterstop with split flange shall be Greenstreak No. 724, or equal.

**2.02 TYPE C WATERSTOP**

- A. Type C waterstop shall be a hydrophilic rubber waterstop made from a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
- B. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.
- C. Performance requirements of chloroprene rubber:
  - 1. Tensile Strength (ASTM D412):
    - a. 1,300 psi minimum.
  - 2. Ultimate Elongation (ASTM D412):
    - a. 400% minimum.
  - 3. Hardness, Shore A (ASTM D2240):
    - a. 50 plus or minus 5.
  - 4. Tear Resistance (ASTM D624):
    - a. 100 pound per inch minimum.
- D. Performance requirements of chloroprene hydrophilic rubber:
  - 1. Tensile Strength (ASTM D412):
    - a. 350 psi minimum.
  - 2. Ultimate Elongation (ASTM D412):
    - a. 600% minimum.
  - 3. Hardness, Shore A (ASTM D2240):
    - a. 52 plus or minus 5.
  - 4. Tear Resistance (ASTM D624):
    - a. 50 pound per inch minimum.
  - 5. Expansion Ratio (Volumetric Change - Distilled Water at 70 degrees F):
    - a. 3 to 1 minimum.
- E. Waterstop shall be Hydrotite manufactured by Greenstreak, or equal.
- F. Nominal size of waterstops for construction joints shall be 10 mm high by 30 mm wide (Hydrotite CJ-1030-4M or equal) and nominal size of waterstops around pipes that penetrate concrete shall be 4 mm high by 20 mm wide (Hydrotite DSS0420 or equal), unless specified or noted otherwise.
- G. Hydrotite adhesive by Greenstreak or equal.
- H. Leakmaster sealant by Greenstreak or equal.
- I. Cyanoacrylate adhesive by Greenstreak or equal.



### **PART 3 EXECUTION**

#### **3.01 PREPARATION**

- A. Concrete shall be carefully and thoroughly consolidated with vibrator machine around Type A and B waterstops.
- B. New cast-in-place concrete surfaces shall be cast or troweled smooth. New and existing surfaces shall be cleaned of all oil, dirt and lattice under type C waterstops. Where existing surfaces are rough apply a swellable sealant (as specified in 2.02.H) base under the type C waterstops.

#### **3.02 INSTALLING**

- A. Waterstop shall be installed in accordance with manufacturer's recommendations.
- B. Types A and B Waterstops:
  - 1. Waterstop shall extend entire length of joint and shall be centered so that half of waterstop is embedded on each side of joint, unless shown otherwise on Drawings.
  - 2. Waterstop shall be continuous around corners and intersections to provide a continuous seal and to make a watertight structure.
  - 3. Field splices shall be limited to straight butt splices. Intersections and transitions shall be made with fabricated and tested junction sections.
  - 4. Splices shall be made with splicing iron in accordance with manufacturer's recommendations. Use of torch or direct flame is prohibited.
  - 5. Dirt, grease, and splattered concrete shall be cleaned from waterstop and wire loops.
- C. Type C Waterstops:
  - 1. Waterstop shall extend entire length of joint and shall be continuous around corners and intersections to provide a continuous seal and to make a watertight structure.
  - 2. Secure waterstop to concrete or penetrating pipes with a chloroprene rubber compatible adhesive approved by manufacturer. Apply the adhesive to both the concrete or pipe surface, and to the waterstop, and allow to dry to a tacky consistency, then place the waterstop into position.
  - 3. Cut square and Glue spliced ends together with cyanoacrylate adhesive per manufacturer's recommendations.
  - 4. Concrete shall be placed over the waterstop within 4 hours of placement. Prevent rain water, curing water and other sources of water from prematurely activating the waterstop prior to concrete placement. Remove, clean surface and replace any waterstops that have been damaged or prematurely activated.

**3.03 SCHEDULE**

- A. Waterstop shall be placed in following locations:
  - 1. Joints in walls and slab below grade which separate occupiable space or equipment rooms from earth or water.
  - 2. Joints at and below 100-year flood elevation indicated on the Drawings or as otherwise specified.
  - 3. Joints in walls and slabs of liquid-retaining, conveying and secondary containment structures.
  - 4. Other locations shown on Drawings or specified elsewhere.
- B. Waterstop shall be Type B unless otherwise shown on the Drawings or specified elsewhere.
- C. Waterstop shall be Type A in expansion joints unless otherwise shown on the Drawings or specified elsewhere.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 03200**  
**CONCRETE REINFORCEMENT**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes reinforcing steel, load transfer dowels, and accessories.
- B. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Placing drawings shall indicate:
      - 1) Construction joints, splice locations, and splice lengths.
      - 2) Bending schedules.
      - 3) Accessories.
    - b. Product literature for mechanical splices and adhesives.
  - 2. Information for the Record:
    - a. Mill certificates.

**1.03 QUALITY ASSURANCE**

- A. Reinforcement shall be detailed, fabricated, and placed in accordance with following codes, standards, and specifications.
  - 1. "Details and Detailing of Concrete Reinforcement (ACI 315)", American Concrete Institute, and "Reinforcing Bar Detailing," Concrete Reinforcing Steel Institute (CRSI).
  - 2. "Manual of Standard Practice", Concrete Reinforcing Steel Institute.
  - 3. "Standard Tolerances for Concrete Construction and Materials (ACI 117)", American Concrete Institute.
- B. Concrete reinforcement shall be in accordance with "Building Code Requirements for Structure Concrete (ACI 318) and Commentary (ACI 318R)", American Concrete Institute, and "Specifications for Structural Concrete for Buildings" (ACI-301).
- C. All placing of reinforcing bars in the form shall follow the CRSI "Placing Reinforcing Bars."

- D. Concrete reinforcement for environmental engineering concrete structures (liquid retaining structures) shall also be in accordance with "Environmental Engineering Concrete Structures (ACI-350)," American Concrete Institute.

#### **1.04 DETAILING**

- A. When splices are not indicated on Drawings, reinforcement shall be furnished so as to minimize splices. Horizontal rebar shall be spliced within the limits of adjacent pours to be poured later to allow for unrestrained shrinkage movements. Splice locations shall be subject to Engineer's approval. Contractor shall give sufficient advance notice satisfactory to Engineer's representative for his inspection upon completion of installation.
- B. When slab or wall reinforcement is interrupted by openings or embedments, additional reinforcement shall be furnished as shown on Drawings.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Bundles of reinforcing bars shall be tagged with weatherproof tags indicating quantity, grade, size, and Shop Drawing designation.
- B. Bundles of welded wire fabric shall be tagged with weatherproof tags indicating quantity, style designation, width and length.
- C. Reinforcement shall be stored off ground and shall be protected from oil, mud, and other deleterious substances.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Reinforcing bars shall be grade 60 deformed bars conforming to ASTM A615 or ASTM A996.
- B. Reinforcement to be welded shall be grade 60 bars conforming to ASTM A706.
- C. Welded wire fabric shall be fabricated from underformed wire and shall conform to ASTM A185, except welded intersections shall be spaced not farther apart than 12-inch welded wire fabric shall be furnished in flat sheets.
- D. Load-transfer dowels shall conform to ASTM A36 and shall be fitted with expansion sleeve. Dowel size shall be as indicated on Drawings.

#### **2.02 BAR SUPPORTS**

- A. Bar supports in contact with forms shall be Class 1, maximum-protection, plastic-coated wire supports. Other bar supports may be Class 3, no-protection, wire supports.
- B. Bar supports on grade shall be precast concrete blocks not less than 4 inches by 4 inches wired in place. Blocks shall have compressive strength not less than the specified compressive strength of concrete being placed.

- C. Form spacers shall be all-plastic, snap-on devices, specifically designed to position reinforcing bars in concrete.

### 2.03 MECHANICAL SPLICE

- A. Threaded mechanical splices and dowel bar replacements (DBR) shall be furnished where shown or otherwise permitted.
- B. Mechanical splice and dowel bar replacement shall develop 125% of the specified reinforcement yield strength. The next larger size coupler shall be furnished at no additional cost to Owner when required to develop specified strength.
- C. When dowel bar replacements are provided to facilitate future expansion, epoxy coated rebar couplers shall be used. Rebar couplers shall be greased and capped with threaded plastic plugs to make a watertight seal.
- D. Mechanical splices and dowel bar replacements shall be as manufactured by Dayton Superior, Lenton, Bar Splice Products, Inc., or equal.

### 2.04 ADHESIVE

- A. Adhesive for embedding reinforcement in existing structures shall be 100% solids, 100% reactive, epoxy conforming to ASTM C881, Type IV, Grade 3, Classes B and C. The adhesive shall be formulated to withstand the maximum allowable published loads permanently without creep or failure.
- B. Bond strength to concrete per ASTM C882 shall be 1800 psi minimum at 7 days.
- C. Adhesive shall be mixed in accordance with manufacturer's instructions.
- D. The adhesive shall be type "HIT-RE-500-V3" manufactured by Hilti or equal. The "fast set" formulation of the "Power-Fast Epoxy" as manufactured by Powers/Rawl shall not be used.

### 2.05 FABRICATION

- A. Reinforcement shall be accurately fabricated to dimensions shown on approved Shop Drawings. Bend dimensions shall conform to CRSI Manual of Standard Practice.
- B. Bends shall be shop formed unless otherwise indicated. Radial fabrication (Type 9 Bars) may be furnished straight and sprung to fit when permitted by CRSI Manual of Standard Practice.
- C. Reinforcement shall be cold bent, and shall not be bent or straightened in injurious manner.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Reinforcement shall be accurately placed, supported, and tied prior to concrete placement. Reinforcement shall be subject to review of Resident Project Representative prior to placing concrete.

### **3.02 PREPARATION**

- A. Grade shall be leveled such that specified concrete cover is maintained.
- B. When ground is too soft to support reinforcement, Contractor shall over excavate and construct concrete mud mat at no additional cost to Owner. Mud mat shall be minimum of 3 inches thick, unless noted otherwise.

### **3.03 ERECTION AND INSTALLATION**

- A. Reinforcement shall be placed in accordance with approved Shop Drawings.
- B. Reinforcement and dowels shall be adequately supported and fastened before concrete is placed and shall be secured against displacement. Supports shall be placed at minimum of 4-feet centers.
- C. Concrete cover for wall and column reinforcement shall be accurately maintained by use of form spacers or Class 1 bar supports.
- D. Templates shall be furnished for placement of column dowels.
- E. Load-transfer dowels shall be accurately aligned perpendicular to joint. Placing cages shall be used to ensure proper alignment.
- F. Reinforcement shall be placed within the tolerances specified in ACI 117, but the required number of bars shall not be reduced. When it is necessary to move reinforcement to avoid interference with other reinforcement, conduits, or embedded items exceeding specified tolerances, the resulting arrangement of bars shall be subject to Engineer's approval.
- G. Driving or forcing reinforcement into concrete is prohibited.
- H. Field bending or straightening of reinforcement is prohibited, except as specifically shown on Drawings. Bars with kinks or bends not shown on Shop Drawings are not permitted.
- I. Welding of reinforcement is prohibited except as specifically shown on Drawings.
- J. Unless specifically noted otherwise, welded wire fabric shall be installed near the top in slabs on grade (2 inches from the top of slab). Fabric should extend to within 2 inches of the joints and the edges of the slab. When used for temperature reinforcement in structurally reinforced elevated slabs, welded wire fabric shall be placed 3/4 inches down from the top surface of the slab, unless otherwise shown, and shall extend into supporting beams and walls for anchorage unless an expansion joint is called for.

### 3.04 CONCRETE COVER

- A. Concrete cover shall be as indicated on Drawings. If drawings do not specify concrete cover for reinforcement, it shall be in accordance with the requirements of ACI-301 and/or ACI-350 as applicable.
- B. Allowable Tolerances in Concrete Cover shall be:
  - 1. To formed surfaces: plus 1/4 inch
  - 2. To unformed top surface: minus 1/4, plus 1/2 inch

### 3.05 LAP SPLICES

- A. Splices shall be located as shown on approved Shop Drawings.
- B. Bar lap splice shall be Class B splices and their lengths shall be as shown on Drawings.
- C. Welded wire fabric shall be lapped a minimum of 2 cross wire spacings, but not less than 8 inches.

### 3.06 MECHANICAL SPLICES

- A. Mechanical splices and dowel bar replacements shall be installed in accordance with the manufacturer's instructions.

### 3.07 WELDING

- A. When welding of reinforcement is shown on Drawings, welding shall conform to "Structural Welding Code - Reinforcing Steel", (AWS D1.4), American Welding Society.
- B. Tack welding and other welding not specifically shown on Drawings is prohibited.

### 3.08 FIELD BENDING

- A. When bending or straightening of reinforcement partially embedded in concrete is shown:
  - 1. Inside bend diameter shall be minimum of 6 bar diameters.
  - 2. Beginning of bend shall not be closer to concrete surface than 6 bar diameters.
  - 3. No. 5 bars and smaller may be cold bent the first time only when temperature is above 32 degrees F. Bars shall be preheated for subsequent bending or straightening.
  - 4. Bars larger than No. 5 shall be preheated.
- B. Preheating of Reinforcement shall be as follows:
  - 1. Preheat shall be applied to length of bar equal to a minimum of 5 bar diameters each way from center of bend. Preheat shall not extend below surface of concrete. The temperature of the bar at concrete interface shall not exceed 500 degrees F.

2. Preheat temperature shall be 1100 degrees to 1200 degrees F. Temperature shall be maintained until bending or straightening is completed. Preheat temperature shall be measured by temperature measurement crayons or other acceptable method.
  3. Reinforcement shall not be artificially cooled, until the material temperature is less than 600 degrees F.
- C. Bending or straightening of bars other than specifically shown on Drawings is prohibited.

### 3.09 DOWELING TO EXISTING STRUCTURE

- A. Dowels shall be embedded into existing concrete where shown on Drawings. Unsound concrete shall be reported to Engineer.
- B. Adhesive dowels shall be placed in holes larger than the reinforcement diameter using a rotary percussion hammer and carbide bit. Hole diameters shall be as recommended by manufacturer for each specific reinforcing diameter.

1. Unless indicated otherwise, adhesive dowels shall be embedded as follows:

Stud Diameter	Minimum Embedment
#3	3-1/4 inches
#4	4-3/8 inches
#5	5-3/4 inches
#6	6 inches
#7	7-1/4 inches
#8	8-7/8 inches

- C. Hole shall be cleaned of dust and residue by blowing the hole with dry and oil-free compressed air. Air nozzle shall be inserted to bottom of hole. The holes should also be brushed using a nylon brush to remove dust and other debris which may have been pressed into the walls of the hole.
- D. Standing water and frost shall be removed immediately prior to injecting adhesive.
- E. Adhesive shall be injected from bulk-loading caulking gun, disposable caulking tubes, or pneumatic dispenser. Adhesive shall be injected using extension on nozzle to reach bottom of hole. Adhesive shall be injected to pre-determined depth which will cause hole to be completely filled after bar is inserted.
- F. Bar shall be inserted and slightly rotated to ensure adhesive completely surrounds bar.
- G. Adhesive displaced from hole shall be removed immediately.
- H. The manufacturer's installation guidelines for the specific adhesive chosen shall be strictly followed.

### 3.10 CLEANING

- A. Reinforcement, at time concrete is placed, shall be free of mud, oil, or other materials that may adversely affect or reduce bond.



- B. Reinforcement with rust, mill scale, or combination of both shall be considered satisfactory provided minimum dimensions, weight, and height of deformations of hand-wire-brushed test specimen are not less than applicable ASTM specification requirement.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 03300**  
**CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing, placing, finishing, and curing cast-in-place concrete. Miscellaneous materials required for concrete construction are included.
- B. Anchor bolts and other cast-in items are furnished under other Sections.
- C. The Contractor, before commencing Work, shall examine all adjoining Work on which this Work is dependent for proper installation and workmanship according to the intent of this specification, and shall report to the Engineer any condition which prevents this Contractor from performing first class work.
- D. Laboratory services for quality control shall be furnished in accordance with requirements of Section 01410.
- E. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Concrete mix designs including substantiating data and test records. Concrete Mix Design, Proportioning.
    - b. Product literature for admixtures, curing compounds, and miscellaneous materials.
    - c. Locations of construction and control joints not shown on Drawings, and proposed changes in locations.
    - d. Material certifications.
    - e. Aggregate gradation and percentages of deleterious substances.
    - f. Batch plant certification.
  - 2. Information for the Record:
    - a. Manufacturer's application instructions for miscellaneous materials.
    - b. Quality control test reports.
    - c. Slab profile report.
- B. Copy of concrete delivery ticket shall be presented to Resident Project Representative for each batch. Delivery ticket shall indicate:
  - 1. Name of ready-mixed company and plant designation.

2. Truck number.
3. Concrete class.
4. Quantity of concrete.
5. Date.
6. Time when batch was loaded.
7. Type and name of admixtures.
8. Actual batch weights of cement, fly ash, aggregates, and water.
9. Location of pour and time of unloading shall be added to the ticket at Site.

### 1.03 QUALITY ASSURANCE

- A. Batch Plant:
  1. Batch plant shall be central batch plant with automatic or semi-automatic control. Concrete may be mixed using either central-mixed, shrink-mixed, or truck-mixed methods. If concrete is shrink-mixed or truck-mixed, the truck and concrete shall conform to ASTM C94.
  2. Batch plant shall be certified by the Department of Transportation, National Ready Mixed Concrete Association (NRMCA) or an independent certification using NRMCA "Check list for Certification of Ready Mixed Concrete Production Facilities" executed and certified by independent Professional Engineer registered in state of Site. Evidence of current certification shall be submitted.
- B. Pre-installation Conferences:
  1. Before beginning concrete work, Contractor shall hold a meeting to review detailed requirements for preparing concrete mix designs and to determine proper procedures for concrete construction. A representative of Contractor, testing laboratory, concrete producer, concrete pumping contractor, and Engineer shall be in attendance.
  2. Contractor shall submit for Engineer review a plan showing the locations of all proposed construction and control joints, which are not shown on the construction Drawings, and a schedule that incorporates the alternating pour sequences required to allow for strength gain and control of volumetric shrinkage changes.
  3. When dry-shake floor hardener or metallic topping is specified, manufacturer's representative shall instruct Contractor on proper equipment and application procedures.
- C. Concrete work shall be in accordance with the current edition of the following codes, standards and specifications:
  1. American Concrete Institute (ACI).
  2. "Manual of Standard Practice", Concrete Reinforcing Steel Institute (CRSI).

**1.04 DELIVERY AND HANDLING**

- A. Concrete shall be delivered in accordance with ASTM C94 except the time limit for discharging of concrete during hot weather shall be reduced as specified.
- B. Concrete shall be delivered in agitating trucks or in mixing trucks operating at agitating speed.

**1.05 ENVIRONMENTAL CONDITIONS**

- A. Unless adequate protection is provided, concrete shall not be placed during rain, sleet, or snow, or when inclement weather is imminent.
- B. Cold Weather:
  - 1. Cold weather concreting procedures per "Cold Weather Concreting," ACI 306R, shall be followed whenever any one of the following conditions occur or are expected to occur:
    - a. The air temperature is below 40 degrees F at the time of concrete placement.
    - b. The average daily air temperature is below 40 degrees F for three consecutive days immediately prior to the day of concrete placement.
    - c. An average daily air temperature below 40 degrees F is foreseen or occurs during any day of the specified concrete curing period.
  - 2. For purposes of the paragraphs above, the average daily temperature is defined as the arithmetic mean of the highest and lowest temperature during the period from midnight to midnight. All air temperatures are to be measured at the Site.
- C. Hot Weather:
  - 1. Hot weather concreting procedures per "Hot Weather Concreting," ACI 305R, shall be followed whenever any one of the following conditions occur or are expected to occur:
    - a. The air temperature is above 90 degrees F at the time of concrete placement.
    - b. Whenever conditions of concrete temperature, air temperature, wind velocity, and relative humidity combine to cause flash set, excessively low slump, cold joints, plastic shrinkage cracking, or otherwise impair the quality of concrete,
  - 2. When the evaporation rate of bleed water exceeds 0.1 pounds per square foot per hour, steps shall be taken to prevent plastic shrinkage cracking. Evaporation rate shall be determined by the method presented in "Hot Weather Concreting," ACI 305R.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Cement - ASTM C150 Type I or II, unless indicated otherwise. All cement shall be from the same mill. Cement for Class A-2 concrete shall contain less than 8% tricalcium-aluminate (C3A).
- B. Coarse Aggregate - Aggregates for normal weight concrete shall be crushed limestone conforming to ASTM C33, Class 4S. Aggregates for lightweight concrete shall meet the requirements of ASTM C330. Aggregates shall satisfy all quality requirements specified therein (i.e. grading, limits on deleterious substances, etc.).
- C. Fine Aggregate - ASTM C33.
- D. Fly Ash - ASTM C618, Class C or Class F, including supplementary chemical requirements and supplementary physical requirements, except loss-on-ignition shall be less than 5%. The use of fly ash shall be in accordance with "Use of Fly Ash in Cement (ACI-232.2R)".
- E. Silica Fume - ASTM C1240.
- F. Ground Granulated Blast Furnace (GGBF) slag shall be in accordance with ASTM C989 Grade 100 or 120. Slag for Class A-1 concrete shall contain less than 12% tricalcium-aluminate (C3A) and slag for Class A-2 concrete shall contain less than 8% tricalcium-aluminate (C3A).
- G. Admixtures - The use of all admixtures shall be in accordance with "Chemical Admixtures for Concrete (ACI 212.3R)", and "Guide for the Use of High Range Water Reducing Admixtures in Concrete (ACI 212.4R)."
  - 1. Air entraining - ASTM C260.
  - 2. Water-reducing - ASTM C494.
  - 3. Accelerator - ASTM C494, Type C or E, admixture shall be non-corrosive as verified by long-term accelerated corrosion testing by an independent laboratory.
  - 4. Anti-washout admixture - Master Builders "Rheomac UW450", or equal.
  - 5. Only those admixtures expressly stated by the manufacturer as being chloride-free shall be used.
  - 6. The maximum water-soluble chloride ion content, expressed as a percentage by weight of the cement, contributed from all concrete ingredients shall not exceed 0.10% for non-prestressed concrete structures. Written certification of chloride ion content shall be submitted. Testing for Chloride Ion content shall conform to ASTM C1218.
  - 7. If more than one admixture is used, the admixtures shall be compatible with each other and shall be incorporated into the concrete mix in correct sequence and timing so that desired effects of all admixtures are realized and harmful effects are avoided.

8. Air-entraining and chemical admixtures shall be incorporated into the concrete mix in a water solution. The water so included shall be considered to be a portion of the allowed mixing water.
- H. Water shall conform to ASTM C94. Mixing water, including that contributed by aggregates and admixtures, shall be clean, and free from injurious amounts of oils, acids, alkalis, organic materials, chloride ions, or other substances that are deleterious to concrete or reinforcement. Non-potable water shall not be used.
- I. Fiber reinforcement
  1. Polypropylene fiber reinforcement shall be 1-1/2-inch-long fibrillated polypropylene fibers with UL rating and conforming to ASTM C1116, Type III. Mesh shall be fabricated by SI concrete Systems, Inc., type "Fiber Mesh 300" or approved equal. The concrete mix shall be dosed with fibers at a rate of 1.5 pounds per cubic yard, unless recommended differently by the fiber manufacturer, and approved by the Engineer.
  2. Steel fiber reinforcement shall be 2-inch-long corrugated low carbon, cold drawn steel fibers conforming to ASTM A820, Type I SI Concrete Systems, Inc., type "Novocon 1050" or approved equal. The concrete mix shall be dosed with fibers at a rate of 25 pounds per cubic yard, unless recommended differently by the fiber manufacturer, and approved by the Engineer.

## 2.02 ACCESSORIES

- A. Curing Compound - Compound shall be membrane-forming, liquid applied, non-yellowing, VOC-compliant, water-based acrylic polymer resin conforming to ASTM C309, Type 1 and ASTM C1315, Type 1, Class A. The compound shall include sealing and dustproofing properties. Minimum solids content shall be 25%. Compound shall not permit a moisture loss in excess of 0.40 kilograms per square meter (0.082 pounds per square feet) in 72 hours. Sodium silicate based products are not acceptable. Compound shall be Dayton Superior "Cure & Seal 1315 J22WB", SpecChem, LLC. "Cure & Seal WB 25", L&M Construction Chemicals, Inc. "Lumiseal WB Plus" or equal. Curing compound in potable water treatment plant construction shall be non-toxic and free of taste and odor.
- B. Bonding Adhesive for Cracks, etc. - ASTM C881 100% solids, 100% reactive two component epoxy bonding adhesives. Sika Corporation, "Sikadur 32, Hi-Mod", Dayton Superior "Sure Bond (J-58)", The Euclid Co. "Dural 452 Gel", Master Builders "MasterEmaco ADH326", or equal.
- C. Bonding Adhesive for Vertical Joints - Non-vapor barrier forming, solvent-free, moisture insensitive, epoxy modified cementitious product Sika Corporation "Sika Armatec 110 Epocem", Euclid Co. "Duralprep A.C." or equal.
- D. Bonding Grout - Identical concrete mix as approved for each concrete Class, except that an identical quantity of the fine aggregate shall be substituted for all coarse aggregate.
- E. Liquid Floor Hardener – A VOC compliant, Non-yellowing, dust proofing, liquid applied hardener with non-slip properties that dries to a clear finish. L&M Construction

Chemicals "Seal Hard", W.R. Meadows "Liqui-Hard", ChemMasters "Chemisil Plus", or equal. Apply after concrete has cured as recommended by the manufacturer.

- F. Bond Breaker - Bond breaker shall be non-staining type which will provide a positive bond prevention, such as SpecChem "SpecTilt 100", Nox-crete "Silcoseal Classic"; or equal.
- G. Premolded Expansion Joint Fillers:
  - 1. Exterior Walks and Pavements - Asphalt impregnated cellular fibers securely bonded together, in conformance with ASTM D1751. W. R. Meadows "Fibre Expansion Joint", J D Russell Company "Fiberflex", or equal.
  - 2. Other Locations - Self expanding cork type in conformance with ASTM D1752, Type III. W.R. Meadows, Inc. "Sealtight - Self-Expanding Cork Joint Filler", Masco "Self Expanding Cork", or equal.
- H. Isolation Joints - Flexible foam expansion joint filler, W.R. Meadows "Sealtight - Ceramar", or equal.
- I. Compressible Material - Rigid extruded polystyrene from Board Foamular 150 (15psi) by Owens Corning Company or compressible fill material by Plasti-Fab or equal. Provide foam board, unless noted otherwise.
- J. Epoxy Joint Filler - Two component, 100% solids, flexible epoxy filler with minimum Shore D hardness of 50. The Euclid Chemical Company "Euco 700", Sika Corporation "Sikadur 51 SL", W.R. Meadows, Inc "Rezi-Weld Flex", or equal. Only to be used to fill interior non-moving saw cut or tooled construction or control joints and shrinkage cracks. Not suitable for constant immersion.
- K. Non-slip Aggregate Floor Treatment - Aluminum oxide or emery grit. BASF chemical company "Master Top 120SR", Dayton Superior "Emery Non-slip", or equal.
- L. Vapor Barrier - 6 mil polyethylene, ASTM D2103.

## **2.03 RESERVED**

## **2.04 RESERVED**

## **2.05 CONCRETE MIXES**

- A. Contractor shall design and be responsible for the performance of all concrete mixes. Mixes shall have the required quality, consistency, and workability to permit concrete to be readily worked into forms and around reinforcement without segregation or excessive bleeding. Hardened concrete shall develop all characteristics required by Contract Documents
- B. Proportioning:
  - 1. Concrete mixes shall be proportioned to maximize durability and water tightness. To this end the total water content shall be reduced to the lowest practical amount that is consistent with placing and consolidation methods.



Water reducing and high range water reducing admixtures shall be used as required to maintain workability. Specified water/cementitious ratio shall not be exceeded.

2. Concrete proportions shall comply with ACI 211.1, ACI 301, ACI 318 and for the environmental components of the Work ACI 350.
  - a. Proposed mix designs proportioned by field test data or trial mixes shall be accompanied by a complete standard deviation analysis and calculations for the required average compression strength  $f'_{cr}$ . Test records used for determining standard deviation and average strength shall have been made within the past 12 months. These test records must represent materials, quality control procedures and conditions similar to those expected, and changes in materials and proportions within the test records shall not have been more restricted than those for the proposed Work.
  - b. Proportioning by empirical methods on basis of water/cement ratio is not permitted.
  - c. Concrete mix proportions are subject to Engineer's approval.

C. Design mixes shall have following requirements:

1. Three normal weight concrete mixes are generally required; Class A-1, A-2 and Class B. Concrete mixes shall be as follows:

	Class A-1	Class A-2 (Wastewater)	Class B
28-Day Compressive Strength $f'_c$ (psi)	4500	4500	3000
Maximum Water/Cementitious Ratio:	0.44	0.42	.66
Minimum Cementitious Content (Lbs/CY)	600	650	480
Maximum Cementitious Content (Lbs/CY)	800	800	650
Slump (Inches)	See below	See below	See below

For calculating water/cementitious ratio of the mix, the weight of the water shall be that of the total free water in the mix, which includes the mixing water, the water in any admixture solutions, and any water in the aggregates in excess of that needed to reach a saturated surface dry condition.

2. Concrete placed under water shall contain an approved anti-washout admixture and shall contain a minimum of 600 pounds of cement per cubic yard. Fly ash or GGBF slag shall not be used in the concrete mix.

D. Slump:

1. When superplasticizer is not included in the mix, slump shall be 2-4 inches.
2. When superplasticizer is included in the mix, the maximum slump measured upon delivery to the construction site shall be 3 inches. Superplasticizer shall be added at the Site after verification of slump to increase slump to the desired amount.
3. Tolerance of 1 inch above the maximum specified slump will be permitted for one batch in any five consecutive batches.
4. Concrete of lower slump than specified may be used provided it is properly placed and consolidated. Field adjustment of slump by addition of water is not permitted.

E. Air Content:

1. All concrete shall be air entrained unless specified or noted otherwise on the Drawings.
2. Concrete to be air-entrained shall have an air content as schedule below, unless specified otherwise:

Nominal maximum size of coarse aggregate (inch)	ASTM C33 Aggregate Size number	Total air content percent by volume
3/8	8	7.5
1/2	7	7.0
3/4	67	6.0
1	57	6.0
1-1/2	467	5.5

3. Allowable deviation from specified air content is plus or minus 1%.
4. Interior floor slab specified to receive a trowel finish shall not be air entrained. Maximum air content shall be 3%.
5. Floors receiving dry-shake hardeners or heavy-duty topping shall not be air-entrained. Maximum air content shall be 3%.
6. Air entrainment is not required for Class B concrete.

F. Coarse Aggregate Size:

1. Nominal maximum size of aggregate shall not be more than one-fifth of narrowest dimension between side forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between reinforcing bars.
2. Coarse aggregate shall be largest size consistent with placing methods and specified constraints. Minimum coarse aggregate shall be Size Number 57, unless smaller size is required by dimensional or reinforcement spacing constraints.

G. Cementitious Material:

1. The cementitious mixture shall contain cement and either fly ash or GGBF slag, but not both.

2. When fly ash is used in the concrete mixture, it shall comprise between 15% to 25% of the total cementitious mixture. When slag is used in the concrete mixture, it shall comprise between 25% to 50% of the total cementitious mixture. The percentages are based on weight of the total cementitious mixture.
3. For concrete in contact with wastewater, Class A-2, the cementitious design mixture shall consist of ASTM C150 Type II cement and slag or ASTM C150 Type II cement and Class F fly ash. Alternately, ASTM C150 Type I cement and Class C fly ash may be used provided the design cementitious mixture is tested per ASTM C1012 to have 0.10% or less expansion in 6 months. The test results shall be submitted with the proposed concrete mix design.
4. Air content for concrete containing fly ash shall be closely monitored and the dosage of air-entraining admixture shall be modified as required.

## **2.06 CONCRETE PRODUCTION**

- A. Ready-mixed concrete is to be used unless otherwise specified. It shall be batched, mixed, and transported in accordance with ASTM C94.
- B. Admixtures other than air-entraining admixture shall not be added without Engineer's written approval.
- C. Admixtures shall be charged into mixer as solutions and shall be measured by means of acceptable dispensing device. If two or more admixtures are used, they shall be added separately. Admixtures shall be used in accordance with manufacturer's instructions.
- D. During cold or hot weather conditions, special precautions, as specified in ACI 306R or ACI 305R, respectively, shall be taken during batching, mixing, and curing.

## **2.07 STORAGE OF MATERIALS**

- A. Cement shall be stored in weathertight containers.
- B. Aggregate stockpiles shall be arranged to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. Frozen or partially frozen aggregates shall not be used.
- C. Sand stockpiles shall be allowed to drain to ensure a relatively uniform moisture content throughout the stockpile.
- D. Admixtures shall be stored in a manner to prevent contamination, evaporation, freezing, or damage. Admixtures in the form of suspensions or nonstable solutions shall be agitated to assure thorough distribution of ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Reinforcement, sleeves, inserts, anchors, and embedded items shall be accurately placed, supported, and tied prior to concrete placement. Other trades and contractors required to furnish embedded items shall be given ample notice of concrete placement. Reinforcement and embedded items shall be subject to review of Resident Project Representative prior to placing concrete.
- B. Contractor shall notify Resident Project Representative a minimum of 24 hours before placing concrete, excluding non-working days.
- C. Concrete shall be placed only between hours of 8:00 a.m. and 6:00 p.m. unless otherwise permitted. Concrete shall not be placed after 12:00 noon on last working day of week.

### **3.02 PREPARATION**

- A. Hardened concrete and foreign materials shall be removed from inner surfaces of conveying equipment.
- B. Waterstop shall be secured in place to ensure that it cannot bend to form cavities during concreting.
- C. Formwork shall be completed and snow, ice, and water shall be removed from forms. Before placing reinforcing steel or concrete, the surfaces of the forms shall be covered with an acceptable coating material, or form liner may be used.
- D. The space to receive concrete shall be free of laitance, dirt, and other debris. Laitance shall be removed by wire brushing.
- E. Reinforcement and embedded items shall be checked for proper placement and adequate support. All reinforcement at the time concrete is placed, shall be free of mud, oil, or other materials that may adversely affect or reduce the bond. Aluminum conduits or pipes shall not be embedded in concrete unless approved by the Engineer and effectively coated to prevent aluminum-concrete reaction.
- F. Preparation of grade shall be as specified for slabs. Concrete shall not be placed on frozen ground. There shall be no standing water on the subgrade, nor any muddy or soft spots when the concrete is placed.
- G. A final detailed inspection of the foundation, construction joints, forms, waterstops, embedments, reinforcements, and other items of the placement shall be made immediately before the concrete is placed.

### **3.03 PLACING CONCRETE**

- A. Conveying:
  - 1. Concrete shall be handled from mixer to place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and

in a manner which will ensure that required quality of concrete is maintained. Conveying systems shall not impair the strength, slump, or air content of the concrete. Concrete shall be placed and consolidated prior to initial set, and in no case more than 1-1/2 hours after the cement is added to the mix.

2. Chutes shall be metal (except aluminum), or wood with metal lining and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-feet long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
3. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled to prevent segregation. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 inch.
4. Concrete shall not be permitted to drop more than 4 feet freely, or through a cage of reinforcing steel, from conveying device. Concrete shall be deposited through drop chutes, elephant-trunks, or tremies as required. Temporary openings in wall or column forms may be used to limit the free fall of concrete to less than four feet. The openings should be spaced no more than six to eight feet apart.
5. Concrete shall not be conveyed through pipes made of aluminum or aluminum alloy.

B. Depositing:

1. Concrete shall be deposited continuously or in layers of such thickness that no concrete will be deposited which has hardened sufficiently to cause planes of weakness within the sections. No interruption in concrete placement shall exceed 30 minutes to avoid cold joints in the structural elements being placed. Alternate placing equipment shall be immediately available for use in the event that the primary placing equipment or system breaks down.
2. Placing shall proceed at such a rate that concrete which is being integrated with fresh concrete is still plastic.
3. Concrete which has partially hardened or has been contaminated shall not be deposited.
4. Placing of concrete for supported elements, such as beams and elevated slabs, shall not begin until supporting elements, such as columns and walls, have cured for a minimum of 7 days, unless the concrete has attained 80% of the specified design compression strength or the shoring for the supporting elements has been designed to carry the weight of the supported elements and their construction load.
5. Concrete shall be placed continuously between construction, isolation, and expansion joints. Where joints are spaced greater than 25 feet apart the placing of concrete adjacent to previously placed concrete shall not begin until 48 hours after completion of previous placement, unless otherwise noted. Concrete shall

be deposited as nearly as practical in its final position and shall be carried up evenly in forms to avoid segregation due to rehandling or flowing. Layers shall not exceed 24 inches. Concrete shall not be permitted to flow laterally in forms.

6. The temperature of the concrete mixture immediately before placement shall be between 50 degrees F and 90 degrees F, except as provided under cold weather and hot weather concreting.

C. Consolidating:

1. Concrete shall be consolidated by vibrating, so that concrete is thoroughly worked around reinforcement and embedded items, and into corners and angles of forms, eliminating air and stone pockets. Vibrators shall extend into underlying layers to bond two layers together. To avoid excessive pressure on the forms, the vibrator should penetrate no more than two feet into the underlying layer.
2. Vibrators shall be the largest size and most powerful that can be used properly in the Work, as described in "Recommended Practice for Consolidation of Concrete" (ACI 309R). A minimum of one spare operable vibrator shall be available on site. Mechanical high frequency vibrators with a minimum frequency of 8,000 revolutions per minute are preferred for consolidation of concrete within the forms.
3. Vibrators shall not be used to transport or drag concrete within forms. Vibrators shall be inserted and withdrawn from the concrete slowly.
4. Vibrators shall be inserted in the fresh concrete at points approximately 18 inches apart or as recommended by the vibrator manufacturer. The vibration shall be of sufficient duration and intensity to thoroughly consolidate the concrete, but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed.

D. Under Water Concreting:

1. Concrete shall not be placed under water unless otherwise indicated or permitted. The recommendations given for concrete placed under water in Chapter 8 of ACI 304 shall be followed subject to the requirements specified herein.
2. Concrete shall be deposited by tremie or other acceptable method such that fresh concrete enters mass of previously placed concrete from within, causing water to be displaced with minimum disturbance at the surface of the concrete.
3. Concrete shall not be disturbed after placement.

E. Defective Concrete:

1. Defective concrete is defined as concrete in place which does not conform to specified design strength, required percent air, shapes, alignments and elevations, as shown on the Drawings and/or which presents faulty surface

areas. Evaluation and acceptance of concrete shall conform to ACI 318 and as determined by Engineer.

2. All defective concrete shall be removed and replaced in a manner meeting with the Engineer's approval. Should surface imperfections occur, they may be patched at the discretion of, and in a manner satisfactory to the Engineer. The Engineer reserves the right to require complete removal and replacement of such defective Work should the patching fail to satisfactorily restore the required quality and appearance of the Work. All such Work shall be performed at the Contractor's expense, without extension of time.
3. If for any reason, in the opinion of the Engineer, the testing of any section of the completed structure is necessary, a superimposed load shall be applied by the Contractor and the test conducted in accordance with the current Building Code at the Contractor's expense irrespective of the results of such tests. In cases where failure is declared, the Engineer shall have the authority to order the defective construction removed. All expense of removing such defective construction and substituting new construction, including expense of removing and replacing the Work of others, or protecting and repairing the Work of others, shall be borne by this Contractor.

### 3.04 JOINT INSTALLATION

#### A. Construction Joints:

1. Construction joints shall not be spaced further apart than 60 feet, unless noted otherwise. Where construction joint spacing exceeds 25 feet concrete placement shall be alternated so that adjacent sections are placed a minimum of 48 hours apart to allow for volumetric change of adjacent pours due to shrinkage and to help minimize cracks. Joints shall be located where they will least impair the strength, watertightness, and architectural design of the finished structure. Joint types and locations shall be subject to Engineer's approval. Construction joints shall not be located less than 5 feet from any other joint to which they are parallel.
2. Joints in walls and columns shall be placed at the tops of footings and mat foundations, unless shown otherwise. Joints should be made perpendicular to the main reinforcement where practical.
3. Joints shall be constructed straight by means of a temporary straight edge or rustication strip placed in forms. Joints shall be perpendicular to reinforcement.
4. Reinforcement shall be continuous across construction joints unless otherwise indicated. Unless otherwise specified or shown on Drawings, longitudinal keys at least 1-1/2 inches deep by 3-1/2 inches wide shall be provided in all joints in walls, and between walls and slabs or footings.
5. Surface of concrete shall be thoroughly cleaned and laitance shall be removed by wire brushing prior to placing adjoining concrete.

6. At all vertical joints in new concrete and in new against previously existing concrete, and wherever else called for on the Drawings, bonding adhesive paste shall be applied per the manufacturer's directions.
  7. At all horizontal joints in new concrete and in new against previously existing concrete, and wherever else called for on the Drawings, bonding grout shall be applied in a 2-inch-thick layer.
- B. Expansion and Isolation Joints:
1. Expansion and isolation joints shall be located and constructed as shown. Generally, joints shall be located at the perimeter of slabs-on-grades and other locations shown. These joints shall have filler material and have exposed faces sealed.
  2. Reinforcement and other embedded metal items shall not extend continuously through expansion or isolation joints unless shown otherwise.
  3. Unless polystyrene foam boards are called for on Drawings, premolded type joint fillers shall be installed for expansion joints in accordance with manufacturer's instructions. Joint filler shall be accurately placed and secured. Fillers for each joint shall consist of as few pieces of material as possible. Pourable or non-sag joint sealants per Section 07900 shall be placed in top or face of joints, as applicable, per manufacturer's instructions. All joints in tanks and within buildings shall be sealed unless otherwise shown. Where called for on the Drawings, exterior joints in or around walks and pavement shall be sealed.
- C. Control Joints:
1. Unless indicated otherwise on the Drawings, control joints in slabs shall be located at a maximum spacing of 30 times the slab thickness in both directions with a maximum aspect ratio not to exceed 2 to 1. These joints shall preferably be located on column lines with joints also located between column lines if required to satisfy maximum spacing. Driveways and sidewalks shall have control joints spaced at intervals approximately equal to the slab width. Drives and walks wider than 12-feet shall have longitudinal and transverse joints at 12-foot maximum spacing. All control joints shall be continuous, not staggered or offset. Control joints shall not be located in liquid containing or conveying structures, such as tank, channels and etc.

### 3.05 FINISHING OF FORMED SURFACES

- A. Surface defects shall be patched. Patching procedures shall be as follows:
1. Honeycombed and other defective concrete shall be removed to sound concrete. Cut or chip edges perpendicular to surface or slightly undercut; featheredging is not permitted. Area to be patched and surrounding area within at least 6 inches shall be dampened to prevent absorption of water from patching mortar.



2. Bonding grout consisting of 1-part cement and 1-part fine sand passing a No. 30 mesh sieve mixed to the consistency of a thick cream, shall be thoroughly brushed into surface immediately prior to applying patching mixture.
  3. Patching mixture shall be composed of same proportions as used for concrete except that coarse aggregate shall be omitted and mixture shall not consist of more than 1-part cement to 2-1/2 parts sand by damp loose volume. Mixing water shall be no more than necessary for handling and placing. Patching mixture shall be prepared in advance and allowed to prehydrate with frequent manipulation with trowel, until stiffest consistency that will permit placement is obtained.
  4. Where concrete is exposed to view, color of patching mixture shall be adjusted to match surrounding concrete by substituting appropriate amount of white cement for gray cement. Proper color shall be determined by trial patches.
  5. Patching mixture shall be applied before bond coat begins to lose water sheen. Patching mixture shall be thoroughly consolidated and struck off so as to leave patch slightly higher than surrounding surface. Patch shall be left undisturbed for one hour after which time it shall be finished with metal tools. Patched area shall be moist cured for not less than 7 days.
- B. Tie holes shall be patched as follows:
1. The holes shall be plugged, unless stainless steel noncorrosive or acceptably coated ties are used, as approved by Engineer.
  2. Tie holes shall be cleaned and dampened prior to patching with a non-metallic, non-shrink grout. Patching material shall be packed solid into hole.
  3. Contractor may substitute alternate materials and procedures subject to the approval of Engineer. These materials shall be applied in accordance with manufacturer's written recommendations wherever applicable.
- C. Stains, rust, efflorescence, and surface deposits on exposed concrete shall be removed by methods acceptable to Engineer.
- D. After removal of forms, the surface of concrete shall be given one or more of the finishes specified below as scheduled in the Finishing Schedule of this specification.
1. Rough Form Finish - Fins exceeding 1/8 inch in height shall be removed. Otherwise surfaces shall be left with texture imparted by forms.
  2. Smooth Form Finish - The form facing material with or without form-liner shall produce a smooth, hard, uniform texture in the concrete. The type of facing material or form-liner selected is dependent upon the type of smooth finish desired and shall be approved by the Engineer. Tie holes and defects shall be patched. All fins shall be completely removed.
  3. Special Architectural Finishes - This shall be produced in accordance with Section 6 of ACI 301R.
  4. Smooth Rubbed Finish - The smooth rubbed finish shall be produced on a concrete with smooth form finish as specified above.

- a. Forms shall have been removed and patching completed as soon after placement as possible without damaging or jeopardizing structure.
  - b. Finishing shall be performed no later than the day following form removal.
  - c. Surfaces shall be thoroughly wetted and rubbed with carborundum brick or other abrasive until form marks, fins, and irregularities are removed and uniform color and texture are produced. Cement grout shall not be used.
5. Grout Cleaned Finish - The grout cleaned finish shall be produced on a concrete with smooth form finish as specified above.
- a. Cleaning shall not begin until all contiguous surfaces to be finished are completed and accessible. Finishing as the Work progresses is not permitted. Finishing of an area shall be completed on day it is started.
  - b. Finishing grout shall consist of 1-part cement and 1-1/2 parts fine sand with sufficient water to produce consistency of thick paint. Where concrete is exposed to view, color of grout shall be adjusted to match surrounding concrete by substituting appropriate amount of white cement for gray cement. Proper color shall be determined by trial patches.
  - c. Wet surface sufficiently to prevent absorption of water from grout and apply grout uniformly with brushes or spray gun. Scrub surface vigorously with cork float to coat surface and fill air bubbles and holes. While grout is still plastic, remove excess grout with rubber float or burlap. After surface whitens from drying, rub vigorously with clean burlap. Finish shall be kept damp for minimum of 36 hours after final rubbing.
- E. Finishing of Related Unformed Surfaces:
- 1. Tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after placement and shall be floated to texture consistent with that of adjacent formed surface. Where smooth rubbed finish or grout cleaned finish is specified, finish shall continue uniformly across unformed surfaces.

### 3.06 SLAB INSTALLATION

- A. Floor construction shall comply with ACI 302R. Floors shall be Class 5 except floors with heavy-duty topping shall be Class 7.
- B. Preparation - Subgrade supporting slabs shall be well drained and of adequate and uniform load bearing capacity. Subgrade shall be free of frost before concrete is placed. Subgrade shall be moist at time of placement. Ground may be dampened with water, but there shall be no standing water on subgrade, nor muddy spots.

- C. Vapor barriers shall be installed in all occupied spaces or where shown on Drawings. A minimum 4-inch layer of granular, self-draining compactable fill, shall be placed under the vapor barrier. Joints shall be lapped 6 inch minimum. Caution shall be taken during construction not to tear or otherwise damage the vapor barrier. Damaged vapor barriers shall be patched or replaced.
- D. Floors and slabs shall be sloped to drains as shown maintaining thickness shown on Drawings as a minimum. When formwork is cambered, screeds shall be set to like camber to maintain proper concrete thickness.
- E. A minimum of 1/4 inch per foot slope shall be provided for exterior slabs, driveways, and walks. Driveways and walks can be pitched to one side or crowned along the longitudinal centerline with drainage to both sides as most suitable to surrounding drainage pattern.
- F. Concrete shall not be deposited more rapidly than it can be spread, straight-edged, and darby or bull-floated. These later operations shall be completed before bleed water collects on surface. Rakes shall not be used for spreading concrete to avoid segregation. Slabs shall be consolidated by internal vibrators of high frequency and low amplitude, or vibrating screeds.
- G. Placement of large slab areas shall be sequenced to reduce initial shrinkage cracks. Such slabs can be poured in a series of long strips separated by similar long strips poured at another time. The adjacent pours shall be at least 48 hours apart. Placing sequence and number of pours are subject to the approval of Engineer.
- H. Construction joints shall not be spaced further apart than 60 feet in both directions. Where construction joint spacing exceeds 25 feet concrete placement shall be alternated, in a strip or checkered fashion, so that adjacent sections can be placed a minimum of 48 hours apart to allow for volumetric change of adjacent pours due to shrinkage and to help minimize cracks.
- I. Control joints in slabs shall be located at a maximum spacing of 30 times the slab thickness, in both directions, with a maximum aspect ratio not to exceed 2 to 1, unless noted otherwise. These joints shall be located on column lines where practical. Driveways and sidewalks shall have control joints spaced at intervals approximately equal to the slab width. Drives and walks wider than 12-feet shall have longitudinal and transverse joints at 12-feet maximum spacing. All control joints shall be continuous, not staggered or offset, where practical. Saw-cutting of control joints shall be performed with "Soff-Cut" saw after final finishing as soon as the concrete surface is firm enough not be torn or damaged by the blades and prior to the application of curing compound. In any case, saw-cutting of joints shall be done within two hours after final finishing. Control joint shall be 1/8-inch-wide by one inch deep. Control joints shall not be located in liquid containing or conveying structures, such as tank, channels and etc.
- J. Finishes:
  - 1. Scratched Finish - After concrete has been placed, consolidated, struck off, and leveled, but prior to final set, surface shall be roughened with rakes.

2. Floated Finish - After concrete has been placed, consolidated, struck off, and leveled, surface shall not be worked further until ready for floating. Floating shall begin when bleed water sheen disappears and surface has stiffened sufficiently. Floating shall be performed with wood hand float or power float. During first floating, high spots shall be cut down and low spots shall be filled. Slab shall be refloated immediately to uniform sandy texture.
  3. Troweled Finish - Surface shall first be float finished, followed by power trowel, and then hand troweled. Additional trowelings shall be performed after surface has hardened sufficiently. Final troweling shall be done when ringing sound is produced as trowel is moved over surface. Finished surface shall be free of trowel marks and uniformly smooth and hard. Dusting surface with cement is not permitted.
  4. Broom Finish - Surface shall first be float finished and then given coarse texture by drawing broom over surface.
  5. Non-Slip Finish - Non-slip abrasive aggregate shall be applied in accordance with manufacturer's instructions.
- K. Finishing Tolerances:
1. Floor flatness (FF) and floor levelness (FL) tolerance for slabs on grade with trowel finish shall be FF25/FL20. Minimum local tolerance over 2 bay shall be 2/3 of specified tolerance.
  2. Floated finish surfaces shall be constructed to tolerance of FF 20/FL17.
  3. FL shall not apply to slabs where slope is shown or specified.
- L. Liquid hardener shall be applied to interior exposed concrete floors which do not receive paint, dry-shake hardener, or other coating, or floor coverings. Material shall be applied in accordance with manufacturer's instructions. Remove curing, sealer and dustproofing compounds prior to placing the liquid hardener.
- M. Construction and control joints shall be filled with epoxy joint filler where shown. Joint filler shall be applied not sooner than 3 months after slab construction is completed and shall be installed in accordance with manufacturer's instructions.
- N. Expansion and isolation joints shall be sealed using moisture insensitive and movement tolerating joint sealants per Section 07900.

### 3.07 CURING

- A. Beginning immediately after placement, concrete curing shall be initiated to protect the concrete from moisture loss and premature drying. Concrete shall be continuously cured for a minimum of 7 days. Tanks and other liquid-retaining structures shall be cured for minimum of 10 days. Elevated slabs, joists, and beams shall be cured for at least 14 days and as many additional days as necessary for tests to verify that the concrete has attained 90% of its specified design strength up to a maximum of 21 days. For the entire duration of the curing period, the concrete shall be protected from detrimental weather conditions as specified elsewhere in this Section.

- B. Curing procedures for each type of concrete section shall be submitted and shall be in accordance with ACI 308, "Standard Practice for Curing Concrete," subject to the additional requirements specified herein.
- C. Concrete surfaces not in contact with forms shall be cured by one of following procedures:
  - 1. Ponding, fog spraying, or continuous sprinkling with water. Care shall be taken to avoid thermal shock from use of cold curing water or excessive evaporation rates. Alternate drying and re-wetting of slabs during curing shall be avoided to avoid hairline cracks at the surface.
  - 2. Application of burlap or absorptive mats kept continuously wet.
    - a. Burlap shall be clean and thoroughly rinsed in water before it is used.
    - b. Burlap and absorptive mats shall be soaked as frequently as required to maintain continuously wet surface.
    - c. Burlap and absorptive mats shall remain in place unwetted for minimum of 3 days after end of curing period to permit concrete to dry slowly.
  - 3. Application of waterproof sheet material conforming to ASTM C171.
    - a. Sheet material shall be placed over the wet surface of fresh concrete as soon as possible without marring surface. Material shall be placed flat without wrinkles.
    - b. Sheet material shall cover all exposed surfaces and shall extend beyond edges of slab a distance of at least twice the thickness of the slab.
    - c. Sheet material shall be lapped a minimum of 6 inches. Windrows of earth or wood shall be placed along edges and laps to seal joints and secure material from displacement by wind.
  - 4. Application of approved curing compound.
    - a. Curing compound shall be used only after receiving approval by the Engineer.
    - b. Curing compound shall not be used on walls to receive smooth rubbed or grout cleaned finishes, prior to the completion of the application of these finishes. Curing compound maybe applied, at contractor discretion, over these finishes to complete the curing processes.
    - c. Curing compound shall not be used on surfaces to receive paint, liquid hardener, coatings, sealers, floor hardeners, tile, adhesives, or other materials requiring bond, unless positive measures are taken to remove it completely from the areas to receive bonded application.
    - d. Curing compound shall be placed in accordance with manufacturer's instructions after finishing, and immediately after water sheen has disappeared from concrete surface.

- e. Exposed steel, keyways, or concrete to be surfaced shall be protected from curing compounds, unless the manufacturer of the surfacing material submits written documentation approving the use of their material on concrete on which the specific curing compound was applied.
  - f. Curing compounds shall not be used on surfaces to receive concrete toppings. Refer to Section 03510.
- D. Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by sun shall be minimized by maintaining forms continuously wet.
- 1. Forms shall be continuously sprinkled or covered with wet burlap.
  - 2. If forms are loosened but not removed, water shall be made to run down inside of form by use of soaker hoses.
  - 3. If forms are removed prior to completion of curing period, concrete shall be cured by one of the methods specified for concrete surfaces not in contact with forms.

### 3.08 COLD WEATHER CONCRETING

- A. Cold weather concreting procedures concerning production, transportation, placement, protection, curing, and temperature monitoring shall be submitted to Engineer for review prior to onset of cold weather.

B. Concrete Production:

1. Minimum concrete temperatures during mixing shall be as follows:

Air Temp	Least dimension less than 12 inch	Least dimension 12 inch or greater
30 to 45 degrees F	60 degrees F	55 degrees F
0 to 30 degrees F	65 degrees F	60 degrees F
Below 0 degrees F	70 degrees F	65 degrees F

2. The mixing temperatures shall not be more than 15 degrees F above the values given above. When necessary in order to produce concrete of the specified temperature, the mix water, the aggregates, or both, shall be heated prior to batching. Heating shall be done in a manner which is not detrimental to the mix and does not prevent the entrainment of the required amount of air. The methods used shall heat the materials uniformly. Aggregates shall not be heated directly by gas or oil flame, or on sheet metal over fire. Neither aggregates nor water shall be heated to over 150 degrees F. If either are heated to over 100 degrees F, they shall be mixed together prior to the addition of the cement so that cement does not come into contact with materials which are in excess of 100 degrees F.
- C. Preparation - All snow, ice, and frost shall be removed from the surfaces, including reinforcement, against which the concrete is to be placed. Concrete shall not be placed

around any embedment which is at 32 degrees F or less and is sufficiently massive as to cause the adjacent concrete to freeze.

- D. Placing - Minimum concrete temperatures at the time of placement shall be 55 degrees F for sections with smallest dimension less than 12 inches, and 50 degrees F for larger sections. Maximum concrete temperature shall not exceed 20 degrees F above the minimum required temperatures at the time of placement.
- E. Protection:
  - 1. Protection shall be provided and shall be adequate to prevent the surface temperature of the concrete from falling below 50 degrees F for the duration of the specified curing period. During this period, the concrete surface shall not be exposed to heated air that is more than 20 degrees F above this minimum value. At the end of the protection period, concrete shall be allowed to cool gradually. Maximum decrease in surface temperature shall be 5 degrees F in a one-hour period and 40 degrees F in a 24-hour period.
  - 2. At the time of placement, Contractor shall keep a record of the date, time, outside air temperature, temperature of concrete, and weather conditions (calm, windy, clear, cloudy, etc.). After placement, the Contractor shall keep a record of the date, time, outside air temperature, inside enclosure air temperatures, concrete surface temperatures and weather conditions for the duration of the specified curing period. These conditions shall be recorded at regular intervals, but not less than twice per each 24-hour period, with no period exceeding 16 hours without recorded conditions. The concrete surface temperatures shall be recorded at several locations on the placed section including interior, edge and corner locations and their corresponding enclosure air temperatures at these locations where applicable. These records shall be submitted to the Engineer or resident field representative weekly. The Contractor shall place a sufficient number of thermometers on the concrete surfaces throughout the Work to allow monitoring of concrete surface temperatures representative of all the Work. The Contractor shall place a minimum of two thermometers, each capable of recording the high and low temperature.
  - 3. Materials and equipment required for protection shall be available at Site before cold weather concreting commences
  - 4. Heated Enclosure:
    - a. Enclosure shall be strong enough to be wind-resistant and weather-tight and ample space shall be provided between concrete and enclosure to permit free circulation of the warmed air.
    - b. Maximum air temperature within enclosure shall be 70 degrees F.
    - c. Heaters shall be indirect fired type and shall be vented outside of enclosure. Combustion products shall not be permitted to come in contact with protected concrete.

- d. Heaters and ducts shall be arranged so as not to cause areas of overheating or drying of concrete surface.
- 5. Insulation:
  - a. Slabs not less than 12 inches thick placed on ground, elevated slabs, and walls may be protected by insulated forms and insulation blankets. Insulation shall be wind resistant and weather-tight.
  - b. Insulation type and thickness shall be selected with due regard for concrete temperature, air temperature, and length of protection period in accordance with "Cold Weather Concreting" (ACI 306R). Special care shall be taken at corners and edges of structure. Insulation type, thickness, and "R" value shall be as indicated in cold weather concreting procedures.
  - c. When minimum concrete temperature is not maintained, insulation shall be removed and immediately replaced by a heated enclosure. A sufficient number of surface thermometers shall be furnished and installed as directed by Resident Project Representative.
- F. Curing - If water curing is used, it shall be terminated at least 24 hours before concrete is exposed to freezing temperatures. Curing period shall be completed by non-water curing methods.

### 3.09 HOT WEATHER CONCRETING

- A. Hot weather concreting procedures including production, transportation, placement, protection, and curing shall be submitted for Engineer's review prior to onset of hot weather.
- B. Concrete Production and Delivery - The temperature of the concrete at time of placement shall be maintained within specified temperature by any combination of the following:
  - 1. Type III cement is prohibited.
  - 2. The temperature of the aggregates shall be kept low by shading the aggregate piles or sprinkling the aggregate with water.
  - 3. Concrete ingredients shall be cooled before mixing or flake ice shall be substituted for all or part of mixing water as required to reduce concrete temperature. Mixing shall continue until ice is completely melted.
  - 4. Delivery of concrete shall be scheduled so that concrete is deposited as soon as practicable. Concrete shall be completely discharged within 1 hour after introduction of mixing water to cement.
  - 5. Water reducing or retarding admixtures with shrinkage compensating cement shall be used in such quantities as recommended by the manufacturer.



- C. Preparation - Steel forms, reinforcement, and embedments shall be cooled to below 90 degrees F by means of spraying with water or other approved methods immediately prior to concrete placement.
- D. Placing - Concrete shall be placed at lowest practicable temperature. Temperature of concrete as placed shall not cause difficulty from loss of slump, flash set, or cold joints and shall be between 75 degrees F and 90 degrees F and in no case shall exceed 90 degrees F.
- E. Protection:
  - 1. During hot weather conditions prior to the application of curing materials, the concrete being placed and finished shall be protected from damage due to rapid evaporation. Such protection shall be adequate to prevent premature crusting of surface or an increase in drying shrinkage and cracking. Such protection shall be provided by raising the humidity of the surrounding air by fog spraying, the use of wind breaks or sun shades, additionally reducing of the temperature of the concrete, scheduling placement during the cooler times of days or nights, reducing time between placement of concrete and start of curing, or any combination thereof.
  - 2. Forms shall be covered and kept moist.
- F. Curing:
  - 1. Curing shall be performed by water methods only unless approved otherwise.
  - 2. When the use of waterproof sheet material is approved for hot weather concreting, the material shall be pigmented white.
  - 3. Forms shall be loosened as soon as practicable and water curing shall be used as specified.

### 3.10 MASS CONCRETE

- A. Concrete sections with minimum dimension larger than 36 inches shall be treated as mass concrete.
- B. Concrete Production:
  - 1. Type III cement and accelerating admixtures are prohibited.
  - 2. Cement content shall be reduced by substitution of fly ash within specified limit.
  - 3. Concrete ingredients shall be cooled before mixing or flake ice shall be substituted for all or part of mixing water as required to reduce concrete temperature. Mixing shall continue until ice is completely melted.
- C. Placing:
  - 1. The temperature of concrete when deposited shall be between 50 degrees F and 70 degrees F.
  - 2. Concrete shall be placed in layers approximately 18 inches thick. Vibrator shall extend into previously placed layer.

D. Curing:

1. The curing period for mass concrete shall be a minimum of 14 days.
2. When the surrounding air temperature exceeds 40 degrees F, forms and exposed concrete shall be kept continuously wet for the first 48 hours after placing. Concrete shall be cured by any acceptable method after the first 48 hours, except when surrounding air temperature exceeds 90 degrees F, water curing methods shall be used exclusively. When cold weather concreting provisions apply, continuous wetting during first 48 hours is not required.
3. During and at conclusion of the curing period, the temperature of the air immediately adjacent to concrete shall not fall more than 3 degrees F in any 1 hour, nor 30 degrees F in any 24 hours.

**3.11 TESTING**

A. Concrete materials and operations shall be tested as the Work progresses.

B. Duties of testing laboratory shall be as follows:

1. Review, check, and test proposed materials for compliance with Specifications before the start of the Work.
2. Sample aggregates from concrete production stockpiles, at least once a month, during the placement of concrete and test for compliance with the specifications. The moisture content of each sample shall be measured and recorded.
3. Review and test proposed mixture design when required by Engineer.
4. Randomly sample concrete during construction in accordance with ASTM C172 and perform scheduled tests.
5. Measure and report surface profile of slabs in accordance with ASTM E1155. Surface profile shall be determined for first trowel finish slab and first float finish slab on project and other slabs specified.

C. Test Schedule:

1. Strength:

- a. One strength test shall be made for each 50 cubic yards, or fraction thereof, of each class of concrete placed on any one day. Frequency of testing shall not provide less than 5 strength tests for each class of concrete.
- b. Concrete strength test shall consist of three specimens from each sample molded and cured in accordance with the section of ASTM C31, "Curing Specimens for Checking the Adequacy of Mixture Proportions for Strength or as the Basis for Acceptance or Quality Control".
- c. Specimens shall be tested in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be

tested at 7 days for information. Strength test result shall be average of strengths of 28-day specimens. If one specimen shows evidence of improper molding, handling, or testing, it shall be discarded and remaining specimen shall be considered as strength test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded.

2. Cold Weather Concreting and Form Removal:
  - a. When cold weather concreting procedures apply or when form removal provisions of Section 03100 apply, field cured specimens shall be made to determine when protection procedures may be terminated or when forms may be removed. These field cured specimens shall be in addition to strength tests and shall be made at same time as strength specimens.
  - b. Specimens shall be molded and cured in accordance with the section of ASTM C31, "Curing for Determining Form Removal Time or When a Structure May be Put into Service". Contractor shall determine number of specimens required, but number of specimens shall not be less than three.
  - c. Specimens shall be tested in accordance with ASTM C39. Age-at-test of specimens shall be selected by Contractor.
3. Slump shall be measured for first batch of each concrete class delivered in morning and afternoon, for each strength test, and whenever consistency of concrete appears to vary. Slump shall be measured in accordance with ASTM C143. In the event that a batch fails to comply with specified requirements, the slump shall be measured on each successive batch until three batches meet the specified requirements.
4. Air content shall be determined for first batch of each concrete class delivered in morning and afternoon, for each strength test, and as required by field representative. Air content shall be measured in accordance with ASTM C231, ASTM C173, or ASTM C138. When concrete is placed by pumping, air content and slump shall be measured before pump and also at pump discharge. In the event that a batch fails to comply with specified requirements, the air content shall be measured on each successive batch until three batches meet the specified requirements.
5. Temperature of concrete sample shall be measured for each strength test.
6. If the measured slump or air content falls outside the specified limits, make additional tests immediately. Test all succeeding trucks for both slump and air until three in succession pass the slump and air tests.

### 3.12 EVALUATION OF STRENGTH

- A. Contractor shall perform concrete mix work and produce concrete structures in full compliance with Specifications.

- B. Concrete strength will be considered satisfactory if the average of three consecutive strength test results equals or exceeds the specified strength, and no individual strength test result falls below specified strength by more than 500 psi.

### 3.13 CONCRETE SCHEDULE

- A. Unless indicated otherwise on the Drawings or specified, concrete shall be furnished as follows:
- Class A-1: For all structures not defined under Class A-2 or Class B concrete.
- Class A-2: For structures that cover, convey or store wastewater such as channels and tanks, and their attached auxiliary structures, and all other concrete that will be submerged or exposed to wastewater.
- Class B: Pipe saddle supports, Pipe pier supports, buried electrical duck banks, equipment pads, housekeeping pads and mudmats, unless noted otherwise. The above items shall not be exposed to weather and shall not be submerged in liquids; otherwise they shall be of Class A concrete as specified above.

### 3.14 CONCRETE FINISHING SCHEDULE

- A. Concrete shall be finished as follows unless indicated otherwise:
1. Building Interior:
    - Floors intended as walking surfaces or to receive a floor covering, bases, and curbs: Troweled finish.
    - Other slabs intended to receive roofing, water-proofing membrane or sand bed terrazzo: Float finish.
    - Exposed formed surfaces: Smooth-rubbed finish.
    - Other formed surfaces: Rough form finish.
  2. Building Exterior:
    - Slabs, drives, and walks: Broom finish.
    - Exposed formed surfaces: Smooth-rubbed finish to 6-in below grade.
    - Other formed surfaces: Rough form finish.
  3. Pedestrian Ramps and Exterior Stairs: Non-slip finish.
  4. Tanks and Other Liquid Retaining Structures:
    - Slabs: Float finish.
    - Interior formed surfaces: Grout-cleaned finish.
    - Exterior formed surfaces: Grout-cleaned finish to 6-in below grade.
    - Other formed surfaces: Rough form finish.

### **3.15 ELECTRICAL CONDUITS AND LIQUID PIPE EMBEDMENTS**

- A. Prior to placing concrete with embedded conduits and pipes the contractor shall submit a layout plan drawing that includes the locations, quantity and size of these items. The layout plan shall be submitted to the Engineer at least 14 days prior to placement for approval.
- B. Conduits, pipes and sleeves passing through slabs, walls or beams shall not impair significantly the strength of construction. Conduits and pipes shall not be embedded in columns or beams without the approval of the engineer.
- C. Conduits and pipes embedded within slabs and walls shall not be larger in outside dimension than one-third the overall thickness of the slab or wall that they are embedded in.
- D. Conduits and pipes embedded within slabs and walls shall not be spaced closer than 3 diameters on center.
- E. Concrete cover over conduits, pipes and fittings shall not be less than 2 inches.

### **3.16 HOUSEKEEPING PADS**

- A. Unreinforced concrete housekeeping pads shall be installed under all floor-mounted items such as motor control centers, electrical panels, control panels, transformers, process equipment, and HVAC equipment unless otherwise specified or detailed on the Drawings. Housekeeping pads shall be Class A concrete 4 inches high with chamfered edges and a troweled finish.
- B. Reinforced concrete equipment pads shall be installed under all generators, pumps, motors, blowers, drives or other pieces of equipment that require support greater than 4 inches above the floor. Refer to typical pad details given on the drawings.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 WET WELL PROTECTIVE COATING**

- A. Contractor to provide a multi-component (layer) flexible-sealant liner as specified herein. The liner is intended to provide infiltration resistance and corrosion protection. Acceptable liner products are as follows:
  - 1. OBIC Products – OBIC Armor 1000F
- B. The protective coating system shall consist of a spray-able, solvent free modified polymer or VOC free two component polyurea that chemically and permanently fills voids in concrete and damaged bricks within the precast structure. The system should cause the precast concrete to become sealed against the penetration of liquids from any direction and shall protect the precast concrete from deterioration due to corrosive wastewater environments.
- C. The manufacturer of the sealant liner shall provide the type of material and dosage for the application. The sealant equipment provided by the manufacturer shall be specifically designed for the actual dosage amount to apply the liner system.

- D. The specified coating shall be applied to the walls, floor (including fillets) and underside of the ceiling.
- E. Protective Coating Installation Procedure:
  - 1. The Contractor shall monitor the atmosphere for hydrogen sulfide, methane, low oxygen or other gases. The Contractor shall provide approved flow control equipment, surface preparation, and installation and testing equipment.
  - 2. Preparation and Cleaning of Interior Surfaces - The Contractor shall clean all interior surfaces to be free of grease, loose bricks, mortar, unsound concrete and other materials by water blasting, wet or dry sandblasting, acid washing or other mechanical methods as approved by the Engineer. The Contractor may be required to employ degreasers or concrete cleaners to properly prepare the concrete interior surface to receive the primer and liner material. Following the cleaning, the interior surfaces shall be thoroughly rinsed to remove any residue from the cleaning operation. The precast concrete interior surface shall be dried and at a proper temperature to receive the primer and liner material.
  - 3. Concrete Patching - all non-leaking holes, missing bricks, missing mortar, unsound concrete, delaminated concrete, cracks and spalls shall be repaired, repointed or filled using a pre-mixed, non-shrink, cement based patching mortar consisting of hydraulic cement, graded silica aggregates, polymer, special plasticizing and accelerating agents formulated specifically for vertical or overhead use. The concrete patching material shall contain no chlorides, gypsums, plasters, iron particles, aluminum powder or gas forming agents and shall not promote corrosion of steel that the grout material may come into contact with.
    - a. Set time - less than 30 minutes per ASTM C191.
    - b. One hour compressive strength - minimum of 200 psi per ASTM C109.
    - c. Ultimate compressive strength - minimum of 5,000 psi per ASTM C109.
    - d. Bond strength - minimum of 1,700 psi per ASTM C882.
  - 4. Grouting – All leaking holes, missing bricks, missing mortar, cracks or joints shall be grouted as specified in section 03300.
  - 5. Flow Bypassing - The Contractor shall provide all required flow bypassing around the structures to be rehabilitated. The bypass shall be constructed in accordance with these Specifications.
  - 6. After completion of surface preparation, the Contractor shall perform the seven-point check list, which is the inspection for leaks, cracks, holes, exposed rebar, ring and cover condition, invert condition, and inlet and outlet pipe connection.
  - 7. The Contractor's liner application procedures shall conform to recommendations of the manufacturer, including materials handling, mixing, environmental controls during application, safety and spray equipment. The liner shall be applied to entirety of the interior surfaces of the structure including chimney, walls and benches.

8. Spray equipment shall be specifically designed to accurately ratio and apply the liner system.
9. Application of multi-component liner system shall be in strict accordance with manufacturer's recommendation. Final installation shall be a minimum of 500 mils. Acceptance of the liner shall be based upon the specified thickness. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.
10. The Contractor shall provide a final written report to Owner and Engineer detailing the location, date of report, and description of repair.
11. The protective coating shall be applied to the interior of the wet well's concrete surfaces both above and below the normal water line including walls, floor, fillets and under side of the top slab. The coating shall be applied prior to the installation of piping or equipment. Damage to the coating by work occurring subsequent to the lining shall be repaired.
12. **The Contractor shall be aware of the 21-days cure time required prior to the application of OBIC to the interior of the wet well. The curing time shall be included in the Contractor's project schedule for the work.**

#### 4.02 ADDITIONAL TESTING

- A. Preparation and testing of field cured specimens required for cold weather concreting and for form removal requirements shall be furnished by Contractor at no additional cost to Owner.

END OF SECTION





**SECTION 03310  
GROUT**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes non-shrink cementitious and epoxy grouts.
- B. Masonry grout and bonding grout are specified in other Sections.
- C. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Contractor shall indicate variances from requirements of Contract Documents.
    - b. Product literature.
    - c. Material certifications of ASTM standard and grade.
    - d. Laboratory test reports for grout compressive strength tests.
  - 2. Information for the Record:
    - a. Manufacturer's mixing, placing, and curing instructions.

**1.03 PRODUCT HANDLING**

- A. Environmental limitations specified by manufacturer shall be observed. Heated enclosures shall be provided as required.

**PART 2 PRODUCTS**

**2.01 NON-SHRINK GROUT**

- A. Grout shall be prepackaged, nonmetallic, noncorrosive, non-staining cementitious grout. Grout shall remain volume stable in both dry and wet conditions and provide a minimum of 95% effective bearing area.
- B. Grout shall conform to ASTM C1107 Grade C when tested at fluid consistency of 25 seconds or more per ASTM C939 at temperature extremes of 45 degrees F and 90 degrees F and a working time of 30 minutes. Metallic grouts are prohibited.
- C. Non-shrink property shall not be based on any gas generating additives such as aluminum oxide.
- D. Minimum compressive strength:           1 day   3500 psi

(2-inch cube cured at 70 degrees F)	7 day	5500 psi
	28 day	7500 psi

- E. Non-shrink grout shall be Five Star "Fluid Grout 100", Master Builders "Masterflow 928 Grout", or equal.

## 2.02 EPOXY GROUT

- |    |   |                                     |  |
|----|---|-------------------------------------|--|
| A. | Grout shall be non-shrink prepackaged epoxy grout which will achieve a minimum effective bearing area of 95%. |                                     |  |
| B. | Max unrestrained linear shrinkage:  | 0.0005 inch per inch (ASTM C531)    |  |
|    | Max coefficient of expansion:   | 27 x 10-6 inch/inch/degree F        |  |
|    | Minimum compressive strength:   | 7 day 11,500 psi                    |  |
|    |   | (2-inch cube cured at 70 degrees F) |  |
| C. | Epoxy grout shall be Five Star "HP Epoxy Grout", Master Builders "Masterflow 648", or equal.                  |                                     |  |

## 2.03 MIXING

- A. Grout shall be mixed with mechanical mixers in accordance with manufacturer's written instructions. A mortar mixer with moving blades shall be used to thoroughly blend the potable water into the mix.
- B. Water used to mix non-shrink cementitious grout shall be potable. Water shall be added in just sufficient quantity to obtain desired consistency, but shall not exceed manufacturer's maximum recommendations. Grout shall be used in as stiff a consistency as possible. Grout shall not be re-tempered by addition of water. Grout manufacturer shall be consulted when additional flowability is required.
- C. Materials other than those supplied by grout manufacturer shall not be added to grout.
- D. Cementitious grout shall be mixed close to its placement site, and transportation and placement time shall be limited to less than 15 minutes. Mixed grout temperature shall be held between 45 degrees F and 70 degrees F using ice or hot water as required.
- E. Epoxy Grouts - ingredients are prepackaged and pre-measured and shall be completely mixed in accordance with the manufacturer's instructions.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Concrete to receive grout shall have minimum compressive strength of 3000 psi. New concrete shall be cured as specified prior to placing grout.
- B. Defective or deteriorated concrete shall be removed. Laitance, grease, oil, and other substances which prevent bond shall be removed. Concrete shall be roughened by

chipping, sand-blasting, or other mechanical means to assure the bond of the grout to the existing concrete.

- C. Oil, grease, and dirt shall be removed from the underside of base plates and bearing plates. Air relief holes shall be provided in base plates to eliminate air entrapment.
- D. Concrete to receive non-shrink cementitious grout shall be saturated with water for 24 hours prior to grout placement. Concrete to receive epoxy grout shall be dry.
- E. Forms shall be constructed of coated wood or steel. Forms shall be constructed and anchored to resist hydraulic head of grout and shall be leak-tight when fluid grouts are used.
- F. Unless otherwise specified, non-shrink, cementitious grout shall be used under column and equipment bases. Equipment such as stamping machines, compressors, crushers, etc., involving high impact or vibration, and applications requiring chemical resistance, shall use non-shrink epoxy grouts.
- G. When placing more than 5.0 cubic feet of epoxy grout, contact the manufacturer for recommendations.

### 3.02 PLACING

- A. Grout shall be placed in accordance with manufacturer's instructions.
- B. Grout shall be placed from only one side of form to avoid air entrapment. Grout shall be placed in a continuous operation to avoid cold joints under base plates. Spaces and cavities below top of baseplate shall be completely filled without voids or air pockets.
- C. Grout shall be rodded or vibrated to remove entrapped air.
- D. Grout exposed to view shall be finished smooth after initial set.
- E. Unless otherwise shown, cementitious grouts shall be placed in minimum 1 inch thickness and epoxy grouts shall be placed in minimum 2-inch thickness. Manufacturer's recommendations for minimum thicknesses required for specific situations shall override these specified minimum values.
- F. If the grout extends up the side of a baseplate, it must be cut back to the lower level of the baseplate to avoid cracking of the grout due to possible movement of the baseplate caused by temperature changes, vibrations, etc.

### 3.03 CURING

- A. Grout shall be cured and protected in accordance with manufacturer's instructions.
- B. Non-shrink cementitious grout shall be wet cured for minimum of 7 days.

## PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION



**SECTION 04200**  
**UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing, all labor, materials, equipment, and appliances required to complete the masonry work, including the following:
  - 1. Furnishing and placing masonry units, grout, mortar, masonry lintels, sills, copings, weep holes, and connectors.
  - 2. Furnishing and setting of the steel reinforcement as indicated on the Drawings and as herein specified or necessary.
  - 3. Furnishing, erecting, and maintaining bracing, forming, scaffolding, rigging, and shoring.
  - 4. Furnishing and installing other equipment for constructing masonry.
  - 5. Cleaning masonry and removing surplus material and waste.
  - 6. Installing steel lintels, nailing blocks, all bolts, anchors, inserts, window and door frames, connectors, and construction items to be built in to the masonry, and building in vent pipes, conduits, and other items furnished and located by other trades.
  - 7. The removal and repair of sections of the masonry for inspection as directed by the Engineer.
- B. Products Furnished but not Installed in this Section:
  - 1. Dovetail anchor slots shall be installed under Section 03100.
- C. Products installed but not furnished under this Section include the following:
  - 1. Steel lintels for unit masonry specified in Section 05500.
  - 2. Frames for masonry openings specified in Division 8.
- D. Laboratory services shall be furnished in accordance with requirements of Section 01410.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:

- a. Reinforcement placing drawings. The drawings shall show the location of reinforcement in plan, elevation and section views, and include bending schedules.
  - b. Product literature for joint reinforcement, anchors and ties, premolded joint fillers, and accessory materials.
  - c. Mortar and grout mix proportions.
  - d. Manufacturer's color selection kit for each type of masonry and mortar.
  - e. Samples of each type of facing brick and architectural concrete masonry units showing range of colors, textures, finishes and dimensions.
  - f. Six-inch-long sample of each premolded joint material.
  - g. Product Certifications - Results of tests of mortar, grout mixes, and masonry units attesting compliance with applicable ASTM Standards.
  - h. Certification of compliance for each type and size of anchors, ties, metal accessories, and reinforcement to be used in construction, demonstrating compliance with applicable ASTM Standards.
  - i. Show locations of the wall expansion joints with the corresponding vertical reinforcement.
2. Information for the Record:
    - a. Manufacturer's installation instructions.
    - b. Results of tests on components of mortar, grout, and masonry units to provide evidence that they conform to applicable ASTM specification requirements.

### 1.03 QUALITY

- A. Preconstruction Verifications - The Contractor shall submit the following information prior to the start of construction. The Contractor shall pay for independent laboratory services if required to obtain the following information. Current tests and certificates issued by the manufacturer will be accepted in lieu of laboratory test results.
  1. Test indicating that clay masonry units conform to ASTM C62, ASTM C216 or ASTM C652 and that concrete masonry units conform to ASTM C55 or ASTM C90. Manufacturer's certificates stating that the supplied units conform to these tests will be accepted.
  2. Grout mix designs indicating type and proportions of materials conforming to the proportion specification of ASTM C476, Table 1. Grout mix component material certificates stating conformance with applicable materials listed in ASTM C476.
  3. Mortar mix designs indicating type and proportions of materials conforming to the proportion specification of ASTM C270, Table 1. Mortar mix component

material certificates stating conformance with allowable materials listed the Mortar specification section herein.

- B. Fire-Resistance Ratings - Provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
  - 1. All concrete masonry unit walls shall have a minimum two-hour fire rating.
- C. Single-Source Responsibility for Masonry Units - Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
- D. Single-Source Responsibility for Mortar Materials - Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- E. Masonry construction and materials shall conform to all requirements of the following codes and standards:
  - 1. "Building Code Requirements for Masonry Structures" (ACI 530/ASCE 5/TMS 402), American Concrete Institute, American Society of Civil Engineers, The Masonry Society.
  - 2. "Details and Detailing of Concrete Reinforcement" (ACI 315), American Concrete Institute.
  - 3. "Ohio Building Code".

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver masonry units to job site in undamaged condition. Deliver and handle units to prevent chipping, breaking, or other damage.
- B. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, and other causes. If units become wet, do not install until they are in an air-dried condition.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil. Protect from bending and other damage.

## PART 2 PRODUCTS

### 2.01 MASONRY UNITS

- A. Units shall be sized as shown or specified. Provide or cut special shapes for corners, jambs, lintels, or other areas as required. Special units shall match color and texture of standard units. Units shall be sound, dry, clean, free of cracks, and shall have reached the specified moisture content and compressive strength prior to placing in the structure.
- B. Concrete Masonry Unit (CMU) shall conform to ASTM C90, Type I. Nominal dimensions of standard unit shall be 8-inch high by 16-inch long. Thickness shall be as shown. Unless otherwise specified, units shall be normal weight. When CMU units are used for exterior walls add the following:
  - 1. Units shall contain integral polymer water repellant admixture. Admixture shall be W. R. Grace "Dry-Block Water Repellent Admixture", Euclid Chemical Company "Eucon Blocktite" or equal. Admixture shall be used in accordance with manufacturer's instructions.
  - 2. Where required in Part 4, units shall be integrally colored with mineral oxide pigments. Color will be selected by Owner from manufacturer's standards.
- C. Architectural Concrete Masonry Unit (AMU) shall conform to ASTM C90, Type I, normal weight. Nominal dimensions of standard unit shall be 8-inch high by 16-inch long. Thickness shall be as shown.
  - 1. Unit shall be split-faced and center scored type.
  - 2. Units shall contain integral polymer water repellant admixture. Admixture shall be W. R. Grace "Dry-Block Water Repellent Admixture", or Owner approved alternate. Admixture shall be used in accordance with manufacturer's instructions.
  - 3. Where required in Part 4, units shall be integrally colored with mineral oxide pigments. Color will be selected by Owner from manufacturer's standards.
- D. Concrete Masonry Pre-Insulated Unit (CPMU) shall conform to ASTM C90, Type I, medium weight (115 pcf). Nominal dimensions of standard unit shall be 8-inch high by 16-inch long. Thickness shall be as shown. The units shall be type HI-R-H as defined by the Concrete Products Group and supplied by Fendt products, or Owner approved alternate.
  - 1. Units shall be constructed to receive pre-shaped insulation board inserts specifically formed to fit into the front face of the block cell to provide continuous wall insulation on the exterior side of the block and continuous grouting on the back side of the block.
  - 2. The block/insulation system shall have a minimum thermal R-value of 13.74.
  - 3. Unit shall be standard faced type.



4. Units shall contain integral polymer water repellant admixture. Admixture shall be W. R. Grace "Dry-Block Water Repellant Admixture", or equal. Admixture shall be used in accordance with manufacturer's instructions.
  5. Where required in Part 4, units shall be integrally colored with mineral oxide pigments. Color will be selected by Owner from manufacturer's standards
- E. Architectural Concrete Masonry Pre-Insulated Unit (APMU) shall conform to ASTM C90, Type I, medium weight (115 pcf). Nominal dimensions of standard unit shall be 8-inch high by 16-inch long. Thickness shall be as shown. The units shall be type HI-R-H as defined by the Concrete Products Group and supplied by Fendt products, or Owner approved alternate.
1. Units shall be constructed to receive pre-shaped insulation board inserts specifically formed to fit into the front face of the block cell to provide continuous wall insulation on the exterior side of the block and continuous grouting on the back side of the block.
  2. The block/insulation system shall have a minimum thermal R-value of 13.74.
  3. Unit shall have an exterior split-faced texture.
  4. Units shall contain integral polymer water repellant admixture or Owner approved alternate. Admixture shall be W. R. Grace "Dry-Block Water Repellant Admixture". Admixture shall be used in accordance with manufacturer's instructions.
  5. Where required in Part 4, units shall be integrally colored with mineral oxide pigments. Color will be selected by Owner from manufacturer's standards.

## 2.02 MORTAR

- A. Mortar mix shall conform to ASTM C270, Type S, proportion specification. Required Applicable specifications for mortar material components are: Masonry Cement (ASTM C-91), Mortar Cement (ASTM C1329), portland cement (ASTM C150, Type I), hydrated lime (ASTM C207, Type S) and sand (ASTM C144).
- B. Mortar for exterior masonry units shall contain integral polymer water repellant admixture. Admixture shall be W.R. Grace "Dry-Block Mortar Admixture", "Dry-Brick Mortar Admixture", or equal.
- C. Where mortar is required to be colored it shall be colored with mineral oxide pigments. Color shall be selected by Owner from manufacturer's standard colors.
- D. Calcium chloride and other admixtures containing chloride ion are prohibited.
- E. Mortar shall be used as soon as possible after mixing. Mortar which has begun to stiffen or is not used within two hours after initial mixing shall be discarded. Mortar that cannot regain original plasticity after single retempering shall be discarded.

**2.03 GROUT**

- A. Grout mix components and mixing procedures shall conform to ASTM C476. Admixtures shall not be used without written permission of Engineer.
- B. Grout shall be proportioned in accordance with ASTM C476, Table 1. The grout shall be mixed to a slump of between 8 and 12 inches. Aggregate for grout shall conform to ASTM C404.

**2.04 MASONRY STRENGTH**

- A. Net area compressive strength (f'm) of concrete and brick masonry at 28 days, in each wythe and grouted collar joint, shall be not less than 2000 psi.
- B. Net area compressive strength of clay masonry units shall not be less than 3350 psi.
- C. Net area compressive strength of concrete masonry units shall not be less than 3050 psi.

**2.05 BAR REINFORCEMENT**

- A. Reinforcement shall be grade 60 deformed bars conforming to ASTM A615.
- B. Reinforcement to be welded shall be grade 60 and conform to ASTM A706.
- C. Bars shall be fabricated in conformance with CRSI Manual of Standard Practice.
- D. Reinforcement shall be cold bent, where bending is specifically shown, but shall not be bent or straightened in injurious manner.

**2.06 JOINT REINFORCEMENT**

- A. Joint reinforcement shall be manufactured with wire conforming to ASTM A82, size number W1.7 (9 gauge) for both longitudinal and cross wires. Longitudinal wires shall be deformed in conformance with requirements of ACI 530.1/ASCE 6/TMS 602.
- B. Joint reinforcement shall be fabricated in truss or ladder configurations.
  - 1. Ladder type reinforcement shall have three longitudinal wires weld-connected to perpendicular cross rods to form a ladder design. Two wires shall reinforce back-up wythe and third wire shall act as tie and reinforcement for facing wythe. Cross wires shall be spaced at 15-inch centers and shall not have moisture drip. Hohmann & Barnard, Inc. "230 Ladder-Tri-Mesh or 220 Ladder-Mesh", Blok-Lok "BL-11 Ladder Reinforcement", Wire-Bond "Series 200 Ladder Mesh (3 Wire System)", or equal.
- C. Corners and intersections shall be factory fabricated.
- D. Joint reinforcement shall be hot dip galvanized in accordance with ASTM A153, Class B-1 or B-2.
- E. Plate, header, and bent bar anchors shall conform to ASTM A36.
- F. Sheet metal anchors and ties shall conform to ASTM A1008.
- G. Wire ties and anchors shall conform to ASTM A82.

## 2.07 PREMOLDED JOINT MATERIAL

- A. Expansion Joint Filler for Face Brick - Highly compressible extrusion of four connected rubber tubes. Material shall conform to ASTM D1056, Grade 2A1 or 2B1. Williams Products, Inc. "Everlastic 1056 Joint Filler", Hohmann & Barnard "NS – Closed Cell Neoprene Sponge" or equal.
- B. Shear Keys - Designated to provide lateral stability to masonry walls at expansion and control joints: Rubber conforming to ASTM D2000, 2AA-805 with minimum durometer hardness of 80, or PVC conforming to ASTM D2287, Type PVC 654-4 with minimum durometer hardness of 85. Hohmann & Barnard "RS Series – Rubber Control Joints" or equal.
- C. Control Joint Compressible Filler for Concrete Masonry - Expanded neoprene conforming to ASTM D1056 Grade 2A1. Thickness shall be as shown. Williams Products, Inc. "Williams Neoprene Everlastic NN-1 1040 Series", or equal.
- D. Isolation Gasket - Expanded PVC conforming to ASTM D1056 Grade 2A1 and ASTM D1667, Grade VE41. Williams Products, Inc. "Everlastic Vinyl Type U 1000 Series", or equal.

## 2.08 ANCHORS AND TIES

- A. Dovetail Anchors:
  - 1. Dovetail anchor slot shall be minimum 20-gauge hot dip-galvanized steel. Hohmann & Barnard "No. 305 - Dovetail Slot," or equal.
  - 2. Anchor shall be 1 1/4-inch wide by 12-gauge hot dip galvanized sheet metal fabricated to fit in dovetail slots. Anchor shall be notched to receive 9 gage veneer reinforcement wire. Hohmann & Barnard No. 303 SV, or equal.
- B. Weld on Ties - Anchor shall be 1/4-inch wire or 14 gauge sheet metal designed to weld to steel frame, with adjustable 3/16 wire tie. Anchor shall be mill galvanized and tie shall be hot dip galvanized. Hohmann & Barnard, Inc. "359 Weld-On Tie" or "359-FH Weld-On Tie" with "VBT Vee Byna Tie" or "301W Column Web Tie" or equal.
- C. Corrugated Wall Ties - 7/8-inch wide by 22-gauge, hot dip galvanized steel. Hohmann & Barnard "CWT-Corrugated Wall Tie" or equal.
- D. Corrugated Wall Ties - 7/8-inch wide by 22-gauge, mill-galvanized steel. Hohmann & Barnard "CWT-Corrugated Wall Tie," or equal.
- E. Rigid Straps - 1-1/2-inch-wide by 1/4-inch thick by 2 feet-0-inch-long, ASTM A36 steel bar formed in Z shape with 2-inch legs. Hohmann & Barnard, Inc., "No. 344 - Rigid Partition Anchor", or equal.

## 2.09 ACCESSORIES

- A. Weepholes shall be 3/8-inch OD by 4-inch long medium density polyethylene, white or clear in color, with two cotton wicks per weephole. Hohmann & Barnard, Inc. Model No. 341, or equal.
- B. Hardware cloth shall be corrosion proof, biologically inert, and shall not reduce bond in mortar joint. Hohmann & Barnard "MGS-Mortar/Grout Screen" or equal.

## 2.10 MASONRY CLEANERS

- A. Solution of 2 cup dry measure tetrasodium polyphosphate and two cup dry measure laundry detergent dissolved in one gallon of water.

## PART 3 EXECUTION

### 3.01 COORDINATION

- A. Cold weather construction requirements apply when ambient temperature is below 40 degrees F or temperature of masonry units is below 40 degrees F.
- B. Hot weather construction requirements apply when ambient air temperature exceeds 100 degrees F, or ambient temperature exceeds 90 degrees F and wind velocity exceeds 8 mph.
- C. Prior to beginning masonry work, Contractor shall inspect and verify that foundations are constructed within specified tolerances. Contractor shall notify the Engineer when such inspections are scheduled.
- D. Contractor shall notify Engineer when foundations are not suitable for masonry construction.
- E. The Contractor shall attend to walling-in at their proper position all steel beams, steel columns, bar joists, lintels, openings, window and door frames, anchors, anchor bolts, cutout boxes, electric conduits, downspouts, pipe sleeves, and all similar Work, and shall form all flues, ventilating shafts, leader shafts, recesses, and openings in the walls for the complete performance of the other Work of the Contract.

### 3.02 PERFORMANCE REQUIREMENTS

- A. Masonry shall be constructed within following tolerances (measured in inches) from dimensions shown:
  - 1. Dimension of Elements:
    - a. In cross section or elevation    -1/4, +1/2
    - b. Mortar joint thickness    + 1/8
    - c. Grout space and cavity width    -1/4, +3/8
  - 2. Elements:
    - a. Variation from level    + 1/4 in 10-feet

- + 1/2 maximum
  - b. Variation from plumb + 1/4 in 10-feet  
and true to a line + 3/8 in 20-feet  
+ 1/2 maximum
- 3. Location of Elements:
  - a. Indicated in plan + 1/2 in 20-feet  
+ 3/4 maximum
  - b. Indicated in elevation + 1/4 in story height  
+ 3/4 maximum
- 4. Placing of Reinforcement:
  - a. Location relative to face of masonry + 1/2
  - b. Location along length of wall + 2
- B. Regardless of specified tolerances, no portion of a structure shall extend beyond legal boundary of project.

### 3.03 PREPARATION

- A. Laitance, loose aggregate, dirt, and other substances deleterious to bond shall be removed from foundation prior to laying masonry.
- B. Concrete masonry shall not be wetted before laying.
- C. Clay masonry having initial absorption rate exceeding one gram per minute, per square inch, when measured in accordance with ASTM C67 shall be wetted sufficiently to reduce absorption prior to use. Wetted units shall be laid when surface is dry. Allow units to absorb the water so they are damp but not wet at the time of laying.
- D. The coursing of brick work must be predetermined to ensure the location of sills, lintels, etc., at their proper elevation without the use of any half courses or brick pinnars. Interior masonry shall be laid to minimize the need for units of less than half a unit at masonry openings. Any adjustments in location of vertical joints shall be made at inside corners.
- E. Opening frames and hollow metal door frames shall be installed square and plumb and without distortions. Frames shall be rigidly anchored to masonry. Space between masonry and steel frames shall be filled with mortar as units are laid.
- F. All aluminum materials inserted in masonry shall have the contact surface coated with mastic or coal tar paint.
- G. When new masonry is specified to match existing, this is to mean color, texture, size, grade, and type specifications. Laying new units to match existing includes laying units in running bond, window sills, soldier courses, and other feature courses as required.

- H. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is required. Install cut units with cut surfaces and edges concealed where possible.
- I. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

### 3.04 LAYING UNITS

- A. Placing Units:
  - 1. Build cavity and composite walls and other masonry construction to the full thickness shown on the Drawings. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness shown on the Drawings.
  - 2. Units shall be laid in a full bed of mortar.
  - 3. Unless shown otherwise, construct masonry in 1/2 running bond. (Vertical joints in each course centered on units in courses above and below).
  - 4. Courses shall be carried up level with no section of wall extended more than three feet above an adjacent section. When specifically permitted or required, in certain locations, courses shall be stepped as directed.
  - 5. Place units such that exposed faces or edges of masonry are unaltered manufactured surfaces. Cores, cells, and frogs shall not be exposed to view.
  - 6. Units shall be placed while mortar is soft and plastic. Units disturbed to extent that initial bond is broken after initial positioning, shall be removed and relaid in fresh mortar.
  - 7. Contaminated or damaged units shall not be used.
  - 8. Fill cores in hollow concrete masonry units under bearing plates, beams, lintels, posts, and similar items. Unless shown otherwise, grout shall extend a minimum 24-inch deep and 24-inch on each side of the bearing plates.
  - 9. Build non-load-bearing interior partition walls full height of story, unless shown otherwise, to underside of solid floor or roof structure above and install compressible filler in joints between top of wall and underside of structure.
- B. Bed and Head Joints:
  - 1. Unless specified otherwise bed and head joints shall be 3/8-inch thick except at foundation. Bed joint of starting course shall be not less than 1/4-inch and not more than 3/4-inch thick.
  - 2. Structural glazed facing tile shall be constructed with 1/4-inch bed and head joints.
  - 3. Line pin holes shall be filled.
  - 4. Joints shall be tooled with round jointer when mortar is thumbprint hard.

- 5. Mortar protrusions extending 1/2-inch or more into cavity of cavity wall construction or into cells or cavities to be grouted shall be removed.
- C. Collar joints less than 3/4-inch wide shall be filled with mortar as Work progresses.
- D. Hollow Units:
  - 1. Face shells of bed joints shall be fully mortared.
  - 2. Webs shall be fully mortared in piers, columns, and pilasters. Webs shall be fully mortared in starting course on foundation and where adjacent cells or cavities are to be grouted.
  - 3. Head joints shall be mortared minimum distance from each face equal to face shell thickness.
  - 4. Vertical cells shall be aligned.
  - 5. Maintain joint width of 3/8-inch, except for minor variations required to maintain bond alignment.
- E. Solid Units:
  - 1. Bed and head joints shall be solidly filled. Bed joints shall not be furrowed.
  - 2. Head joints shall not be filled by slushing with mortar.
  - 3. Head joints shall be constructed by shoving mortar tight against adjoining unit. Closure units shall be rocked into place pushing mortar against adjacent units.
- F. In glazed tile walls, all outside corners, joints, and lintels shall be square unless noted otherwise on the Drawings. Sills shall be bullnosed. Glazed tile walls shall be provided with a structural glazed tile coved wall base unless noted otherwise on the Drawings.

### 3.05 EMBEDDED ITEMS

- A. Embedded items and accessories shall be installed and secured as units are laid. Embedded items shall be installed as shown.
- B. Chases shall be constructed as units are laid.
- C. Pipes and conduits passing through masonry shall be installed in sleeves as shown. Embedded aluminum conduits, pipes, and accessories shall be heavily coated with mastic or coal tar paint.
- D. Weepholes:
  - 1. Install weepholes in the head joints in exterior wythes of the first course of masonry immediately above foundation wall or slab. Mortar droppings and debris shall be prevented from blocking weephole.
  - 2. Unless shown otherwise on the Drawings, weepholes shall be installed at 16-inch on center above wall openings. Trim weephole material flush with outside face of wall.

- E. Embedded anchor bolts shall be accurately placed, secured against displacement, and grouted in place.
- F. Anchors, ties, and rigid straps shall be installed as shown or specified. Ends of anchors and ties shall be embedded in mortar joints. Ties and anchors shall be embedded minimum of 1/2-inch into outer face shell of hollow units and 1-1/2-inch into bed joint of solid masonry unit or solid grouted hollow unit. Anchors, ties, and rigid straps shall not be field bent.
- G. Premolded joint materials shall be installed as soon as units are laid. Mortar droppings and debris shall be prevented from entering joints.
- H. Wood nailers shall be installed and secured in locations shown or as otherwise required.
- I. Lintels shall be of the type and size indicated on the Drawings or as required, and shall be acceptable to the Engineer. Lintels shall extend at least 4-inch beyond each side of the opening unless otherwise indicated on the Drawings.
- J. Unless otherwise detailed on the Drawings, structural steel shall be isolated from masonry walls by minimum 3/8-inch thick isolation gasket.
- K. Where masonry walls abut, or cover concrete columns, walls, or other concrete construction, the masonry shall be anchored to the concrete by means of dovetail anchor slots cast in the concrete and dovetail anchors. Anchor slots shall be installed at a minimum horizontal spacing of 24-inch center to center. Dovetail anchors shall be installed at a minimum vertical spacing of 16-inch center to center. Vertical cells of hollow masonry units at each anchor shall be filled with mortar.

### 3.06 PROTECTION

- A. Design, provide, and install bracing according to the guidelines in the "Standard Practice for Bracing Masonry Walls Under Construction" by the Council for Masonry Wall Bracing, 1999.

### 3.07 BAR REINFORCEMENT

- A. Reinforcement shall be cleaned of mud, oil, and other materials which adversely affect bond. Reinforcement with rust, mill scale, or combination of both shall be considered satisfactory provided minimum dimensions, weight, and height of deformations of hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.
- B. Reinforcement shall be accurately placed as shown on approved Shop Drawings and secured against displacements before grouting. Wire bar positioners shall be used to position and secure reinforcement.
- C. When it is necessary to move reinforcement to avoid interference with other reinforcement, conduits, or embedded items, the resulting arrangement of bars shall be subject to Engineer's approval.
- D. Unless shown otherwise on the Drawings, clear distance between reinforcing bars and masonry surface shall not be less than 1/2-inch



- E. Bar reinforcement shall be lapped a minimum of 48 bar diameters unless shown otherwise.
- F. Field bending or straightening of reinforcement is prohibited except as specifically shown.

### **3.08 JOINT REINFORCEMENT**

- A. Joint reinforcement shall be placed so that longitudinal wires are embedded in mortar with 5/8-inch minimum cover.
- B. Joint reinforcement shall be lapped in a minimum of 12-inch.
- C. Block walls shall have ladder type reinforcement. Multi-wythe walls or walls with mortar-filled collar joints shall have truss type reinforcement. Unless otherwise shown on the drawings, reinforcement shall be placed in horizontal joints at 16-inch center to center vertically. An additional joint shall be reinforced above and below openings, and shall extend at least 2-feet. beyond the edges of the openings.
- D. Veneer masonry shall be horizontally reinforced in joints at 16 inches on center and shall be tied to backup support wall at 24" on center horizontally.
- E. Intersecting masonry walls shall be tied together with factory fabricated wire reinforcing tees unless shown otherwise. Reinforcing tees shall be installed in same horizontal joints as other common wall wire reinforcing.

### **3.09 CONTROL JOINTS AND EXPANSION JOINTS**

- A. Vertical masonry control and expansion joints shall be spaced at 20-feet maximum on center, unless shown otherwise on the Drawings. The joint spacing shall include the distance measured around building corners to the next joint.

### **3.10 INSTALLATION OF REINFORCED UNIT MASONRY**

- A. Temporary Formwork and Shores - Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Grouting:
  - 1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure. Grout spaces shall be free of mortar

droppings, debris, loose aggregate and other materials deleterious to masonry grout.

2. A grout pour is defined as the height of masonry to be grouted before additional height of masonry can be added. A grout pour can consist of one or several grout lifts.
3. Cleanouts:
  - a. Provide cleanouts in bottom course of masonry for each grout pour when the grout pour exceeds 5-feet in height. Cleanouts shall be constructed at each vertical bar. In solid grouted masonry, cleanouts shall be spaced at 32-inch maximum centers.
  - b. Cleanouts shall have opening of sufficient size to permit removal of debris. Minimum opening dimension shall be 3-inch.
  - c. After cleaning, cleanouts shall be closed and closures shall be braced against grout pressure.
4. Grout shall be placed within 1-1/2 hours after water is introduced to mixture and prior to initial set.
5. Grout shall be confined to areas shown. Hardware cloth shall be used to prevent grout from flowing into areas not intended to be grouted.
6. Contractor shall provide fine or coarse grout as required to meet the required pour height per the following table.
7. Maximum grout pour height and grout space dimension shall be as follows:

Grout Type	Maximum Grout Pour Height (ft.)	Minimum Width of Grout Space (in.)	Minimum Grout Space Dimensions for Grouting Cells of Hollow Units, (in. x in.)
Fine	1	3/4	1-1/2 x 2
	5	2	2 x 3
	12	2-1/2	2-1/2 x 3
Coarse	1	1-1/2	1-1/2 x 3
	5	2	2-1/2 x 3
	12	2-1/2	3 x 3

8. Grout lifts shall not exceed five feet unless masonry to be grouted has cured for at least 4 hours.
9. Grout lifts shall not exceed the maximum pour height. When intermediate bond beams are present grout lifts shall not exceed the distance between bond beam and floor, the distance between adjacent bond beams or the maximum grout pour height, whichever is smaller.
10. Grout shall be consolidated by mechanical vibration as it is placed. Grout pours exceeding 1-foot in height shall be reconsolidated by mechanical vibration after initial water loss and settlement have occurred.

### 3.11 CURING

- A. Moist curing methods similar to those used in concrete construction shall be used to prevent premature masonry dryouts. Periodic wetting of the finished masonry with a fine water spray shall be used to ensure that adequate moisture is available for curing, strength development, and good bond. The Contractor may use alternate methods of curing, subject to the approval of Engineer, such as covering the walls with polyethylene sheets to create a greenhouse effect to aid in moist curing.

### 3.12 COLD-WEATHER CONSTRUCTION

- A. Implement the following requirements when the ambient temperature falls below 40 degrees F or the temperature of masonry units is below 40 degrees F.
1. Preparation:
    - a. Remove visible ice and snow from the surface of existing foundations and masonry to receive new construction. Heat these surfaces above freezing.
    - b. Remove visible ice and snow from units before unit is laid. Units having temperature below 32 degrees F shall not be used. Units which ordinarily require wetting shall be sprinkled with warm or hot water immediately prior to laying.
  2. Construction:
    - a. When ambient temperature is between 40 degrees F and 32 degrees F, mortar sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F at time of mixing. Mortar temperature shall be maintained above 40 degrees F. Grout materials need not be heated provided they are above 32 degrees F.
    - b. When ambient temperature is between 32 degrees F and 25 degrees F, mortar shall comply with the previous requirements. Heat grout aggregates and mixing water to produce grout temperature between 70 degrees F and 120 degrees F at time of mixing. Grout temperature shall be above 70 degrees F at time of placement.
    - c. When ambient temperature is between 25 degrees F and 20 degrees F, mortar and grout shall comply with the previous requirements and the following. Heat masonry surfaces under construction to 40 degrees F. Use wind breaks if the wind speed exceeds 15 mph. Heat masonry to 40 degrees F minimum prior to grouting.
    - d. When ambient temperature is below 20 degrees F, mortar and grout shall comply with the previous requirements and the following. Provide an enclosure and maintain air temperature in the enclosure above 32 degrees F.

3. Protection - Protection is to be based on the anticipated minimum daily temperature.
  - a. When the minimum daily temperature is between 40 degrees F and 25 degrees F complete masonry shall be protected by covering with weather resistive membrane for 24 hours after construction.
  - b. When the minimum daily temperature is between 25 degrees F and 20 degrees F, completed masonry shall be protected with weather resistive insulating blankets, or equal protection, for 24 hours after construction. The protection period shall be 48 hours for grouted masonry.
  - c. When the minimum daily temperature is below 20 degrees F, completed masonry temperature shall be maintained above 32 degrees F for at least 24 hours by using heated enclosures. The protection period shall be 48 hours for grouted masonry.

### 3.13 HOT WEATHER CONSTRUCTION

- A. High temperature, low humidity, and wind adversely affect performance of the masonry. When ambient temperature is above 100 degrees F or above 90 degrees F with wind velocities greater than 8 mph, protection measures shall be taken to assure continue hydration, strength, and maximum bond.
  1. Mortar beds shall not be spread more than four feet ahead of masonry units.
  2. Units shall be laid within one minute of spreading mortar.
  3. Flush mixer, mortar board, etc. with cool water before they come in contact with mortar or mortar ingredients.
  4. Temperature of mortar and grout shall be below 120 degrees F.
  5. Mortar shall be used within 1-1/2 hours after initial mixing.
  6. When wind speed exceeds 10 mph, wind breaks shall be installed.
  7. Install sunshade or schedule Work during cooler parts of the day.
  8. Materials shall be stored in a shaded location and aggregate stockpiles shall be covered with plastic sheets to retard moisture evaporation.

### 3.14 TESTING/FIELD QUALITY CONTROL

- A. All inspection shall be conducted to verify through visual inspection or by testing that the construction and material meet the requirement of the specifications herein and the Contract Drawings. The Contractor shall engage and pay for the services of an independent testing agency per Section 01410, to perform the following testing for field quality control. Retesting of materials failing to meet specified requirements shall also be done at Contractor's expense.
  1. At the start of work, the independent laboratory at the Site of the project shall:

- a. Verify that the grout slump is between 8 inches to 11 inches per ASTM C143.
  - b. Verify grout mix materials and proportions comply with ASTM C476.
  - c. Verify mortar mix materials and proportions comply with ASTM C270.
  - d. Test clay masonry units per ASTM C62, ASTM C216 and ASTM 652 to verify that compressions strengths.
  - e. Test concrete masonry units per ASTM C55 and ASTM C90 to verify that compressions strengths.
  - f. Verify that materials are on site to protect masonry from hot, cold and inclement weather, as applicable.
2. During periodic inspections, the following tasks shall be performed by the independent laboratory for every 5,000 square feet of wall.
- a. Verify that the grout slump is between 8 inches to 11 inches per ASTM C143.
  - b. Verify grout mix materials and proportions comply with ASTM C476.
  - c. Verify mortar mix materials and proportions comply with ASTM C270.
  - d. Test clay masonry units per ASTM C62, ASTM C216 and ASTM 652 to verify that compressions strengths.
  - e. Test concrete masonry units per ASTM C55 and ASTM C90 to verify that compressions strengths.
  - f. Verify that masonry units and mortar joints are placed within the specified tolerances.
  - g. Verify the placement, grade and type of reinforcing, anchors and metal masonry ties.
  - h. Verify that masonry protection procedures for inclement weather are being followed.
3. Continuous Inspections:
- a. Verify grout spaces are free of mortar droppings, debris, loose aggregate, and any material deleterious to the masonry grout.
  - b. Inspect placement of grout with respect to pour heights, lift heights and consolidation procedures.
  - c. Verify major masonry anchorage details to the building frame when called for elsewhere by the Construction Documents.
  - d. Inspect welding of reinforcing bars to other bars or steel frame. Verify welder's qualifications, electrode type and welding procedures and visual inspect welds in accordance with AWS code D1.4.

- e. Verify that masonry protection procedures for hot weather and cold weather are being followed.

### 3.15 PROTECTION

- A. During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's Work. Cover partially-completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24-inch down both sides and hold cover securely in place.
- B. Do not apply any loads for at least three days after building masonry walls.
- C. Stain Prevention - Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect floor and base of walls from mortar splatter by coverings spread on the floor and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
- D. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

### 3.16 REPAIRING, POINTING AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing - During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
- C. In-Progress Cleaning - Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
- D. Final Cleaning - After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Owner's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean brick by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised, using the following masonry cleaner:
  - a. Job-mixed detergent solution.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.

### **3.17 PENETRATIONS**

- A. All penetrations through masonry walls from any element that interrupts the integrity of the masonry wall, whether in part or in whole, shall be sealed such that it's structural integrity and weatherproof performance and longevity equals or exceeds that of the masonry wall system itself.

### **3.18 MASONRY WASTE DISPOSAL**

- A. Recycling - Undamaged, excess masonry materials are Contractor's property and shall be removed from the Site for his use.
- B. Excess Masonry Waste - Remove excess, clean masonry waste that cannot be recycled and legally disposed of off Owner's property.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 MASONRY COLOR**

- A. The following areas shall have integral color added to, AMU, APMU, and mortar:
  1. Pump control building exterior masonry, color to be selected by the Owner.
  2. For the paint colors of the accent stripes, consult the District's branding guidelines found at: <https://www.nwwsd.org/wp-content/uploads/attachments/thedistrict-brandingguidelines.pdf>

END OF SECTION





**SECTION 05120  
STRUCTURAL STEEL**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing, detailing, fabricating, shop coating, delivering, erecting and/or installing structural steel as shown on Drawings and specified in this Section. Structural steel generally includes:
1. Roof, floor and wall framing elements of standard structural shapes or built-up sections.
  2. Base, cap and bearing plates.
  3. Beams, girders, purlins, girts, columns and posts.
  4. Bracing.
  5. Hangers, struts, tie rods, and sag rods.
  6. Anchor bolts for structural steel.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Shop Drawings shall indicate:
      - 1) Materials of construction.
      - 2) Plan layouts, elevations and sections.
      - 3) Connection details.
      - 4) AWS weld designations and welding procedure.
      - 5) Surface preparation and shop coatings.
      - 6) Accessory materials.
      - 7) Required field measurements.
      - 8) Material certification verifying conformance to applicable specifications of ASTM serial designation.
    - b. Product data for each type of product specified.
  2. Information for the Record:
    - a. Welder qualification certificates.

- b. Inspection reports and test certificates.

### **1.03 QUALITY ASSURANCE**

- A. Standards - Structural steel shall be designed, fabricated, and installed in accordance with following standards.
  - 1. "Structural Welding Codes", American Welding Society.
  - 2. "Specification For Structural Steel Building" as approved by American Institute of Steel Construction.
  - 3. "Code of Standard Practice for Steel Buildings and Bridges", as approved by American Institute of Steel Construction.
  - 4. "Specification for Structural Joints Using ASTM A325 or A490 Bolts" as approved by the Research Council on Structural Connections of the Engineering Foundation.
  - 5. "Specification for the Design of Cold-Formed Steel Structural Members", American Iron & Steel Institute.
  - 6. "Surface Preparation Specification", Steel Structuring Painting Council.

### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Contractor shall use special care in unloading, handling, and erecting steel to avoid bending, twisting, or otherwise distorting the members. Material shall be handled in such a way to minimize damage to shop coatings.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports.
- C. Materials to be embedded in concrete or masonry shall be delivered in sufficient time to permit proper placement.
- D. Fastening materials shall be delivered and stored in unopened boxes with labels clearly identifying fastener material, grade, and manufacturer. Only those fasteners which can be installed in the same day shall be removed from storage. Clean and re-lubricate bolts and nuts that become rusty before use.

### **1.05 PROJECT CONDITIONS**

- A. Prior to fabrication, Contractor shall field measure structures when required for proper fit.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Wide Flange Shapes(W) - ASTM A992.

- B. Other Rolled Shapes, Plate, and Bar - ASTM A36 or ASTM A572 Grade 50 as indicated on the Drawings. Where no indication is given, use ASTM A-36.
- C. Hollow Structural Sections (HSS), tube and pipe - ASTM A500 Grade B.
- D. Pipe - ASTM A53, type E or S, grade B.
- E. Shear connectors, where required, shall be stud type and shall conform to ASTM A108 with minimum tensile strength = 60 ksi, and minimum yield strength = 50 ksi.
- F. Galvanizing - ASTM A123.

## **2.02 ASSEMBLY AND ERECTION FASTENERS**

- A. Bolts and Nuts:
  - 1. High strength bolts - ASTM A325, Type 1 or ASTM A490, Type 1. When no indication is given, ASTM A325 shall be used.
  - 2. High strength and alloy bolts shall bear a distinctive head marking identifying bolt grade.
  - 3. Nuts shall be heavy hex type ASTM A563 Grade C for plain A325 high strength bolts and DH for galvanized bolts. For 490 bolts, heavy hex nuts conforming to ASTM A194 Grade 2H, or ASTM A563 Grade DH or DH3, shall be used.
- B. Washers - ASTM F436 plain with plain bolts and galvanized with galvanized bolts
- C. Nuts and washers of same finish and material as bolts shall be furnished.

## **2.03 ANCHOR RODS**

- A. Bolt and Stud Material:
  - 1. Carbon Steel - ASTM F1554, Grade 55.
  - 2. Threaded Rods - ASTM A36.
  - 3. Stainless Steel - ASTM F593, AISI Type 304.
  - 4. Pipe Sleeves - Steel - ASTM A501, ASTM A120, ASTM A53.
  - 5. Anchor Rod Sleeves - Plastic - Wilson Ankor Shield or equal.
- B. Nuts and washers of same finish and material as bolts shall be furnished.
- C. Sufficient thread length shall be provided to permit installation of nut on both sides of concrete form or template. Anchor length shall be sufficient to include 1-1/2-inch grout space beneath column base plates, or as shown on Drawings.
- D. Anchor embedment and hook dimension shall be as shown on Drawings.

## **2.04 WELDING**

- A. Welders, welding operators, and tack welders shall be qualified by tests as prescribed in AWS Structural Welding Code.
- B. Welding shall be performed using only prequalified joint details in accordance with AWS Structural Welding Code.
- C. Welding electrode shall conform to the requirements of AWS D1.1 and Table 3.1 therein.
- D. Butt joints shall be made with full penetration welds. Minimum size of fillet welds shall be 3/16 inch, except as otherwise required.
- E. Rough welds shall be ground to remove sharp edges, undercuts, pinholes and other irregularities. Overgrinding, which would result in decreasing metal thickness or integrity of weld beyond limits of good welding practice, shall be avoided.
- F. Details and sizes of fillet, plug, and slot welds shall conform to provisions stated in Section 2 of AWS D1.1.
- G. All weld connections shall comply with AWS D1.1 for procedures, appearance, and quality of welds and methods used in correcting welding work.

## **2.05 SIMPLE END BEAM AND BRACE CONNECTIONS**

- A. Fabricator shall detail connections that are not explicitly detailed on the drawings.
- B. Shop connections may be welded or bolted. Field connections shall be bolted unless shown otherwise. Beam connections shall have a minimum of two rows of bolts and connecting angles or plates shall be at least half the depth of the connected beam.
- C. Bolted connections shall be designed using 3/4-inch ASTM A325 bolts in snug-tightened condition, unless noted otherwise. Bolt thread condition shall be Type N or Type X. Where detailed connections are not shown and end reactions are not indicated on the Drawings, member connections shall be designed to support the minimum load of 50% of the total uniform load for the member span as given by the "Maximum Total Uniform load, kips" table of the latest edition of the Steel Construction Manual as published by AISC. Use 50 ksi steel ASD tables for W-sections, WT-Sections, M-sections and S-sections. Use 36 ksi steel ASD tables for C-sections, MC-sections and Angles. The connections shall be designed for greater loads when these loads are indicated on the drawings.
- D. Connection design shall take into account block-shear-tension-rupture, block-shear-shear-yielding, block-shear-shear-rupture, bolt hole bearing strength and flange coping.
- E. Connection designs shall take into account pre-tensioned and slip critical conditions when indicated on the drawings.
- F. Provide pretensioned or slip-critical bolted joint connections where specified or indicated on the Drawings.

## 2.06 OTHER CONNECTIONS

- A. Other connections are connections that are not simple. These include, but not limited to, moment, column base plate, connections to materials other than metal and explicitly detailed connections.
- B. Bolted connections shall be designed using 3/4-inch ASTM A325 bolts in Snug-Tightened condition, unless noted otherwise. Bolt thread condition shall be Type N or Type X
- C. Fabricator shall provide bolt spacing, hole sizes, and hole edge distances per the appropriate standard given herein when not provided on the Drawings.
- D. Provide Pretensioned or Slip-Critical bolted joint connections where specified or indicated on the Drawings.

## 2.07 FABRICATION

- A. Structural steel shall be fabricated as shown on approved Shop Drawings. Work shall be straight and true, free from warps, deformations, unauthorized splices, and unauthorized bends. The as-fabricated tolerances of exposed members shall not exceed one-half of the standard camber and sweep tolerances specified in ASTM A6.
- B. Structural steel shall be fabricated and assembled in the shop to the greatest extent practicable. Members shall be fabricated to proper length, so that use of fillers and shims is avoided. Minimum thickness for all gusset plates, stiffeners, etc. shall be 3/8-inch, unless shown otherwise.
- C. Unless shown otherwise, bracing connections shall be detailed such that the gravity axis of the connected members intersects at a common Work point.
- D. Sharp edges shall be removed by power grinding. Projecting corners shall be clipped at a 45-degree angle.
- E. Holes and other provisions for field connections shall be accurately located. Connections shall be shop checked for proper fit. Connection materials shall be match-marked when required for proper erection.
- F. Provide holes for securing other Work to structural steel and for passage of other Work through structural steel as shown on Drawings.
- G. Holes produced by flame cutting shall be ground smooth.
- H. Surfaces to be coated shall have gouges, handling marks, deep scratches, metal stamp marks, slivered steel and other surface flaws repaired. Surface flaws shall be repaired by welding and grinding as required.
- I. For bolted connections, at least one full thread shall project beyond the nut when tightened.

## 2.08 SHOP COATING

- A. Structural steel wholly embedded in concrete or masonry and with a minimum of 2 inches of concrete cover shall be abrasive blasted in accordance with SSPC SP-6, but shall not be coated. Exposed portions of partially embedded structural steel shall be shop coated to a point 4 inches below the concrete surface.
- B. Galvanized structural steel shall be hot dip galvanized after fabrication in conformance with ASTM A123. Threaded parts and hardware shall be galvanized in conformance with ASTM A153 or zinc plated in conformance with ASTM B695. The galvanized faying surfaces of slip-critical bolted connections shall be Class C.
- C. Painting - Unless specified otherwise, all structural steel, unless galvanized, shall be shop primed in accordance with the requirements of Section 09900.
  - 1. Where bolted connections are indicated to be slip-critical, primer shall be minimum of Class A when tested in accordance with "Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints" as adopted by Research Council on Structural Connections. Manufacturer's certification shall include a certified copy of test report.
  - 2. Surfaces which will be inaccessible for field painting after installation shall receive two coats of primer.
- D. Contractor shall ensure primer is compatible with specified field coatings.

## PART 3 EXECUTION

### 3.01 ERECTION

- A. Structural steel shall be assembled accurately to the lines and elevations shown on Drawings. Erection of structural steel shall conform to AISC standards.
- B. Columns shall be leveled with leveling nuts. Leveling plates are not permitted. After column is leveled and plumbed, the base plate shall be set in non-shrink grout in accordance with Section 03300.
- C. Light drifting is permitted to draw parts together, but drifting to match unfair holes is not permitted. Where holes do not match, holes may be reamed slightly using a tapered reamer. Enlarging holes by electric arc or gas torch burning is prohibited.
- D. Faying surfaces of connections shall be free of loose scale, dirt, burrs, oil, grease, and other contaminants.
- E. Altering structural steel in field by electric arc or gas torch burning is prohibited.
- F. Galvanized steel shall not be field bent, cut, welded, or otherwise altered. Material so altered will be considered defective.
- G. Install and connect all permanent bracing concurrently with the main structural steel erection before construction loads are applied.

- H. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- I. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to placing grout.

### **3.02 ASSEMBLY AND ERECTION FASTENER INSTALLATION**

- A. Hardened washers shall be installed under turned element of bolts. Beveled washers shall be installed when bearing surface of the bolted parts have a slope of 1:20 or greater with respect to the bolt axis.
- B. Fastener threads which have been contaminated with dirt shall be cleaned and lubricated.
- C. Bolts shall be tightened progressing systematically from stiffest part of connection toward free edges.
- D. Bolted connections shall be Snug-Tightened-Joints, unless specified or noted otherwise.
- E. Slip-critical and pretensioned joint connection bolts shall be pre-tensioned to the value given by Table 8.1 of Section 16.2 of the Specifications for Structural Joints Using ASTM A325 or A490 Bolts as prepared by RCSC.
- F. Bolts in slip-critical and pretensioned joint connections shall be tightened by one of the following methods: "Turn-of-Nut" with match-marking, Twist-Off-Type Tension-Control Bolt Pretensioning or Direct-Tension-Indicator Pretensioning in accordance with "Specification for Structural Joints Using ASTM A325 or A490 Bolts" as approved by the Research Council on Structural Connections. The Turn-of-Nut Method will not be approved without match-marking of the nut and protruding end of the bolt after snug-tightening.
- G. All connected steel plies shall be free of dirt, oil, lacquer and burrs, and shall be in firm contact prior to bolting. The faying surface shall be uncoated, coated or galvanized in accordance with Section 3 of the Specification for Structural Joints Using ASTM A325 or A490 Bolts as approved by the RCSC. When connection is designated as slip-critical uncoated and coated faying surfaces shall be Class A, and galvanized faying surfaces shall be Class C.
- H. Bolts shall not be reused once tightened beyond snug-tight.

### **3.03 FASTENER AND ANCHOR SCHEDULE**

- A. Unless shown or specified otherwise, fasteners and anchors shall be as follows:
  - 1. Stainless steel and aluminum structures shall have stainless steel fasteners.
  - 2. Galvanized structural steel structures shall have galvanized or zinc-plated fasteners.
  - 3. Other structural steel - anchors and fasteners shall be uncoated.

### **3.04 FIELD WELDING**

- A. Field welding when shown, specified, or otherwise permitted by Engineer shall be performed in strict accordance with the requirements specified for shop welding.
- B. Areas adjacent to field welds shall not be shop primed. Primer shall be applied after welding.

### **3.05 COATING REPAIR**

- A. Field welds, bolts, and other areas where shop coat is discontinuous or has been damaged during erection, shall be cleaned in accordance with SSPC Standard SP3 and shall receive one coat of prime paint to match the original coating.
- B. Repair of minor scratches or defects in galvanized coating may be repaired with zinc-rich paint in accordance with ASTM A780 at Engineer's discretion.

### **3.06 DISSIMILAR MATERIALS**

- A. Where dissimilar materials come into contact, use neoprene washers, spacers, gaskets or other Engineer approved materials between them to provide insulation against electrolytic action.

### **3.07 QUALITY CONTROL INSPECTION AND TESTING**

- A. The Contractor shall employ a laboratory to perform the following inspections and testing verifications:
  - 1. At the start of Work the inspector at the Site of the project shall:
    - a. Verify that the material identification markings for structural members, high strength bolts, nuts and washers correspond to the appropriate ASTM designations.
    - b. Verify that on-site welders designated by the Contractor are certified to perform welding
    - c. Verify that the proper welding electrodes, equipment and procedures are being utilized.
    - d. Verify the calibration of the tension calibrator and observe the pre-installation testing pretensioned and of slip-critical bolts. The pre-installation verification shall be performed according to Section 7, to obtain a pretension greater than 1.05 times that specified in Table 8.1 of the Specification for Structural Joints Using ASTM A325 or A490 bolts as approved by RCSC. This verification shall be performed for each building of the project and for every six months of any one building's construction.



- B. If inspections determine that a specific item does not comply with the Contract Documents the contractor shall make corrections until the item passes the inspection. The cost of corrections and additional inspections shall be paid for by the Contractor.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 CRITERIA FOR BASE METAL REPAIR OF STRUCTURAL STEEL**

- A. This criteria shall cover damage induced to existing structural steel during or subsequent to installation of steel. Injurious imperfections, such as voids and gouges, shall herein be defined as a base metal discontinuity which results in a reduction of the cross-sectional area of a member, and which exceeds the limiting depths specified below for various thicknesses of material. Except for discontinuities of 1/32 inch and less in depth which are acceptable without any repair, base metal shall be conditioned for the removal of discontinuities by chipping and/or grinding. Weld repair is not required, provided the excavated area is well faired without abrupt changes in contour and the depression does not extend below the rolled surface by more than:
  - 1. 1/32 inch for material less than 3/8 inch thick.
  - 2. 1/16 inch for material 3/8 inch to 2 inches (inclusive) thick.
  - 3. 1/8 inch for material over 2 inches thick.
- B. Voids and gouges greater in depth than the limits given above and all cracks and tears are considered injurious and shall be weld repaired using the methods given below; however, in no case shall the depth of excavations exceed 30% of the base metal thickness without written approval of the Engineers. Prior to welding, the excavations shall be visually (and for cracks and tears, magnetic particle or liquid penetrant) examined to insure complete removal of defects. Excavations shall have a minimum root radius of 1/8 inch, a minimum included angle of 45 degrees on the cross section, and shall be gradually tapered up to the base metal surface at the ends. Repair welding shall be performed in accordance with the parameters of an AWS D1.1 qualified backing bar weld procedure. Completed surfaces of all repair welds shall be visually examined to the acceptance criteria of AWS D1.1 Section 8.15.

##### **4.02 CRITERIA FOR REPAIR OF WELD DEFECTS AND DAMAGED WELDS**

- A. Repair of damage or discontinuities in previously completed welds shall be in accordance with the criteria outlined below. In conjunction with the requirements outlined in weld procedure W200A, defects in welds shall be removed by chipping, arc-gouging, or grinding until sound metal is reached. Removal of indications such as cracks or tears, shall be verified by Magnetic Particle or Liquid Penetrant examination. Removal of other indications and/or damaged areas such as nicks, gouges or undercuts, shall be verified by visual examination. Oxygen gouging, where required, is acceptable providing welding preheat is applied. Rewelding shall be performed in accordance with the procedure originally used to make the weld, or an alternate procedure approved in writing by the Engineers. Removal of attachment welds, when required, shall avoid

removal of base material. Any remaining rough edges shall be ground flush with the surrounding surface and visually inspected to insure soundness.

#### **4.03 FABRICATOR APPROVAL**

- A. The fabricator of structural load bearing members and assemblies furnished under this specification Section, shall be registered and approved to fabricate these products without special inspections per the requirements of the current Building Code Section 1704. The approved fabricator shall submit evidence of such registration at the time that Shop Drawings are submitted. At the completion of production, the approved fabricator shall submit a certificate of compliance to the local building code official stating that the fabrication was performed in accordance with the Contract Documents and the approved Shop Drawings.

END OF SECTION

**SECTION 05500  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing, shop detailing, shop coating, fabricating, delivering, and installing all miscellaneous metals and accessories needed to complete installations as shown on the Drawings, whether or not specifically listed herein, except those items specified in other sections. This section includes design engineering where specifically called for by this Section.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Shop Drawings shall indicate:
      - 1) Types of materials with ASTM designations.
      - 2) Plan layouts, elevations and sections.
      - 3) Connection details.
      - 4) AWS weld designations and welding procedure.
      - 5) Surface preparation and shop coatings.
      - 6) Accessory materials.
    - b. Product literature for all materials and accessories required to complete the installation of the items covered in this Section.
    - c. Samples representative of materials and finished products .
    - d.
  2. Information for the Record:
    - a. Welder qualification certificates.
    - b. Inspection Reports and test certificates.
    - c. Required field measurements.
    - d. Manufacturer's installation instructions.

**1.03 QUALITY ASSURANCE**

- A. Standards - Metal fabrications shall be designed, fabricated, and installed in accordance with following standards.
1. "Structural Welding Codes", American Welding Society.

2. "Specifications for Structural Steel Buildings" as approved by American Institute of Steel Construction.
  3. "Specifications for the Design of Cold-Formed Steel Structural Members", American Iron and Steel Institute.
  4. "Specification for the Design of Cold-Formed Stainless Steel Structural Members", ASCE 8.
  5. "Code of Standard Practice for Steel Buildings and Bridges", as approved by American Institute of Steel Construction.
  6. "Specification for Aluminum Structures", Aluminum Association.
  7. "Specification for Structural Joints Using High Strength Bolts" as approved by the Research Council on Structural Connections of the Engineering Foundation.
  8. "Surface Preparation Specification," Steel Structures Painting Council (SSPC).
- B. Welders, welding operators, and tack welders shall be qualified by tests as prescribed in AWS Structural Welding Code.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Contractor shall exercise particular care in handling materials to prevent damage to shop applied finishes and coatings.
- B. Material shall be stored in a manner to prevent bending or warping. Material shall be stored away from uncured concrete and masonry.
- C. Materials to be embedded in concrete or masonry shall be delivered in sufficient time to permit proper placement.
- D. Fastening materials shall be delivered and stored in unopened boxes with labels clearly identifying fastener material, grade, and manufacturer. Only those fasteners which can be installed in same day shall be removed from storage.

#### **1.05 PROJECT CONDITIONS**

- A. Prior to fabrication, Contractor shall field measure new and existing structures when required for proper fit.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Steel (Carbon Steel):
  1. Wide Flange Shapes (W) - ASTM A992.
  2. Other Rolled Shapes, Plate, and Bar - ASTM A36 or ASTM A572, Grade 50 as indicated on the Drawings. Where no indication is given, use ASTM A36.
  3. Sheets - ASTM A570, Grade 36.

4. Hollow Structural Sections (HHS), tube and pipe - ASTM A500, Grade B.
  5. Pipe - ASTM A53, type E or S, Grade B.
  6. Floor and Tread Plate - ASTM A786 using ASTM A36 steel.
- B. Stainless Steel:
1. Unless indicated otherwise stainless steel shall be AISI Type 304, except AISI Type 304L shall be used for welded construction. The minimum yield strength shall be 30,000 ksi.
  2. Sheet, Strip, Plate, and Flat Bar - ASTM A666, annealed.
  3. Round Bar and Structural Shape - ASTM A276, condition A.
  4. Pipe and Tube - ASTM A312 or ASTM A554, annealed.
  5. Floor and Tread Plate - ASTM A793.
- C. Aluminum:
1. Unless specified otherwise aluminum shall be alloy 6061-T6.
  2. Sheet and Plate - ASTM B209.
  3. Rod and Bar - ASTM B211 or B221.
  4. Pipe and Tube - ASTM B210 or ASTM B429.
  5. Floor and Tread Plate - ASTM B632.

## **2.02 ASSEMBLY AND ERECTION FASTENERS**

- A. Bolts and Nuts:
1. High strength bolts - ASTM A325, Type 1 or ASTM A490, Type 1. When no indication is given, ASTM A325 shall be used.
  2. Stainless Steel - ASTM F593, AISI Type 304.
  3. High strength and stainless-steel bolts shall bear a distinctive head marking identifying bolt grade or material.
  4. Nuts - Heavy hex style, ASTM A563, Grade C, for plain A325 high-strength fasteners and DH for galvanized bolts. For A490 bolts, heavy hex nuts conforming to ASTM A194 for Grade 2H, or ASTM A563 Grades DH or DH3.
- B. Lock Nut - Prevailing torque type, IFI 100, Grade A.
- C. Carbon Steel Washers - ASTM F436 plain with plain bolts and galvanized with galvanized bolts.
- D. Lock Washer - Spring type of same material and coating as bolt.
- E. Headed Studs - ASTM A108, Grade 1010 through 1020, and AWS D1.1, Section IV.
- F. Screws:
1. Carbon Steel - SAE Grade 2, zinc plated.

2. Stainless Steel - IFI 104, Grade 304.
- G. Nuts and washers of same finish and material as bolts shall be furnished

## 2.03 ANCHOR BOLTS

- A. General Requirements:
  1. Bolt and Stud Material:
    2. Carbon Steel - ASTM F1554 Grade 36, unless noted otherwise.
    3. Stainless Steel - ASTM F593, AISI Type 304.
    4. Heavy hex nuts and washers of same material and coating as anchor shall be furnished. Where lock nut is indicated, prevailing torque type lock nut shall be furnished in addition to standard nut.
  5. Anchor Bolt Sleeves:
    6. Steel Pipe - ASTM A501, ASTM A120, or ASTM A53.
    7. Plastic - Wilson "Ankor Shield" or equal.
- B. Cast-In Anchor Bolt (Type A):
  1. Sufficient thread length shall be provided to permit installation of nuts on both sides of concrete form or template.
  2. Anchor embedment, and hook dimension shall be as shown on Drawings.
  3. Where sleeve is shown, sleeve shall be fabricated from material indicated above.
- C. Adhesive Anchor (Type B):
  1. Adhesive – 100% solids, 100% reactive epoxy (ester-based resins are not permitted) in conformance with ASTM C881, Type IV, Grade 3, Class B and C. Minimum bond strength to concrete, per ASTM C882, shall be 1800 psi at 7 days. Adhesive shall be mixed in accordance with manufacturer's recommendations. The adhesive shall be formulated to withstand the maximum allowable published load permanently without creep or failure.
  2. Where adhesive anchor is installed in hollow masonry, stainless steel screen tubes shall be furnished to contain adhesive until stud is inserted.
  3. The anchor rods shall be threaded for entire length. Carbon steel rods shall conform to ASTM A193 B7 (high strength) and stainless-steel rods shall conform to AISI 304.
  4. Stud shall be threaded full length.
  5. Adhesive anchors shall be type "HIT-RE-500-V3" manufactured by Hilti, or equal. All formulations of the "Power-Fast Epoxy" as manufactured by Powers/Rawl shall not be used.
- D. Expansion Anchor (Type C):

1. Wedge Type Anchors - FS A-A 1923A, Type 4.
  2. All components shall be of same material.
  3. Expansion anchors shall be type "Kwik Bolt TZ" manufactured by Hilti, or equal.
- E. Sleeve Masonry Anchor (Type D):
1. Sleeve Type Anchors - FS FF-S-325, Group II, Type 3, zinc plated carbon steel.

## 2.04 WELDING

- A. Carbon Steel:
1. Welders, welding operators, and tack welders shall be qualified by tests as prescribed in AWS Structural Welding Code.
  2. Welding shall be performed using only prequalified joint details in accordance with AWS Structural Welding Code.
  3. Welding electrode shall conform to the requirements of AWS D1.1 and table 3.1 therein.
  4. Welded fabrications which will be exposed to weather, submerged, or subject to sewage spray shall be continuously welded.
  5. All welding processes and procedures and joint details shall be in accordance with the requirements of AWS D1.1. Weld quality shall conform to Section 8 of AWS D1.1.
- B. Stainless Steel:
1. Stainless steel shall be welded with inert gas shielded process (GTAW, GMAW, or PAW). Inert gas protection shall be provided to top and under or backside of weld to ensure protection from atmospheric contamination.
  2. Filler metal shall be extra low carbon (ELC) of appropriate type for base material being welded.
  3. Residue, oxide, and heat stain in heat affected zone shall be removed.
- C. Aluminum:
1. Aluminum shall be welded by process which does not require the use of welding flux.
  2. Filler metal shall be as recommended by AA and AWS for base material and welding process used. Filler metal shall be selected to minimize crack sensitivity of weldment and to minimize discoloration of weldment on items to be anodized.
- D. Welding shall be performed in such a manner to prevent warping and distortion.
- E. Butt joints shall be made with full penetration welds. Weld reinforcement on back side shall be smooth, uniform, and no more than 1/16 inch in height.

- F. Rough welds shall be ground to remove sharp edges, undercuts, pinholes and other irregularities. Chipping is permitted to remove sharp edges if followed by welding. Overgrinding, which would result in decreasing metal thickness or integrity of weld beyond limits of good welding practice shall be avoided.
- G. Weld spatter shall be removed by chipping and grinding as required. Use of an anti-spatter coating applied adjacent to weld area prior to welding is permitted.

## **2.05 FABRICATION**

- A. Work shall be fabricated straight and true, free from warpage or other defects and assembled in a first-class workmanlike manner. Joints, copes, miters, and corners shall be accurately cut, machined, filed, and fitted with best methods as required for fabrication.
- B. Work shall be fabricated as shown on approved Shop Drawings. Removable parts or members shall be carefully fitted and secured by screw fastenings or other methods as may be required.
- C. Work shall be fabricated in as large as sections as practicable to minimize field connections. Field connections shall be designed and constructed in most practical locations for strength, appearance, and ease of installation. Field connections shall be mechanically fastened unless field welding is shown, specified, or permitted by Engineer.
- D. Holes and other provisions for field connections shall be accurately located. Connections shall be shop checked for proper fit. Connection materials shall be match-marked when required for proper installation.
- E. Holes produced by flame cutting shall be ground smooth.
- F. Sharp edges of flame cut or sheared carbon steel fabrications shall be removed by power grinding.
- G. Carbon steel surfaces to be coated or galvanized shall have gouges, handling marks, deep scratches, metal stamp marks, slivered steel and other surface flaws repaired. Surface flaws shall be repaired by welding and grinding as required.

## **2.06 SHOP COATING**

- A. Aluminum:
  - 1. Anodizing - Where specified, provide Architectural Class I anodic coating, applied after fabrication.
  - 2. Surfaces which will be in contact with concrete, masonry, or dissimilar metals shall receive a heavy coat of coal tar paint, Bitumastic Super Service Black, or equal.
- B. Carbon Steel:
  - 1. Steel fabrications wholly embedded in concrete or masonry and with a minimum of 2 inches of concrete cover shall be abrasive blasted in accordance



with SSPC SP-6, but shall not be coated. Exposed portions of partially embedded steel shall be shop coated to a point 4 inches below the concrete surface.

2. Galvanizing - Component shall be hot dip galvanized after fabrication in conformance with ASTM A123. Threaded parts and hardware shall be galvanized in conformance with ASTM A153 or zinc-plated in conformance with ASTM B695.
3. Painting - Unless specified otherwise, non-galvanized fabrications shall be shop primed per Section 09900.
  - a. Surfaces which will be inaccessible for field painting after installation shall receive two coats of primer.
  - b. Contractor shall ensure primer is compatible with specified field coatings.

## **2.07 PIPE BOLLARDS**

- A. Metal pipe bollards shall be constructed as shown on the Drawings.
- B. Metal pipe shall be hot dipped galvanized, unless noted otherwise on Drawings.
- C. Plastic bollard guards shall be provided when specified in Part 4.

## **PART 3 EXECUTION**

### **3.01 ERECTION**

- A. Metal fabrications shall be installed in accordance with manufacturer's instructions and as shown on Drawings.
- B. Fabrications shall be installed level and plumb or as otherwise shown on Drawings. Shims shall be furnished when required.
- C. Components shall be assembled as indicated on Drawings. Light drifting is permitted to draw parts together, but drifting to match unfair holes is not permitted. Where holes do not match, holes may be reamed slightly using a tapered reamer. Enlarging holes by burning is prohibited.
- D. Contact surfaces between members and areas adjacent to bolt holes shall be free of dirt, oil, loose scale, burrs, pits, and other defects that would prevent proper seating and connection of the members.
- E. Galvanized or anodized material shall not be field bent, cut, welded, or otherwise altered. Material so altered will be considered defective.

### **3.02 ASSEMBLY AND ERECTION FASTENER INSTALLATION**

- A. Washers shall be installed under turned element of bolts. Hardened washers shall be used for high strength and alloy bolts. Beveled washers shall be installed when bearing surface of the bolted parts have a slope of 1:20 or greater with respect to the bolt axis.

- B. Fastener threads which have been contaminated with dirt shall be cleaned and lubricated.
- C. Stainless Steel - Anti-seizing lubricant shall be applied to threads prior to installation.
- D. Bolts shall be tightened progressing systematically from stiffest part of connection toward free edges.
- E. Bolted connections shall be snug-tightened-joints, unless noted otherwise. All connected steel plies shall be free of dirt, oil, lacquer and burrs, and shall be in firm contact prior to bolting.
- F. High strength and alloy bolts shall not be reused once tightened beyond snug-tight.
- G. For bolted connections, at least one full thread shall project beyond the nut when tightened.

### 3.03 ANCHOR BOLT INSTALLATION

- A. Non-cast-in type anchors shall be installed in predrilled holes of size specified or as recommended by manufacturer. Anchors shall be embedded to depth indicated below unless shown otherwise on the Drawings.
- B. Anchor bolted connections shall be snug-tightened- in accordance with "Specification for Structural Joints Using ASTM A325 or A490 Bolts" as approved by the Research Council on Structural Connections of the Engineering Foundation or as otherwise specified by anchor manufacturer.
- C. Expansion Anchor:
  - 1. Unless indicated otherwise, expansion anchors shall have an effective embedment as follows:

Stud Diameter	Minimum Embedment
1/4 inch	2 inches
3/8 inch	2 inches
1/2 inch	3-1/4 inches
5/8 inch	4 inches
3/4 inch	4-3/4 inches
1 inch	6 inches

- 2. Unless indicated otherwise, expansion anchors shall be spaced as follows:
    - Minimum center to center spacing: 2 times embedment.
    - Minimum edge distance: 3 times embedment.
  - 3. Unsound concrete shall be reported to Engineer.
- D. Adhesive Anchor:
  - 1. Adhesive anchors shall be placed in holes larger than stud diameter using a rotary percussion hammer and carbide bit. Hole diameters shall be as recommended by manufacturer for each specific anchor diameter.

2. Unless indicated otherwise, Adhesive anchors shall have an effective embedment as follows:

Stud Diameter	Minimum Embedment
3/8 inch	3-3/8 inches
1/2 inch	4-1/2 inches
5/8 inch	5 5/8 inches
3/4 inch	6-3/4 inches
7/8 inch	7-7/8 inches
1 inch	9 inches

3. Preparation Procedure:
- Hole shall be cleaned of dust and residue by blasting with dry and oil-free compressed air. Air nozzle shall be inserted to bottom of hole.
  - Sides of hole shall be cleaned with a nylon bristle brush.
  - Compressed air blast shall be repeated.
4. Standing water and frost shall be removed immediately prior to injecting adhesive.
5. Adhesive shall be injected from bulk-loading caulking gun, disposable caulking tubes, or pneumatic dispenser. Adhesive shall be injected using extension on nozzle to reach bottom of drilled hole.
- Anchoring to Concrete - Nozzle shall be inserted to back of hole and adhesive dispensed while slowly withdrawing nozzle. Hole shall be filled to pre-determined depth which will cause hole to be completely filled after stud is inserted.
  - Anchoring to Masonry - Screen tube shall be filled with adhesive while slowly withdrawing nozzle. Screen tube shall be carefully inserted into drilled hole.
6. Stud shall be pushed into adhesive with gentle, uniform pressure while slightly rotated to ensure adhesive completely surrounds stud. Stud shall be inserted to full depth of hole.
7. Adhesive displaced from hole shall be removed immediately. Adhesive which has hardened on projecting portion of stud or on concrete surfaces shall be removed.
8. Nut shall not be tightened nor load applied until adhesive has fully cured as recommended by manufacturer.
9. Threaded anchors shall have at least one full thread projecting beyond the nut when tightened.

### 3.04 FASTENER AND ANCHOR SCHEDULE

- A. Unless shown or specified otherwise, fasteners and anchors shall be as follows:

Base Metal	Fastener Metal and Coating
Stainless steel	Stainless Steel
Aluminum	Stainless Steel
Galvanized steel	Galvanized or zinc plated carbon steel
Field painted or uncoated carbon steel	Unfinished or zinc plated carbon steel

- B. Where a connection involves dissimilar base metals, fastener shall be as required for most corrosion resistant base metal in connection, or dielectric material shall be installed.
- C. Anchors bolts and fasteners in submerged applications shall be stainless steel.
- D. Where anchor type is not shown or specified, anchor furnished shall be suitable for substrate material and specific application. Adhesive anchors are not permitted for anchoring to vertical or overhead surfaces inside of buildings or other fire rated locations.

Substrate Material	Suitable Anchor Type
Concrete	A, B, C
Solid or Grouted Masonry	A, B, D
Hollow Masonry	B, D

### 3.05 FIELD WELDING

- A. Field welding when shown, specified, or otherwise permitted by Engineer shall be performed in accordance with the requirements specified for shop welding.
- B. Areas adjacent to field welds shall not be shop primed. Primer shall be applied after welding.

### 3.06 COATING REPAIR

- A. Welds, bolts, and damage to shop applied coatings shall be touched-up with same or equivalent materials used in original coating.
- B. Minor scratches or defects in galvanized coating may be repaired with zinc-rich paint in accordance with ASTM A780 at Engineer's discretion.
- C. Repair of anodized coatings in field is not permitted. Damaged materials shall be removed and re-anodized.

### 3.07 CLEANING

- A. Metal fabrications shall be cleaned with mild detergents prior to final acceptance. Steel wool, harsh abrasives, or alkaline or acid cleaners are not permitted.

### 3.08 QUALITY CONTROL INSPECTION AND TESTING

- A. The Contractor shall employ a laboratory to perform the following inspections and testing verifications: Where pretensioned or slip critical connections are indicated refer to Section 05120 for additional inspection requirements.

1. At the start of Work, the inspector at the Site of the project shall:
  - a. Verify that the material identification markings for structural members, high strength bolts, nuts and washers correspond to the appropriate ASTM designations.
  - b. Verify that on-site welders designated by the Contractor are certified to perform welding
  - c. Verify that the proper welding electrodes, equipment and procedures are being utilized
2. If inspections determine that a specific item does not comply with the Contract Documents the contractor shall make corrections until the item passes the inspection. The cost of corrections and additional inspections shall be paid for by the Contractor.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 DISSIMILAR MATERIALS**

- A. Where dissimilar materials come into contact, use neoprene washers, spacers, gaskets or other Engineer approved materials between them to provide insulation against electrolytic action.

##### **4.02 CRITERIA FOR BASE METAL REPAIR OF STRUCTURAL STEEL**

- A. This criteria shall cover damage induced to existing structural steel during or subsequent to installation of steel. Injurious imperfections, such as voids and gouges, shall herein be defined as a base metal discontinuity which results in a reduction of the cross-sectional area of a member, and which exceeds the limiting depths specified below for various thicknesses of material. Except for discontinuities of 1/32-inch and less in depth which are acceptable without any repair, base metal shall be conditioned for the removal of discontinuities by chipping or grinding. Weld repair is not required, provided the excavated area is well faired without abrupt changes in contour and the depression does not extend below the rolled surface by more than:
  1. 1/32 inch for material less than 3/8 inch thick.
  2. 1/16 inch for material 3/8 inch to 2 inches (inclusive) thick.
  3. 1/8 inch for material over 2 inches thick.
- B. Voids and gouges greater in depth than the limits given above and all cracks and tears are considered injurious and shall be weld repaired using the methods given below; however, in no case shall the depth of excavations exceed 30% of the base metal thickness without written approval of the Engineers. Prior to welding, the excavations shall be visually (and for cracks and tears, magnetic particle or liquid penetrant) examined to insure complete removal of defects. Excavations shall have a minimum root radius of 1/8 inch, a minimum included angle of 45 degrees F on the cross section, and shall be gradually tapered up to the base metal surface at the ends. Repair welding shall be performed in accordance with the parameters of an AWS D1.1 qualified backing bar

weld procedure. Completed surfaces of all repair welds shall be visually examined to the acceptance criteria of AWS D1.1 Section 8.15.

#### **4.03 CRITERIA FOR REPAIR OF WELD DEFECTS AND DAMAGED WELDS**

- A. Repair of damage or discontinuities in previously completed welds shall be in accordance with the criteria outlined below. In conjunction with the requirements outlined in weld procedure W200A, defects in welds shall be removed by chipping, arc-gouging, or grinding until sound metal is reached. Removal of indications such as cracks or tears, shall be verified by magnetic particle or liquid penetrant examination. Removal of other indications or damaged areas such as nicks, gouges or undercuts, shall be verified by visual examination. Oxygen gouging, where required, is acceptable providing welding preheat is applied. Rewelding shall be performed in accordance with the procedure originally used to make the weld, or an alternate procedure approved in writing by the Engineer. Removal of attachment welds, when required, shall avoid removal of base material. Any remaining rough edges shall be ground flush with the surrounding surface and visually inspected to assure soundness.

#### **4.04 FABRICATOR APPROVAL**

- A. The fabricator of structural load bearing members and assemblies furnished under this Section, shall be registered and approved to fabricate these products without special inspections per the requirements of the current Building Code Section 1704. The approved fabricator shall submit evidence of such registration at the time that Shop Drawings are submitted. At the completion of production, the approved fabricator shall submit a certificate of compliance to the local building code official stating that the fabrication was performed in accordance with the Contract Documents and the approved Shop Drawings.

#### **4.05 PLASTIC BOLLARD GUARDS**

- A. Pipe bollards cover shall be a closed top, 1/8-inch-thick HDPE with UV inhibitors and rated for outdoor environment. The bollard cover shall be integrally colored; Owner shall select color. A reflective striping, as specified, shown or required shall be a 3M #680 reflective self-adhesive tape which is compatible with the HDPE cover and exterior rated. The striping pattern and colors, shall be as specified, shown or as required. HDPE covers shall provide for a uniform height of bollards. Contractor shall coordinate bollard cover size with the metal pipe bollard as shown on the Drawings.

#### **4.06 WET WELL HARDWARE**

- A. All fastening hardware in the wet well shall be 304 stainless steel.

#### **4.07 OWNER'S BUILDING SIGN**

- A. The sign proposed on the building shall be fabricated of ¼-inch steel and anchored to the building façade.

- B. For the colors of the building sign, consult the District's branding guidelines found at:  
<https://www.nwwsd.org/wp-content/uploads/attachments/thedistrict-brandingguidelines.pdf>





**SECTION 05540  
IRON CASTINGS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes manhole covers and frames, inlet grates and frames, stop plank grooves, and other iron castings shown on Drawings.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Product literature that shall be included; General Specifications, Surface Coating, Anchor Bolts, Machine Bearing Surface.
    - b. Independent Shop Drawings shall be submitted for the frame and the cover.
    - c. A submittal of a casting schedule that clearly notes either the structure number or in what circumstances the casting is intended to be installed, shall be included, i.e., roadway.
    - d. All dimensions for both the frame and the cover/grate shall be included.
  - 2. Information for the Record:
    - a. Material certification.
    - b. Proof-load test data.
    - c. Manufacturer's installation instructions.
    - d. Manufacturing Capabilities and Quality Control Measures.

**1.03 PRODUCT HANDLING**

- A. Castings shall be delivered in sufficient time to permit proper placement in pavement and slabs.
- B. Castings shall be stored in such a way as to prevent warping prior to installation.
- C. Additional product handling requirements are specified in Section 01350.

## **PART 2 PRODUCTS**

### **2.01 MANHOLE COVER AND FRAME**

- A. All castings shall be rated for heavy duty service.

### **2.02 INLET GRATE AND FRAME**

- A. Castings shall be suitable for heavy duty service.
- B. Inlet grate and frame shall be a flat inlet grate for use with an ODOT 2-2B as shown on the Drawings.

### **2.03 RESERVED**

### **2.04 PERFORMANCE REQUIREMENTS**

- A. Castings shall be gray iron conforming to ASTM A48, Class 35.

### **2.05 FABRICATION**

- A. Castings shall be free from pouring faults, sponginess, cracks, blowholes, blisters, shrinkage strains, and other defects. Plugging of defective castings is not permitted.
- B. Castings shall be true to pattern in form and dimension. Weight of castings shall not vary by more than 5% from published weight. Contractor shall submit invoices showing actual weight of casting as certified by manufacturer.
- C. Castings shall have machined bearing surfaces.
- D. All castings shall be coated with a non-toxic, nonflammable, water-based, asphalt paint.
- E. Lettering shall be cast on covers. Unless indicated otherwise, the manufacturer's name shall be cast in cover.
- F. Covers shall be furnished with bolts, locks, hinges, perforations, lifting rings, and pick holes as specified, shown on Drawings, or as directed.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Contractor shall examine surfaces to receive castings and shall report unacceptable conditions to Engineer before proceeding with the Work.

### **3.02 ERECTION AND INSTALLATION**

- A. Castings shall be accurately set, aligned, and anchored as shown on Drawings.

- B. Castings shall be installed in accordance with manufacturer's instructions or shown on the drawings. If any discrepancies exist, then the more stringent requirements shall take precedence.

**PART 4 SPECIAL PROVISIONS**

**4.01 STANDARD SANITARY SEWER MANHOLE**

- A. Sanitary Sewer Manhole Castings shall be provided in accordance with the District's Standard Manhole Casting.
- B. Covers for sanitary sewer manholes shall be stamped with the District's sanitary sewer logo.

**4.02 TRENCH DRAINS**

- A. Trench drains shall be provided where indicated on the plans.
- B. Type A trench drains shall be Neenah R4996-C with self-forming trench pan and Type C grate.

**4.03 CONCRETE COLLARS**

- A. Concrete collars shall be provided for all manholes and valve boxes located in paved areas.

END OF SECTION



**SECTION 06630  
MANHOLE STEPS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes manhole steps for new cast-in-place and existing structures.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's installation procedures.
    - b. Product literature.

**1.03 DELIVERY, STORAGE, AND HANDLING**

- A. Steps to be embedded in new structure shall be delivered in sufficient time to permit proper placement.

**PART 2 PRODUCTS**

**4.01 MATERIALS**

- A. Manhole steps shall be polypropylene plastic reinforced with a 1/2-inch grade 60 reinforcing bar.
- B. Manhole steps for new structures shall be M.A. Industries Model PS-1, or equal. Manhole steps for existing structures shall be M.A. Industries Model PS1-PF or equal.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Contractor shall procure manhole steps in sufficient time for installation into precast and cast-in-place concrete structures.

**3.02 PREPARATION**

- A. Existing structures shall be prepared as required by manufacturer.

**3.03 INSTALLATION**

- A. Manhole steps shall be installed square, level, and plumb free of warp, twist, sag, and buckles.
- B. Manhole steps in new concrete structures, whether precast or cast-in-place, shall be installed at time of casting.

- C. Steps shall be installed in accordance with manufacturer's instructions.
- D. Contractor shall reinstall all steps that do not meet the approval of the Owner and Engineer.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 07240  
ROOF INSULATION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing all roof insulation.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Manufacturer's literature.
    - b. Sample: (If requested by the Engineer)  
Two 8-inch by 8-inch pieces of each type and thickness of rigid insulation.
  2. Information for the Record:
    - a. Manufacturer's certificates.
    - b. Manufacturer's certification of installing contractor.

**1.03 ENVIRONMENTAL REQUIREMENTS**

- A. Environmental requirements shall be in accordance with what is indicated on the plans.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Insulation shall be a minimum 3-inch thick over concrete and metal deck areas and a minimum 1-1/2-inch thick over lightweight concrete roof fill areas, and shall be installed in two separate layers, unless otherwise noted on the Drawings or in Part 4 of this Section. The use of tapered insulation shall not result in total insulation thickness less than the minimum specified.
- B. Insulation shall be approved by the roofing manufacturer. Insulation and vapor barriers shall be guaranteed by the roofing manufacturer.
- C. Type A - Fiberglass Board Type:
1. Insulation shall consist of inorganic material made up into sections for convenient handling, preferably 36-inch by 48-inch, faced on top and two ends with tough paper adhered to the insulation boards by hot melt roofing

compound. Materials shall not disintegrate, slump, or provide sustenance to vermin, rodents, insects, bacteria, or fungi.

2. Thermal conductivity at mean temperature of 75 degrees F shall not exceed 0.25 Btu per hour per degree F per inch of thickness per square feet.
3. Permanent deformation shall not exceed 5% after being subjected to a load of 500 pounds per square feet for 1-inch thickness.
4. The material shall be rigid fiberglass roof insulation and shall be in conformance with FS HH-1-526C.
5. Preformed tapered sections shall be used to slope roofs where indicated on the Drawings. The taper of the insulation shall be between 1/8-inch and 1/4-inch per foot. Tapered sections shall be of the same material and provided by the same manufacturer as the standard single thickness insulation.

D. Type B - Polyisocyanurate Board Type:

1. Insulation shall consist of a rigid polyisocyanurate insulation permanently bonded to foil or asphalt fiberglass facers on top and bottom.
2. Thermal conductivity at mean temperature of 75 degrees F shall not exceed 0.14 Btu per hour per degree F per inch of thickness per square feet.
3. Permanent deformation shall not exceed 5% after being subjected to a load of 500 pounds per square feet for 1-inch thickness and have a dimensional stability of less than 1.0%.
4. Minimum compressive strength when tested in accordance with ASTM D1621 shall be 25 psi.
5. Insulation shall be made up into sections for convenient handling, preferably 36-inch by 48-inch. Insulation shall have a minimum 2-pound cubic feet foam core density, and conform with FS HH-1-530A.
6. Preformed tapered sections shall be used to slope roofs where indicated on the Drawings. The taper of the insulation shall be between 1/8-inch and 1/4-inch per foot. Tapered sections shall be of the same material and provided by the same manufacturer as the standard single thickness insulation.
7. The polyisocyanurate insulation shall be as manufactured by NRG Barriers, Inc. or equal.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The insulation shall be installed by a manufacturer-approved applicator.
- B. The Contractor shall examine all surfaces to be covered and notify the Engineer of any defects. Work shall not begin until the surfaces are properly prepared.
- C. All surfaces shall be dry, thoroughly cleaned of all dust, dirt, and debris.



- D. The vapor barrier and insulation shall be applied only between April 1 and October 31, unless otherwise approved by the Engineer.
- E. Roof insulation shall be installed in two separate layers. Joints shall be staggered at least 12-inch in both directions.
- F. Insulation shall be completely dry when installed and shall be covered by the roofing at the end of each working day. Any insulation that becomes wet and/or damaged shall be removed and replaced to the satisfaction of the Engineer. If rain begins during a working day, the insulation shall be immediately covered and protected. The covering and protection of insulation on the job site shall be by waterproof tarps. Sheet plastic will not be accepted.
- G. The roof insulation and roofing shall provide a minimum uplift resistance of 40 psf.
- H. Adhered Insulation Installation:
  - 1. All precast concrete deck joints shall be solidly grouted or caulked with elastic cement meeting ASTM D2822. Caulked joint shall be covered with a 6-inch wide, 15-pound felt strip embedded in elastic cement.
  - 2. Concrete decking shall be primed with a concrete deck primer at an application rate of 1 gallon per 100 square feet.
  - 3. The decking shall have a vapor barrier consisting of two layers of 15-pound organic felt solidly mopped with hot steep asphalt at a minimum application rate of 23 pounds per 100 square feet. Felts shall be overlapped as recommended by the manufacturer.
  - 4. Metal decks shall have a Factory Mutual Class I vapor barrier installed. The vapor barrier shall use an adhesive applied at a minimum rate of 0.4 gallon per 100 square feet which shall secure the overlapping felt.
  - 5. The insulation shall be installed proper side up on the vapor barrier in accordance with FM and UL requirements. The bottom layer of insulation shall be fastened to the deck using a solid mopping of hot steep asphalt applied at a minimum rate of 25 pounds per 100 square feet or by an approved mechanical fastener one per 4 square feet. The second layer of insulation shall be attached to the previous layer of insulation with hot steep asphalt at a minimum application rate of 30 pounds per 100 square feet.
  - 6. Lightweight fill decks contain a larger percentage of moisture than other types of decks, it is essential that adequate venting be provided. Venting shall be accomplished using methods approved by the Engineer.
- I. Loose Laid Insulation Installation:
  - 1. The decking shall have a vapor barrier of loose laid 6 mil sheet plastic. Adjoining sections of visquene shall have an 18-inch overlap. Grind smooth any rough decking surface that may tear or puncture the sheet plastic or lay a double layer of sheet plastic and inspect for damage.

2. The insulation shall be installed proper side up on the vapor barrier in accordance with FM, UL, and the membrane roofing manufacturer's requirements. The bottom layer shall be loose laid, all sides abutting one another. The second layer shall be installed atop the first and all joints staggered 12-inch. An adhesive shall be used to attach the top layer to the first as prescribed by the Engineer.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 ROOF INSULATION - LOCATION, TYPE AND THICKNESS**

- A. Schedule:

Location	Type	Minimum Thickness	Remarks
Pump Control Building	B	5"	Slope Insulation for Roof Drainage

- B. Schedules are not guaranteed to be complete. All insulation shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.

END OF SECTION

**SECTION 07532**  
**ADHERED RUBBER MEMBRANE ROOFING SYSTEM**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes complete, fully-adhered, single ply, rubber membrane roofing system.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's product literature describing the physical properties of all roofing components.
    - b. Drawings showing layout of insulation, including crickets and tapered boards.
  - 2. Submittals for the Record:
    - a. Membrane manufacturers complete instructions for the application of the membrane system including membrane termination details.
    - b. Insulation manufacturer's instructions for securement of insulation to the deck, including fastener density and pattern.
    - c. Contractor's qualifications.
    - d. Manufacturer's certification.
    - e. Performance guarantee and manufacturer's warranty.

**1.03 QUALITY ASSURANCE**

- A. Contractor shall be licensed by membrane manufacturer to install manufacturer's product.
- B. Manufacturer shall certify that all components and materials meet requirements of Specifications and are compatible with roofing system.
- C. Roof system shall meet the following:
  - 1. UL - Class A
  - 2. Factory Mutual – Windstream Classification, Class - I-90.

#### 1.04 WARRANTY

- A. Contractor shall provide manufacturer's 25-year Total System Warranty on roofing system and related components. The roofing system is defined as membrane, insulation boards, flashings, adhesives, sealants and other components provided by manufacturer as an integral part of membrane system, as well as the authorized, licensed roofing contractor's workmanship used to install these materials. Warranty to also include a 72-mph wind warranty as standard.
- B. In addition to the above manufacturer's total system warranty, the Contractor shall provide following performance agreement, which shall bear notarized signature of Contractor, before payment for the roofing will be made.

"For a 2-year period, from the date of final acceptance, the Contractor will provide for the repair of defects and leaks in the roof system within 24 hours of notification from the Owner. The Contractor shall restore the affected areas to the standard of the original Contract Documents without cost to the Owner, unless it is determined that such leaks and defects were caused by abuse, or by an unusual natural phenomenon or failure of related work by others not party to the original Contract."

#### PART 2 PRODUCTS

##### 2.01 MANUFACTURERS

- A. Membrane system shall be standard products of single manufacturer.
- B. Acceptable manufacturers: Firestone Building Products Co. (Basis of Design), Carlisle Corp., Johns Manville, or equal.

##### 2.02 MEMBRANE SYSTEM

- A. Membrane shall be 60 mil non-reinforced fire retardant EPDM sheet elastomer. Standard membrane sheet shall be a minimum of 10-feet wide.
- B. Membrane shall meet the following minimum physical properties:

Physical Property	Test Method	Specification
Tolerance on nominal thickness, percent	ASTM D412	+ 10
Tensile strength, min. psi (MPa)	ASTM D412	1305 (9)
Elongation, ultimate, min. percent	ASTM D412	350
Tear resistance, min., lbf/in (KN/m)	ASTM D624 (Die C)	175 (30.6)
Brittleness Temperature, max., degree F (degree C)	ASTM D746	-75 (-59)
Resistance to water absorption 7-day immersion @ 158-degree F (70-degree C) Change in mass, max. percent	ASTM D471	4
Resistance to weathering Xenon-arc, 4000 hours exposure, 176 degrees F (80 degrees C) black panel temperature	ASTM G26	No cracks No crazing
Sheet composition	ASTM D297	
Weight percent of polymer that is EPDM min., percent		100

Physical Property	Test Method	Specification
Weight percent of sheet that is EPDM polymer min., percent		30

- C. Membrane flashing shall be 60 mil cured EPDM, pre-molded EPDM, pressure sensitive EPDM, or uncured moldable neoprene as required by membrane manufacturer's details.
- D. Splice cleaner, adhesives, primers, sealants, and pourable sealers shall be integral components of membrane system.
- E. Membrane securement strip shall be 45 mil reinforced EPDM membrane, and shall be furnished in 6-inch and 9-inch wide by 100-feet long strips as required.

### 2.03 INSULATION

- A. As indicated on the roof plans and details, provide rigid polyisocyanurate foam core in layers and thicknesses indicated. Insulation board to comply with ASTM 3273 for mold resistance with coated glass facers on both sides. Flat and tapered board as indicated on Drawings.
- B. Acceptable manufacturers: Firestone Resista ISO (Basis of Design), Carlisle Corp., Johns Manville., Celetex Corporation, Dow Chemical, Atlas Roofing, Hunter Panels, or equal.
- C. Insulation shall have a density of 1.5 pcf and shall have minimum compressive strength of 21 psi nominal at 10% deformation.
- D. Insulation board size shall be 4-feet by 8-feet. Preformed tapered boards shall be used to slope roof where indicated on Drawings. Insulation thickness shall be as shown on Drawings.
- E. Insulation shall be manufactured with non-ozone depleting agents.

### 2.04 FASTENING COMPONENTS

- A. Insulation and vapor barrier shall be fully adhered to concrete deck. The adhesive shall be compliant with FM I-90 requirements and installed per the membrane manufacturer's recommendations.
- B. Fasteners for use with steel or plywood decks shall be high performance, threaded, flouropolymer grit coated fasteners, with minimum pullout of 360 pounds per fastener.
- C. Insulation fastening plates shall be 3-inch diameter FM approved metal plates.

### 2.05 VAPOR BARRIER

- A. SBS modified bitumen adhesive, factory-laminated to a tri-laminate woven, high-density polyethylene top surface. V-Force Vapor Barrier Membrane by Firestone or roof membrane manufacturer equal including the appropriate primers as required.

B. Vapor barrier shall meet the following minimum physical properties:

Property	Test Method	Firestone Typical Performance
Thickness:	D5147	30 mils (0.076 mm)
Tensile Strength:	D5147	64 lbf/in (11.3 kN/m), MD 88 lbf/in (15.4 kN/m), XMD
Ultimate Elongation, Bitumen Portion, at 73 degrees F (23 degrees C):	D5147	52%, MD 24%, XMD
Low Temperature Flexibility (Cold Bending):	D5147	-31 °F (-35 °C)
Static Puncture:	D5602	90 lbf (400 N)
Tear Strength at 73 degrees F (23 degrees C):	D5601	84 lbf, MD (375 N) 90 lbf, XMD (400 N)
Lap Adhesion at 73 degrees F (23 degrees C):	D1876	6 lbf/in (1.05 kN/m)
Water Absorption, % by Weight:	D5147	<0.1 %
Peel Resistance:	D903	8 lbf/in (1.4 kN/m)
Water Vapor Permeance, Max.:	E96 Procedure B	0.017 perms (0.92 Ng/Pa•s•m <sup>2</sup> )
Air Permeability:	D1970	0.00114 ft <sup>3</sup> /min•ft <sup>2</sup> (0.007 L/sec•m <sup>2</sup> )

### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Deck shall be cleared of debris and foreign material.
- B. Deck shall be even without high spots or depressions and shall be free of water, ice or snow.
- C. Contractor shall inspect deck and notify Engineer of defects before beginning Work.

#### 3.02 INSTALLATION

- A. Vapor Barrier:
  1. Deck surface shall be primed as required by vapor barrier manufacturer.
  2. Vapor barrier shall be installed loose laid directly over deck with a minimum lap of 6-inch at adjoining sheets.
- B. Insulation:
  1. Insulation shall be installed directly over vapor barrier. When insulation thickness is greater than 2-inch insulation shall be installed in two layers. Top layer shall be minimum of 2-inch thick.
  2. Insulation boards shall be butted together with no gaps greater than 1/4-inch.
  3. Joints between layers of insulation shall be staggered minimum of 12-inch.
  4. On concrete decks, install the boards with end joints staggered. When installing two layers of insulation boards, ensure that the joints of both layers do not coincide. Adhere the boards, with (restricted) dimensions, using an adhesive system and pattern as advised and approved by manufacturer, all in accordance

with national wind uplift standards. Install fully in accordance with manufacturer's instructions

C. Membrane System:

1. Membrane shall be installed, spliced, and secured in accordance with manufacturer's written instructions and details.
2. Position membrane over insulation without stretching.
3. Allow membrane to relax 1/2 hour before bonding to insulation.
4. Lap splices shall be minimum of 6-inch wide.
5. Additional membrane securement shall be provided at perimeter of each roof level, roof section, expansion joint, curb, skylight, interior wall, penthouse, angle change greater than 2-inch in one horizontal foot, and at other penetrations where recommended by membrane manufacturer.
6. Penetrations and walls shall be flashed with cured EPDM membrane or prefabricated accessories (pre-molded and pressure-sensitive products such as pipe boots, pourable sealer pockets, inside/outside corners) that are standard products of membrane manufacturer. Where use of cured membrane or prefabricated accessories is not practical, uncured moldable neoprene shall be used. Membrane flashing shall be installed and terminated in accordance with the membrane manufacturer's written instructions and details.

- D. Daily Seal - When completion of flashings and terminations is not completed by end of work day, loose edges of membrane shall be temporarily sealed in accordance with membrane manufacturer's written instructions and details.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION





**SECTION 07600**  
**FLASHING AND SHEET METAL WORKS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing metal flashing, except through-wall flashing for masonry construction.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's product literature.

**PART 2 PRODUCTS**

**2.01 ALUMINUM SHEET**

- A. Alloy and temper of sheet shall be 3003-H14.
- B. Thickness of sheet shall be 0.032-inch.
- C. Sheet shall conform to standards published by the Aluminum Association.

**2.02 SPECIAL FINISHES**

- A. Anodic coating shall be Architectural Class I. Color will be selected by Owner.
- B. Paint shall be a fluorocarbon coating containing polyvinylidene fluoride resin (Kynar® or equal). Color will be selected by Owner.

**2.03 FASTENERS**

- A. Cleats shall be aluminum of same alloy, temper, and thickness of sheet being fastened, and shall not be less than 2-inch wide.
- B. Nails shall be aluminum alloy 6061 conforming to FS FF-N-105B, Type II, Style 20.
- C. Screws, bolts, nuts, and washers shall be aluminum alloy 6061-T6. Washers shall not be less than 0.040-inch thick.

**2.04 FABRICATION**

- A. Flashing shall be formed of aluminum sheet not longer than 10 feet.

- B. Mechanical seams and joints shall be flat-lap or lock seams. Seams and end joints shall not be riveted or fastened to restrict thermal movement. Sealant-filled controlled slip joints shall be used to allow thermal movement.
- C. Brazing of aluminum sheet shall be permitted only under shop conditions. Filler alloy 4047 shall be used for brazing and flux residue shall be completely removed.
- D. Field welding of aluminum sheet shall be permitted only when done with gas tungsten-arc (TIG) or gas metal-arc (MIG) welding processes. Filler alloy 4043 or 1100 shall be used.
- E. Oxyfuel-gas welding of aluminum sheet shall be permitted only under shop conditions. Filler alloy 4043 or 1100 shall be used and flux residue shall be completely removed.
- F. Soldering of aluminum shall not be permitted.

## **2.05 BITUMINOUS PAINT**

- A. Bituminous paint shall be of the cutback type conforming to Specification MIL-C B (1).

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Contractor shall examine the roofing manufacturer's details and coordinate Work between trades before sheet metal is installed.

### **3.02 PREPARATION**

- A. Surfaces receiving aluminum sheet shall be smooth, dry, and free of small projections and hollows.
- B. Aluminum sheet surfaces to be in contact with concrete or masonry shall be coated with bituminous paint.
- C. Anodizing shall be done subsequent to forming and fabricating.

### **3.03 INSTALLATION**

- A. Apron Flashing:
  - 1. The ends of each length of apron flashing shall be lapped not less than 4-inch, or alternatively, a 2-inch sealant filled "S" lock shall be formed at one end of the flashing sheet to receive the end of the adjacent sheet.
  - 2. Where sloping roof meets vertical wall, the flashing shall extend up the wall face not less than 4-inch and shall be counter-flashed. The flashing shall extend over the roofing not less than 5-inch. The lower edge shall be hemmed and secured by blind cleats spaced at 24-inch centers.
- B. Valleys:

1. Valley sheets shall extend not less than 6-inch under the roof covering on each side of the valley, and side edges shall be folded 1/2-inch for cleating. Sheets shall lap not less than 6-inch in the direction of the flow and the upper edge shall be nailed to the roof deck. Side edges shall be secured and aluminum cleats spaced at 24-inch.
  2. The open portion of the valley shall not be less than 5-inch in width at the top and increase in width 1/8-inch per foot toward the eaves.
  3. Where intersecting roofs are on different slopes, an inverted "V" 1 1/2-inch high shall be formed in the metal along the center line of the valley and the lap of the valley sheets shall be increased to 8-inch.
- C. Gravel Stops:
1. Gravel stop shall not be less than 1 1/2-inch high and the outer edge shall extend down not less than 4-inch to form a fascia. The horizontal flange shall extend onto the roof not less than 4-inch and shall be secured to wood nailer with aluminum nails spaced at 3-inch on centers.
  2. The lower edge of the fascia shall be turned out 3/4-inch at an angle of 45 degrees to form a drip and shall hook 3/4-inch over a previously placed aluminum edge strip.
  3. Edge strips shall be continuous with ends of adjacent lengths lapping not less than 1-inch. The lower edge shall be turned out 45 degrees to receive the drip edge of the fascia. Edge strips shall be fastened to wood with aluminum nails spaced at 4-inch, or to masonry with screws spaced at 10-inches.
  4. Corner pieces shall be fabricated and mitered. End joints shall be made using a 12-inch long back-up plate and a 5-inch long top cover plate.
- D. Counter Flashing:
1. Counter flashing shall be installed over base flashings where shown on the Drawings.
  2. On masonry walls, the mortar joint to receive counter flashing shall be raked out to a depth of 1-inch. The counter flashing shall extend into the raked-out joint with the inner edge bent back to form a hook dam. The counter flashing shall be secured by aluminum wedges not more than 8-inch apart and the joint shall be filled with sealant, as specified in Section 07900.
  3. The counter flashing shall overlap the base flashing by not less than 3-inch, and the ends of adjacent lengths shall overlap not less than 3-inch.
- E. Coping Covers:
1. Flat seam cap flashing shall cover parapet walls and shall be joined by 1-inch loose lock seams filled with sealant. Walls shall have a continuous edge strip along both sides secured to wood plate with aluminum nails spaced at 4-inch. The cap flashing shall be hooked over the edge strips with a 3/4-inch loose lock seam.

2. Corner pieces shall be shop fabricated and mitered.
- F. Miscellaneous:
1. Scupper flashing shall cover the interior of the opening provided in wall and shall extend through and project outside of wall as shown on Drawings. Scupper box shall have continuous sides and shall be 1/2-inch smaller than the masonry opening. Flange on the roof side of the scupper box shall extend not less than 4-inch on all sides. Flange shall be continuous with rounded corners.
  2. Aluminum cap flashing shall be provided for curbs, roof hatches, etc., as required by roofing manufacturer's details.
- G. Flashings shall be installed where shown on drawings and where required to make building envelope water tight.
- H. Drip edge, soffit, and fascia shall be installed where shown on the Drawings.

END OF SECTION

**SECTION 07900  
CAULKING AND SEALANTS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes caulking and sealants.

**1.02 SUBMITTALS**

- A. Submittal shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Contractor shall indicate variances from requirements of Contract Documents.
    - b. Product literature.
    - c. Manufacturer's standard color chart.
  2. Information for the Record:
    - a. Manufacturer's surface preparation and installation instructions.
    - b. Written guarantee.

**1.03 QUALITY ASSURANCE**

- A. Contractor shall have minimum of five years experience installing sealants.

**1.04 GUARANTEES**

- A. Contractor shall guarantee sealant joints against adhesive and cohesive failure of sealant and against water penetration through joint for five years.

**PART 2 PRODUCTS**

**2.01 CAULKING AND SEALANTS**

- A. Type A:
1. Sealant shall be two component polyurethane sealant, conforming to ASTM C920, Type M, Class 25, Type I, and either Grade NS or Grade P as appropriate. Sealant shall have Shore A hardness of 20-40 and minimum elongation of 500%.
  2. Sealant shall be suitable for continuous immersion service in water and sewage.
  3. Sealant shall be Sika Corporation "Sikaflex-2c NS/SL", Polymeric Systems, Inc. "PSI 501/551", or equal.

- B. Type B:
  - 1. Sealant shall be one component neutral or acetoxycure silicone sealant conforming to ASTM C920, Type S, Class 25, Grade NS with Shore A hardness of 25-30.
- C. Type C:
  - 1. Sealant shall be one component, non-sag mildew resistant silicone sealant conforming to ASTM C920, Type S, Class 25, Grade NS, with Shore A hardness of 25-30.
- D. Type D:
  - 1. Sealant shall be one component acrylic latex caulk conforming to ASTM C834. Material shall be suitable for painting.
- E. Type E:
  - 1. Two component, coal-tar extended, fuel resistant polyurethane sealant conforming to ASTM C920, Type M, Class 25, Grade NS or Grade P as appropriate, with Shore A hardness of 15-35.

## 2.02 ACCESSORIES

- A. Primer shall be sealant manufacturer's recommended primer for intended substrates and intended service conditions. Primer shall be non-staining.
- B. Backer rod shall be closed cell polyethylene or polyurethane as recommended by sealant manufacturer. Materials impregnated with oils, asphalt, or solvents are not acceptable. Backer rod shall be minimum of 33% oversized.
- C. Bond breaker tape shall be polyethylene or similar type material which does not bond to sealant.

## PART 3 EXECUTION

### 3.01 COORDINATION

- A. Manufacturer's recommendations for proper temperature and humidity conditions for installation shall be followed. Sealants shall not be installed when the ambient temperature is below 40 degrees F.
- B. Substrate surface shall be inspected to ensure that no bond breaking materials contaminate surfaces to which sealant is to adhere.
- C. Joint dimensions shall be verified prior to installing sealant to ensure that dimensions are within tolerances specified in sealant manufacturer's literature.

### 3.02 PREPARATION

- A. Surfaces shall be prepared in accordance with manufacturer's recommendations to ensure maximum adhesion. Surfaces shall be dry, sound, and free of oil, grease, dust,

dirt, curing agents, temporary protective coatings, and other materials deleterious to bond.

- B. Adjacent surfaces which are not to receive sealant shall be masked before primer and sealant is applied. Masking shall be removed immediately after sealant has been installed and tooled.
- C. Primer shall be applied prior to installation of backer rod or bond breaker tape.

### 3.03 INSTALLATION

- A. Backer rod shall be installed using only blunt or rounded tools designed to ensure uniform depth of backer rod without puncturing the material. Backer rod shall not be stretched, twisted or braided.
- B. Where joint depth does not permit use of backer rod, bond breaker tape shall be installed to prevent three-sided adhesion.
- C. Sealants shall be prepared, mixed, and installed in accordance with manufacturer's instructions using equipment recommended by sealant manufacturer. Sealant shall be installed as shown.
- D. Sealants shall be tooled to uniformly smooth, slightly concave surface as shown on Drawings.

### 3.04 SCHEDULE

- A. Unless shown or specified otherwise, sealant types shall be as follows:

Joint Type or Use	Sealant Type
Expansion joints, control joints, isolation joints, precast concrete joints.	A
Door, window, and other wall penetrations in exterior walls.	A
Joints in liquid-retaining structures	A
Structural or non-structural glazing	B
General building-interior use in bathrooms, kitchens, locker rooms, and other wet or humid areas.	C
General building use in areas other than those specified above.	D

- B. Sealant color will be selected by the Owner.

### PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION





**SECTION 08125**  
**HEAVY DUTY ALUMINUM DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing heavy duty aluminum doors, frames, required fasteners, and other accessories required for completion of the Work.
- B. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Door Schedule.
    - b. Dimensional Drawing.
    - c. Manufacturer's literature.
    - d. Samples - When requested by the Engineer.
      - 1) Samples of finish, frame corner construction, door construction, and glazing frame.
      - 2) Samples shall be clearly identified as to location and type of finish.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Aluminum doors shall be as manufactured by Cross Aluminum Products, or equal.
- B. Products furnished for use in this Section shall be of one manufacturer unless specifically shown otherwise or approved by the Engineer.

**2.02 DOORS**

- A. Door sections to be 4-inch tubular shapes of 6063-T5 alloy.
- B. Joinery shall be steel tie rod bolted through stiles, where applicable a minimum of three 3/8-inch diameter cadmium plated steel rods a door.
- C. The finish of doors and door parts shall be free of scratches, defects, die lines, and blemishes and shall have a natural anodized finish in conformance with AA Specification M12C22A41.

- D. Minimum wall thickness 0.100-inch with 0.187-inch minimum at lock and hinge stiles.
- E. Door sections are to interlock a minimum of 3/8-inch and form a 1/4-inch thick vertical reinforcement every 4 inches.
- F. Exterior doors to be installed with urethane boardstock.
- G. Glass stops to be extruded glazing channels, which are easily removed from the inside. Minimum wall thickness 0.080-inch.
- H. Fluted No. 10 pattern extruded in door section.
- I. Exterior doors shall be fully weather-stripped.
- J. All double doors shall have a continuous astragal of the same material and color as the doors and installed on the exterior of the active leaf to cover the gap between doors. Each door shall have non-ferrous lever handles in place of knobs on the passing side of the astragal or as called for on the hardware schedule. The assembly shall contain a booster spring to ensure the lever returning to a horizontal position.

## **2.03 ALUMINUM FRAMES**

- A. All sections of frames shall be fabricated from aluminum alloy 6063 and T-6 temper with a minimum thickness of 0.125-inch. Screws shall be 18-8 stainless steel.
- B. All framing members shall be accurately milled with flush hairline joints. Frames shall be closed back or open back as detailed on the Drawings.
- C. Door frame corner members shall be heavily reinforced with channel type corner gussets fastened with concealed stainless-steel screws.
- D. Frames shall be reinforced in the areas to receive locks, hinges, and door closers.
- E. Door frame finish shall match that of the door. The finished product shall be free of scratches, defects, and blemishes.
- F. Door stops shall be attached to the frame with concealed fastenings with vinyl inserts for weatherproofing and silencing.

## **PART 3 EXECUTION**

### **3.01 DELIVERY, HANDLING, AND STORAGE**

- A. Delivery, handling, and storage shall be in accordance with the requirements of Section 01350.

### **3.02 INSTALLATION OF FRAMES**

- A. Set frames to maintain scheduled dimensions, hold head level, and set jambs plumb and square.
- B. Secure anchorages and provide connections to adjacent construction.

- C. Apply protective coating of bituminous paint to backs of frame to separate aluminum from contact with masonry, concrete, or other galvanically incompatible materials.
- D. Frame shall be set with a minimum of eight anchors.

### **3.03 INSTALLATION OF DOORS**

- A. Comply with manufacturer's instructions for installation of door hardware, operators, and other components.
- B. Adjust hinges so doors operate smoothly and fit properly when closed.
- C. Adjust and lubricate locks, operators, and hinges.
- D. Clean aluminum surfaces and remove protective tape and excess caulking sealants.
- E. Thresholds are to be provided at exterior doors. Bottom, head, and jamb weather-strips shall be adjusted to fit correctly.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 08315**  
**ROLL-UP AND OVERHEAD DOORS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing and installing of roll-up and overhead doors complete and ready for service as shown on the Drawings and described in this Section.
- B. Each roll-up door shall be furnished complete with a curtain, hood, guides, gears, motor operator, weather-stripping, safety strip, and all other accessories required for satisfactory operation.
- C. The erector of the doors shall be approved by the manufacturer.
- D. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Door Schedule.
    - c. Dimensional Drawing.
    - d. Manufacturer's literature.
    - e. Electric Operated Doors:
      - 1) Motor information per Section 11050.
      - 2) Wiring schematic.
      - 3) Controls catalog data.
  - 2. Operation and maintenance manual.

**PART 2 PRODUCTS**

**2.01 EQUIPMENT**

- A. General - The dimensions of the roll-up doors shall be as shown on the Drawings and as called for in the door schedule. The doors, frames, and operators shall be products of Overhead Door Corp., or equal.
- B. Doors:

1. The door curtain shall be of interlocking slats formed in easy curves without sharp bends. The slats shall be flat profile and shall be insulated with foam. The front of the slat shall be 0.040-inch-thick aluminum while the back of the slat shall be 0.024-inch-thick aluminum.
  2. Slats shall be of sufficient section to provide curtain strength adequate to safely resist a wind load of 20 pounds per square feet.
  3. Insulation shall be CFC-free polyurethane providing an R value of 7.7.
  4. Ends of slats shall be provided with end locks with integral slat lugs as wind locks which engage bars and lock the curtain in the guides. Bottom bar shall be two aluminum angles.
  5. The curtain shall be coiled on a pipe or barrel of size sufficient to carry the door load, with a deflection not to exceed 0.03 inch per feet of opening width. The door shall be evenly counterbalanced by helical springs contained in pipe. All springs shall be anchored to the same tension rod and held in position by the same adjusting wheel accessible from the outside.
  6. The coil brackets shall be of high grade iron or precision formed steel plate designed to house the ends of the coils and support the counterbalance assembly.
  7. The coil shall be housed in a minimum 24-gauge aluminum hood.
  8. The gears shall be high grade gray iron, cast teeth machine molded from machine-cut patterns.
  9. The guides shall be built of structural aluminum angles to form a slot of sufficient depth to retain curtain in guides against heavy wind pressure. Guides shall be mill finish provided with wind lock bars.
  10. Guides and hood shall be weather-stripped to prevent air passage.
  11. Doors shall be equipped with vinyl or neoprene seals to close the void between the door and head.
  12. All non-galvanized, exposed, ferrous metal surfaces will receive one-coat of rust inhibitive primer.
  13. Hood to include a baffle
  14. The door shall be a series 625 rolling overhead door as manufactured by overhead door or approved equal.
  15. Doors shall be provided with bottom bar side locks.
- C. Electric Operators:
1. The electrically operated roll-up doors shall be provided with a compact unit designed and built by the door manufacturer, requiring a minimum side clearance.

2. The motor to be high starting torque having sufficient power to operate door at an approximate average speed of 1-foot per second. The electrical supply to the motor will be 208/3/60.
3. Adjustable screw-type limit switches which will break the circuit at the termination of travel.
4. High efficiency worm gearing, running in an oil bath, should be furnished together with a spring-set solenoid operated brake completely housed to protect against damage, dust.
5. An emergency hand-chain operator which does not affect the timing of the limit switch shall be provided to operate the door in case of power failure.
6. The operator shall be designed to transmit motion to the door without shock and automatically release motor from driving unit prior to stalling, so as to prevent any damage to unit from any type of overload. An efficient overload protective device, which will break the power circuit and protect against damage to motor windings, shall be both heat and current sensing, and installed integral with the unit.
7. Each door shall be supplied with a control panel that contains a reversing starter, control transformer, and all operating components connected to a terminal strip. Also supplied with each door shall be a fused disconnect and an "open/close/stop" pushbutton station shipped loose with each door operator. All enclosures shall be NEMA 12 unless otherwise noted on the Drawings.
8. Unless otherwise noted on the Drawings or in the Door Schedule, the Contractor shall provide a combination compressible weather seal and an electrical safety strip mounted along the bottom edge of each motor operated door. The device shall operate in conjunction with the door operator control to stop and reverse the door to the open position if an obstruction is encountered while closing.
9. Locations of door operators shall be as shown on the Drawings.
10. The doors shall include a reversing edge with NEMA 4 photo sensors.

### **PART 3 EXECUTION**

#### **3.01 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle roll-up doors in accordance with the requirements of Section 01350.

#### **3.02 INSTALLATION OF FRAMES**

- A. Set frames to maintain scheduled dimensions, hold head level, and set jambs plumb and square.
- B. Secure anchorages and provide connections to adjacent construction.

**3.03 INSTALLATION OF DOORS**

- A. Comply with manufacturer's instructions for installation of door hardware, operator, and other components. The installation shall include conduit and wire per Division 16, required to connect the pushbutton station, disconnect switch, and safety strip to the control panel.
- B. Adjust so doors operate smoothly and fit properly when closed.
- C. Adjust and lubricate locks and operators.
- D. Clean surfaces and remove protective tape and excess caulking sealants.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 08320  
FLOOR DOORS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing floor doors in the locations shown on the Drawings.
- B. Floor doors shall be aluminum interior, exterior diamond plate or interior recessed to receive carpet, composition or resilient flooring specified under other Items.
- C. Door arrangement shall be either single leaf or double leaf hinged as shown on the Drawings.
- D. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Manufacturer's literature.
    - c. Door Schedule.
    - d. Dimensional Drawing.
  - 2. Information for the Record:
    - a. Operation and maintenance manuals.

**1.03 GUARANTEE**

- A. The manufacturer shall guarantee proper operation and against defects in material and workmanship for a period of one year from date of shipment. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in General Conditions of these Specifications.

**PART 2 PRODUCTS**

**2.01 EXTERIOR DOORS**

- A. Doors shall have channel frames and shall be 1/4-inch aluminum with an anchor flange around the perimeter.

- B. Door leaf shall be 1/4-inch aluminum diamond pattern plate reinforced with aluminum stiffeners designed to withstand the specified load rating and as required to prevent distortion of the leaf when in any position. Doors shall be equipped with heavy forged brass hinges, stainless steel pins, spring operators for easy operation, and automatic hold-open arm with release handle. A snap lock with removable handle shall be provided.
- C. A 1-1/2-inch drainage coupling shall be provided in the door frame. Drainage shall be piped by the Contractor to outlet with 1-1/2-inch PVC pipe to drain or as shown on the Drawings.
- D. Hardware shall be stainless steel throughout.
- E. Factory finish shall be mill finish.
- F. A bituminous coating applied by the manufacturer to the exterior of the frame and all aluminum in contact with concrete.
- G. Doors shall be as manufactured by Bilco, Halliday Products or approved equal.
- H. Unless shown otherwise on the plans, all door drains shall be routed through slabs to drain into adjacent backfill.

## **2.02 ACCESS DOOR FALL PROTECTION**

- A. Each hatch shall be designed to combine covering of the opening, fall-through protection per OSHA standard 1910.23 and controlled confine space entry per OSHA standard 1910.146.
- B. The safety grate shall be made of 6061-T6 aluminum and designed per the "Specifications for Aluminum Structures", by the Aluminum Association, Inc. 5th Edition, December 1986 for "Bridge Type Structures."
- C. The grating shall be designed to withstand a live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span.
- D. Grate openings shall allow for visual inspection, limited maintenance, and float adjustments while safety grate fall-through protection is left in place. The grating shall cover the full opening except for a maximum 6-inch width on each end of the opening.
- E. Design must assure that the fall-through protection is in place before the doors can be closed, thereby, protecting the next operator.
- F. Each grate shall be provided with a permanent hinging system, which will lock the grate in the 90-degree position once opened.
- G. Each grate supplied with a locking device (for Owner's padlock) that will prevent unauthorized entry to the confined space. The grating system will allow anyone to make visual inspection and float adjustments without entering the confined space.
- H. Grate shall be coated with an OSHA-type safety orange or yellow color, promoting visual awareness of the hazard. The aluminum safety grates shall receive a two-coat, powder coating system, applied by the electrostatic spray process. The base coat is a

thermosetting epoxy powder coat finish with a minimum thickness of 2 to 4 mils. The top coat is a mar-resistant, TGIC polyester powder coating with a minimum thickness of 2 to 4 mils. Each coat shall be baked at 450 to 375 degrees F until cured.

- I. Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum.

### PART 3 EXECUTION

#### 3.01 GENERAL

- A. The Contractor shall install the floor doors in the locations shown on the Drawings. Installation shall be in accordance with the manufacturer's recommendations.
- B. Doors shall be modified by the manufacturer as required when necessary to suit the installation shown on the Drawings.
- C. Doors shall be installed to open in the direction shown on the Drawings or as ordered by the Engineer.
- D. The bituminous coating on door frames shall be touched up by the Contractor if the coating has been damaged.

### PART 4 SPECIAL PROVISIONS

#### 4.01 FLOOR DOOR SCHEDULE

- A. All access floor doors shown on the Drawings and scheduled below shall be provided:

Mark	Clear Opening	Location	Loading	Remarks
FD1-1	40"x64"	Wet Well Top Slab	H20	Double Door With Fall Protection
FD1-2	40"x64"	Wet Well Top Slab	H20	Double Door With Fall Protection
FD1-3	40"x64"	Wet Well Top Slab	H20	Double Door With Fall Protection
FD1-4	36"x36"	Wet Well Top Slab	H20	Single Door With Fall Protection
FD1-5	72"x48"	Wet Well Top Slab	H20	Double Door With Fall Protection
FD3-1	60"x36"	Flow Meter Chamber	300 psf	Double Door With Safety Post Ladder Extension (See Section 02551)
FD3-2	36"x36"	Flow Meter Chamber	300 psf	Single Door

- B. The clear opening dimensions provided is the minimum distance between all frame, strike plates, accessories, brackets, hinges, or structural components. It is understood the concrete opening will be larger than the clear opening.

END OF SECTION



**SECTION 08520  
ALUMINUM WINDOWS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing aluminum windows, and all anchors, bolts, screws, shims, nails, screens, and other accessories required for complete installation.
- B. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements for the Contract Documents.
    - b. Manufacturer's literature.
    - c. Dimensional Drawing.
    - d. Samples - When requested by the Engineer.
      - 1) Corner assembly of each type window to be used on the project.
      - 2) Samples shall be clearly identified as to location and type of finish.
  - 2. Operation and maintenance manuals.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Windows shall be a product of Kawneer, Wausau, or approved equal.
- B. Products for use in this Section shall be of one manufacturer unless specifically shown otherwise.
- C. Exterior windows shall comply with the latest edition of the Air Infiltration Test ASTM E283, under a minimum pressure of plus or minus 6.2 pounds per square feet, which shall result in less than 0.5 L/(s m<sup>2</sup>) air filtration.
- D. Exterior windows shall comply with the latest edition of the Water resistance Tests ASTM E331 and ASTM E547 under a minimum pressure of plus or minus 8.0 pounds per square feet, which shall result in no water penetration.

## 2.02 MATERIALS

- A. Aluminum Extrusions - Window and mullion sections shall be extruded from 6063-T5 aluminum alloy and temper.
- B. Aluminum Sheet and Plate - Exposed aluminum plate to receive an anodic finish shall be 5005 alloy to match extrusions, and shall conform to ASTM B209.
- C. Aluminum Finish - All exposed window members shall be free of scratches and other serious surface blemishes. All aluminum, unless otherwise specified, shall have a clear finish produced by buffing, caustic etch, and an anodic oxide treatment in conformance with AA Specification M12C22A31.
- D. All screws, anchors, and other fastening devices shall be of 304 stainless steel of sufficient strength to perform the functions for which they are used.
- E. Frames in contact with masonry, concrete, or steel shall be back-coated with a heavy bituminous paint.

## 2.03 WINDOW

- A. Windows shall be 2-inch minimum Sealair 8225T, Isolock Series heavy commercial as manufactured by Kawneer, Wausau, or approved equal. The windows shall be either fixed or projected sash as shown on the Drawings or as specified.
- B. Construction:
  - 1. Ventilators shall be of the projected type, limited to approximately a 50-degree opening.
  - 2. Windows shall be prepared for inside glazing and designed for use with 1-inch thick insulating glass.
  - 3. All frame corners and meeting rail intersections shall be coped and tenon joined, forged, then made permanently leakproof. The frames shall contain a continuous thermal break.
  - 4. Ventilator corners shall be mitered and joined with reinforcing clips set in epoxy. All corners shall be made permanently leakproof.
  - 5. Each ventilator shall be balanced on heavy duty four bar hinges which include a positive stop and an adjustable friction shoe to hold the vent in any open position up to 50 degrees.
  - 6. Weather-stripping shall be by means of a double row of neoprene Chevron-type splines, retained in the dovetail recesses of the frame extrusions.
  - 7. Locking handles, strike, and keepers shall be furnished with each ventilator.
  - 8. Insect screens shall be constructed with extruded frames, rigidly joined at their corners. Screen cloth shall be 18 by 16 mesh aluminum. Screen frames shall match the finish of the windows.

## **2.04 OPERATORS**

- A. Windows shall be supplied with manual operators unless electric operators are indicated on the Drawings or called for in Part 4 of this Section.

## **PART 3 EXECUTION**

### **3.01 DELIVERY, HANDLING, AND STORAGE**

- A. Delivery, handling, and storage shall be in accordance with the requirements of Section 01350.

### **3.02 INSPECTION**

- A. Assure that window openings conform with dimensions and tolerances shown on the Drawings.
- B. Check that surfaces to contact windows are free of debris.
- C. Check that window units supplied are of the types and dimensions specified, and that they are undamaged, correctly finished, and clearly identified as to location.

### **3.03 INSTALLATION**

- A. Comply with manufacturer's directions for the installation of window units, hardware, and other components. Set units plumb, level, and true to line without warp or rack.
- B. Anchor frames solidly to surrounding construction to prevent distortion or misalignment.
- C. Apply bituminous paint to window frame wherever aluminum would be in contact with concrete, masonry, or a galvanically incompatible metal.

### **3.04 FINAL ADJUSTMENTS**

- A. Adjust movable units to operate smoothly and to be weathertight when closed.
- B. Lubricate hardware and moving parts.
- C. Clean aluminum surfaces and remove excess sealants.
- D. Remove debris from Work site.
- E. Leave window units in closed position to protect against dirt and the elements.

## **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

This page was intentionally left blank.



**SECTION 08700  
FINISH HARDWARE**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing all hardware necessary to operate the doors scheduled or shown on the Drawings.
- B. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Hardware schedule.
    - c. Key schedule.
    - d. Manufacturer's literature.
    - e. Manufacturer's warranty.

**1.03 MANUFACTURER'S WARRANTY**

- A. A two-year guarantee shall be provided by the hardware manufacturer on the workmanship and materials for door closers, lock sets, door handles, and exit devices.
- B. All other hardware items are subject to one year's guarantee requirements from the date of final acceptance.
- C. The provisions of these warranties shall not be construed as relieving or reducing the obligations of the Contractor outlined in the General Conditions of these Specifications.

**1.04 QUALITY ASSURANCE**

- A. Hardware shall be a standard product of one of the following manufacturers or equal.

Item	Manufacturer
Hinges, Pulls, Push Plates	Select Products, Stanley, Sargent, or equal
Locks, Closers, Dead Bolts	Schlage
Thresholds	Zero, National Guard, or equal
Weather-stripping	Zero, Tremco, National Guard, or equal
Flush Bolts	Ives, Stanley, Corbin, Glyn Johnson, or equal

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. All hardware shall be made of stainless steel or bronze with finish as scheduled. Concealed parts of hardware shall be of nonferrous metal unless otherwise specified.
- B. All door closers shall have cast iron bodies with scheduled finish and of proper size for the doors on which they will be mounted. Door closers shall be applied indoors and equipped with brackets if necessary. All door closers shall have hold-open features unless otherwise indicated or required.
- C. All hardware (for each opening) shall be delivered to the building site separately wrapped and packaged with the correct screws and bolts for installation. Each package shall be properly labeled with location numbers corresponding with the hardware schedule.
- D. Each package of finish hardware shall include all screws, strikes, plates, knobs, roses, and other items required for complete and finished installation.
- E. All double doors shall have nonferrous lever handles in place of knobs on the passing side of the astragal. The assembly shall contain a booster spring to ensure the lever returning to a horizontal position.

### **2.02 TEMPLATES**

- A. Furnish and deliver directly to the metal door manufacturer templates of all hardware to be applied to doors and frames.

### **2.03 KEYS AND KEYING**

- A. Locks shall be heavy duty. Each cylinder shall have six pin tumblers. Strikes shall be of the box type.
- B. Locks shall be master keyed to existing doors according to instructions provided by the Owner. The Contractor shall submit an RFI requesting keying instructions from the Owner.
- C. Four keys shall be furnished for each lock.

### **2.04 PANIC GUARD EXIT DEVICE**

- A. Panic Exit Device shall include as an integral part of the device a retractable deadlocking bar mechanism which provides a continuous barrier at the meeting stiles. The device shall not require additional mullions, coordinators, timing devices, etc., to allow proper door function.
- B. Panic Exit Device shall have the capability of being dogged in the unlocked position by a single turn of the cylinder key.

- C. Meeting stiles shall be designed and constructed to house and conceal all mechanical components and provide a smooth, uncluttered appearance. No exposed screws or fasteners shall occur on the exterior surface of the door stiles.
- D. "Panic Guard" Exit Device shall be installed by the manufacturer at the factory before shipment is made. Device shall be listed by UL.

### **PART 3 EXECUTION**

#### **3.01 HARDWARE INSTALLATION**

- A. Finish hardware shall be applied in a workmanlike manner. All butts shall be of uniform spacing and the leaves so set as to avoid screw holes penetrating the face of the door. Locks shall be set level and with true back sets. The striking plates, opposite same, shall be in exact alignment with latches and bolts.
- B. Upon completion, the Contractor shall check all hardware, fit all keys in their respective locks, and deliver all keys properly tagged to the Owner. Delivery of the keys shall not constitute acceptance of the building.

### **PART 4 SPECIAL PROVISIONS**

#### **4.01 HARDWARE SCHEDULE**

- A. The manufacturers' names and catalog numbers shown on this schedule have been used as a guide to type, style, and materials of construction only. Other manufacturers of the hardware are noted in Subsection 1.04 of this Section.
- B. The hardware schedule does not necessarily include all the hardware for all the buildings.
- C. The Contractor shall furnish all hardware of whatever nature as necessary to complete the buildings whether or not shown on this hardware schedule.
- D. Hardware Schedule:

<b>Type I – Single Panel</b>			
<b>Quantity</b>	<b>Item</b>	<b>Finish</b>	<b>Manufacturer</b>
1	Continuous Hinge SL-11-HD	Clear	Select Products
1	Lockset S-51 Saturn	BMHA 626	Schlage
1	Closer SC61-SS-696 w/Hold Open	BMHA 626	Schlage
1	Threshold 513	Alum.	National Guard
1 Set	Weather Strip FS160A	Alum.	National Guard
1	Door Bottom Seal 35	US26D	National Guard
1	Kick Plate	US26D	Schlage

END OF SECTION



**SECTION 08800  
GLAZING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing glass necessary for completion of the Work.
- B. Additional product requirements are specified in Section 01350.

**1.02 MEASUREMENTS**

- A. The Contractor shall verify the dimensions of all openings in the building to be glazed and shall correctly size all glass to fit properly.

**1.03 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Manufacturer's literature.
    - c. Manufacturer's warranty.
    - d. Prior to purchase, the Contractor shall submit two representative samples of each type of glass proposed for glazing.

**1.04 MANUFACTURER'S WARRANTY**

- A. A 10-year warranty shall be provided by the manufacturer on the workmanship and materials for all glazing. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in the General Conditions of these Specifications.

**PART 2 PRODUCTS**

**2.01 QUALITY OF GLASS**

- A. All glass shall be of the best grade of its respective kind and shall be free from flaws of any sort. All glass shall be of new material, as manufactured by Pittsburgh Glass Co., Libbey-Owens-Ford Co., Mississippi Glass Co., or equal.

- B. Each piece of glass shall bear the manufacturer's label giving the name of the manufacturer and the quality of the glass, including its weight or thickness. Absence of label will constitute cause for rejection.
- C. All glazing and glazing materials shall comply with the requirements of the safety standard for Architectural Glazing Materials issued by the Consumer Product Safety Commission.

**2.02 TINTED INSULATING GLASS (TYPE A)**

- A. Tinted insulating glass shall be 1-inch thick metal banded insulating units. The outer element shall be 1/4-inch "Solarbronze" polished plate and the inner element shall be of clear 1/4-inch polished plate separated by a hermetically sealed air space. Glass shall be Twindow units as manufactured by PPG, LOF, or equal.

**2.03 TINTED PLATE GLASS (TYPE B)**

- A. Tinted plate glass shall be 1/4-inch thick as manufactured by PPG, LOF, or equal.

**2.04 TINTED TEMPERED GLASS (TYPE C)**

- A. One-quarter inch thick tempered glass with Solarbronze tint as manufactured by PPG, LOF, or equal.

**2.05 CLEAR TEMPERED GLASS (TYPE D)**

- A. One-quarter inch thick clear tempered glass as manufactured by PPG, LOF, or equal.

**2.06 CLEAR PLATE GLASS (TYPE E)**

- A. Clear plate glass in windows shall be 1/4-inch thick as manufactured by PPG, LOF, or equal.

**2.07 CLEAR TEMPERED INSULATING GLASS (TYPE F)**

- A. Clear tempered insulating glass shall be 1-inch thick metal banded insulating units. The outer element shall be 1/4-inch clear tempered glass and the inner element shall be of clear 1/4-inch tempered glass separated by a hermetically sealed air space. Glass shall be as manufactured by PPG, LOF, or equal.

**2.08 CLEAR TEMPERED PATTERNED GLASS (TYPE G)**

- A. Clear tempered patterned glass shall have a thickness of 1/4-inch, +1/16-inch, and shall be "Flemish Amber" as manufactured by Mississippi Glass Co., LOF, or equal.

**2.09 CLEAR WIRED GLASS (TYPE H)**

- A. Clear wired glass shall have a thickness of 1/4-inch and shall be "polished Misco" as manufactured by Mississippi Glass Co., LOF Diamond Weld, or equal.

**PART 3 EXECUTION**

**3.01 GLAZING**

- A. Provide sufficient clearance around edges of all glass to allow for expansion and contraction, vibration and adjustment. Glazing beads and stops will be provided and fitted by the Contractor. They shall be set tight but shall not bind the glass.
- B. All glass set in Neoprene Structural Gaskets shall be installed by the Contractor with neoprene setting blocks and lock strips furnished by structural gasket manufacturer.
- C. All glass where compounds are required shall be bedded with resilient setting blocks and set with an elastic glazing compound as manufactured by A.C. Horn Co. "Vulcatex"; Sonneborn Chemical and Refining Co. "Kaukit"; Euclid Chemical Co. "Eucalk"; or equal. Compound shall conform to FS TT-C598, Grade 1.
- D. The exterior side of insulating glass in gaskets shall be sealed with A.C. Horn Co. "Hornflex" Thiokol LP-32 Sealant, Sonneborn Chemical and Refining Co. "Sonolastic Sealant," or equal. Compound shall conform to ANSI A116.1 for polysulfide base sealing compounds, or as required by the glass manufacturer.

**3.02 BREAKAGE AND CLEANING**

- A. The Contractor shall replace all lights of glass damaged during construction and shall deliver buildings to the Owner with all lights in like-new condition.
- B. On completion of Work, the Contractor shall thoroughly clean all glass of dirt, paint, and stain and remove glazing compound from adjoining Work.

**PART 4 SPECIAL PROVISIONS**

None

END OF SECTION





**SECTION 09255**  
**PVC WALL & CEILING PANEL CONSTRUCTION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all metal stud partitions, PVC panels, and joint trim systems, metal trim, and accessories.
- B. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Manufacturer's literature.

**PART 2 PRODUCTS**

**2.01 METAL STUDS AND PVC WALL PANEL CONSTRUCTION**

- A. Metal studs shall be 20-gauge, 3 5/8-inch stud spaced at 16-inch OC, and be of screw stud type system, unless noted otherwise. Provide cold rolled channel stiffeners between studs approximately 4 feet-6-inch above floor line. Ceiling joists shall be 20-gauge with height as noted on drawings. Use other stud sizes if required by the Drawings.
- B. PVC Wall & Ceiling Panels shall be 1/2-inch thick plain panels. Panel shall be tongue and groove with hidden fasteners. Panel corners shall have matching PVC trim pieces of same color provided by same manufacturer.
  - 1. Panels and system shall be Trusscore, Inc. Wall & Ceiling Board PVC Interlocking Panel, or Equal.
  - 2. Panels shall meet ASTM D4226 Standard.
  - 3. Panel fasteners to metal studs shall be stainless steel or zinc coated 1" No. 10 panhead screws at a minimum of 16" o.c. unless manufacturer instructions indicate a closer spacing.
  - 4. Panels shall be Class A Fire Rating.
  - 5. Panel colors shall be as selected by owner from manufacturer standard colors.

- C. Warranty on panels shall be executed by manufacturer for repair or replacement of panels that fail in materials or workmanship within 20 years from date of Substantial Completion. Warranty shall include the labor required for the repair or replacement.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install wall and ceiling panels in accordance with manufacturer's instructions at locations indicated on the Drawings
- B. Install wall and ceiling panels plumb, level, square, flat, and in proper alignment.
- C. Install trim in accordance with manufacturer's instructions.
- D. Ceiling Panels: Anchor ceiling panels with fasteners in accordance with manufacturer's instructions.
- E. Wall Panels: Anchor wall panels with construction adhesive and fasteners in accordance with manufacturer's instructions.
- F. Contractor shall provide proper blocking where required to reinforcement construction to receive all items that depend on wall hung type of construction.
- G. Field-cut panels as necessary in accordance with manufacturer's instructions. Ensure cuts are straight, square, and do not damage panels.
- H. Where damage has occurred to panels, remove and replace damaged Work in accordance with manufacturer's instructions.

#### **4.02 CLEANING AND ADJUSTMENT**

- A. Clean with a mild detergent or soap scum remover. Where detergents do not work, low pressure washers with mild soap and a soft cloth may be used.
- B. Multi-purpose cleaners may be used, provided they are PVC compatible. Spot test material in an inconspicuous location prior to cleaning.
- C. Do not use of abrasive cleaners.

END OF SECTION

**SECTION 09900  
PAINTING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and application of protective coatings to all wood, concrete, and metal surfaces as specified or as shown on the Drawings.
- B. Included in this Section is surface preparation, shop application inspection, and field touch up work as required to provide a complete protective coating system.
- C. In general, the Work shall include the field painting of the following:
  - 1. All exposed interior cast-in-place concrete (except floors) above ground floor.
  - 2. All exposed concrete blocks and hollow core precast slabs.
  - 3. All exposed plaster.
  - 4. All exposed wood.
  - 5. All exposed pipe insulation.
  - 6. All exposed piping, including fittings, valves, couplings, flanges, and other in-line accessories.
  - 7. All machinery, pumps, and equipment.
  - 8. All metal surfaces except the following:
    - a. Bronze surfaces.
    - b. Stainless steel surfaces.
    - c. Aluminum or galvanized steel not requiring color coding or otherwise specified to be coated.
- D. Additional product requirements are specified in Section 01350.
- E. A Coating Schedule appears in Part 4 of this Section.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Coating manufacturer's product data and technical literature including:
      - 1) Catalog number.
      - 2) General classification.
      - 3) Coating material analysis.

- 4) Detailed surface preparation guidelines.
    - 5) Mixing, thinning, and application instructions for each material.
    - 6) Induction time, pot life, viscosity, and drying and curing times for acceptable ranges of temperature and humidity.
  - b. Abrasive manufacturer's information including:
    - 1) Name, address, and phone number of manufacturer and local supplier.
    - 2) Bulk density.
    - 3) Mohs ranking.
    - 4) Sieve analysis.
    - 5) Chemical analysis including impurities.
    - 6) Free silica content.
    - 7) Grain shape (roundness).
  - c. Submittals of coatings by a manufacturer not named in these specifications shall include performance criteria on abrasion, adhesion, exterior exposure, hardness, humidity exposure, salt spray (fog), impact, immersion, etc., as applicable, per the appropriate ASTM standards. If requested by the Engineer, the Contractor shall submit manufacturers complete formula for the coatings which are proposed to be furnished. The Engineer may also require the submission, at the Contractor's expense, of test reports from private laboratories showing results of comparable tests on the coatings proposed and the coatings specified.
  - d. Details of application equipment and procedures.
  - e. Samples of manufacturer's standard colors.
2. Information for the Record:
  - a. Certification that materials meet or exceed Specifications and that coating systems are suitable for intended use.
  - b. Certification that coating systems are compatible with substrate, specified surface preparation, prime coats, sealants and existing finishes.
  - c. Safety Data Sheets (SDS) for coating materials, thinners, diluents, abrasives, cleansers, and other materials.
  - d. Schedule of coating work showing each phase and step of Work.

### 1.03 QUALITY ASSURANCE

- A. Standards - Surface preparation, coating, and patching work performed under this Section shall conform to the applicable provisions and recommendations of the following standards.
  - 1. SSPC Steel Structures Painting Manual, Volume 1, "Good Painting Practice."
  - 2. SSPC Steel Structures Painting Manual, Volume 2, "Systems and Specifications."
  - 3. SSPC Vis. 1 and 2, visual standards and written guidelines.
  - 4. NACE Coatings and Linings Handbook.
  - 5. Applicable NACE standards and recommended practices including RP0178 and RP0184.
- B. Field Mock-ups - Where specified in the Coating Schedule, a field mock-up shall be done prior to performing the required Work.
  - 1. Field mock-ups shall be a minimum of 4 square feet in area, in a location chosen by the Owner or his representative.
  - 2. The mock-ups will serve as a standard of acceptance for applicable coating work under this Contract.
  - 3. The coating manufacturer's representative will be available to advise the Contractor.
  - 4. Step-down mock-ups, showing the prepared substrate, primer, intermediate, and finish coats, as applicable, shall be used. Where the substrate is a ferrous metal, the portion remaining exposed shall be protected with a clear varnish.

### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage, and handling shall be in accordance with Section 01350.
- B. Include the following information on container labels or packing slips:
  - 1. Manufacturer's name.
  - 2. Name or title of material.
  - 3. Batch numbers.
  - 4. Stock number and date of manufacture.
  - 5. Shelf life or expiration date.
  - 6. Contents by volume of pigment, binder, and vehicle.
  - 7. Thinning instructions when recommended.
  - 8. Application instructions.
  - 9. Color name and number.
  - 10. Safety Data Sheets (SDS).

- C. Provide controlled storage for coating materials and abrasives. Store coating materials in environmentally controlled enclosure with minimum ambient temperature of 55 degrees F. Store abrasives in dry area.
- D. Maintain inventory of coating materials, solvents, and cleaners.

#### **1.05 SCHEDULING AND SEQUENCING**

- A. Notify Engineer two weeks in advance of surface preparation and coating application.
- B. Work systematically in accordance with submitted schedule.
- C. Sequence and coordinate abrasive blasting and coating application with Work of other sections. Do not interrupt plant process or interfere with Owner's operations.
- D. Coordinate coating work with installation of sealants specified in Section 07900.
- E. Furnish specified testing and inspection equipment to Owner a minimum of two weeks prior to beginning surface preparation and coating work.

#### **1.06 MANUFACTURER'S RECOMMENDATIONS**

- A. Apply coatings in strict compliance with manufacturer's recommendations and instructions as to environmental conditions, surface preparation, mixing, application, and curing. Where Specifications are more stringent than manufacturer's recommendations, Specifications shall prevail.
- B. Resolve conflicts between Specifications and manufacturer's recommendations and instructions by obtaining written agreement between Engineer and coating manufacturer prior to beginning Work.

#### **1.07 DESCRIPTION**

- A. Shop Painting - Shop painting shall be performed to the extent and as required under Section 01350 and the various individual sections of the specifications. All metal surfaces shall be given a protective shop coat of primer compatible with the field coating. Shop primer color shall be beige where available. If a prime coat has not been applied in the shop, then a prime coat shall be applied in the field after proper surface preparation and prior to the application of the finish coats.
- B. Compatibility - The Contractor shall ensure the primer or finish coating applied in the shop is compatible with the specified field coatings. If the coatings are incompatible, the shop coatings shall be removed by abrasive blasting and coatings applied in conformance with this Section.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. The products shall be as specified in the Coating Schedule. Materials selected for each coating system shall be the product of one manufacturer. The Contractor shall be

responsible for the compatibility of all components of each coating system including primer, thinner, and solvents.

## **2.02 COATING SCHEDULE**

- A. The Coating Schedule included in Part 4 of this Section identifies the areas to be painted, the required materials, and number of coats required.

## **PART 3 EXECUTION**

### **3.01 ENVIRONMENTAL REQUIREMENTS**

- A. Environmental Conditions:
  - 1. Perform Work of this Section under the following environmental conditions.
    - a. Abrasive blast only when surface contamination can be prevented. Abrasive blast only when surface temperature is more than 5 degrees F above dew point and relative humidity is less than 85%.
    - b. No coating shall be applied when the air temperature, as measured in the shade, is below 40 degrees F or above 90 degrees F. No coating shall be applied when the temperature of the surface to be painted is below 35 degrees F or as recommended by the paint manufacturer, whichever is greater. Coatings shall not be applied to wet or damp surfaces, when the relative humidity exceeds 85%, or when the surface to be painted is less than 5 degrees F above the dew point.
  - 2. Coating work may proceed during inclement weather in environmentally controlled enclosures. Environment within enclosure shall comply with Specifications and manufacturer's recommendations. Provide adequate ventilation and illumination. Minimum illumination shall be 150-foot candles.
- B. Interior Painting may be done only when the building has been thoroughly dried, by natural or artificial heat, and when the Work area is properly heated and ventilated, clean, and as nearly dust free as possible. Room temperature shall be maintained within the manufacturer's recommendations during application and until coatings are dry.
- C. Dust - Coating shall not be applied in areas where dust is being generated.

### **3.02 PROTECTION**

- A. During the construction period, all electrical and mechanical equipment and other equipment and apparatus shall be protected from paint drippings by means of tarpaulins, burlap, wooden housings, or other protection.
- B. Finished work of other trades, surfaces not being painted concurrently or not to be painted, and factory finished lockers, toilet partitions, etc., that will not require field painting shall be protected at all times from paint spots and damage to the finish.

- C. Perform cleaning and coating operation in manner which prevents dust and contaminants from falling in newly applied coating.
- D. Protect portions of Work which are partially or entirely completed and which are adjacent to surfaces being prepared by abrasive blasting.
- E. Protect completed Work from solvents, contaminants, or other substances which may damage coating.
- F. Prominently display "Wet Paint" signs in sufficient number to protect newly applied coating.

### 3.03 PREPARATION OF SURFACES

- A. General - All surfaces, of whatever material, which are to be painted shall be thoroughly cleaned of dirt, grease, rust scale, or other injurious substance, and, at the time of application of the coating, shall be clean and dry.
- B. Metal Surfaces:
  - 1. Remove weld spatter and other projections. Grind sharp edges to a minimum radius of 1/8-inch. Grind rough welds smooth. Grinding shall be in accordance with SSPC Surface Preparation Commentary. Surfaces shall be smooth and contoured in compliance with SSPC-SP 12.
  - 2. Surfaces which have not been shop coated shall be abrasive blasted prior to any prime coats. Abrasive blasting shall be done in accordance with the Coating Schedule.
  - 3. Shop primed surfaces shall receive a field sweep blast prior to the application of subsequent coats.
  - 4. Abrasions or defects on shop coated surfaces shall be spot primed.
  - 5. Surfaces which are to receive a high heat coating shall be Near White Blast Cleaned (SSPC, SP-10) and painted within eight hours; or, if recommended by the manufacturer of the approved high heat coating, the surfaces may be thoroughly cleaned to bare metal and given wash coats or a cold phosphatizing treatment as recommended by the manufacturer and as approved by the Engineer.
- C. Concrete and Masonry Surfaces:
  - 1. New concrete and masonry surfaces shall be allowed to become completely cured for at least 30 days at a temperature of 75 degrees F and, immediately prior to treatment, shall be thoroughly cleaned of all dirt, grease, form release agents and stains. Curing compounds shall be removed.
  - 2. Concrete surfaces shall be pressure washed with solution of trisodium phosphate (4 ounce per gallon) and detergent in hot water. Water temperature shall be approximately 180 degrees F. Immediately flush surface with clean potable water until pH of surface meets acceptance criteria of ASTM D4262.



3. If recommended by the coating manufacturer, on concrete surfaces less than six months old, one coat of zinc sulfate solution shall be uniformly applied and allowed to dry before application of the coating.
  4. Concrete surfaces shall be abrasive blasted with coarse, hard, and angular abrasive after cleaning. Air stream shall be free of moisture and oil.
  5. Acid etching is not permitted.
- D. Wood Surfaces shall be sanded smooth and filled with an approved paste or liquid grain filler, and cracks and crevices shall be filled with a non-shrinking, elastic composition especially prepared for this purpose. Wood surfaces to be varnished shall be rubbed smooth with pumice and oil.
- E. Clean up all debris from the surface preparation operation.

### **3.04 ABRASIVE BLASTING**

- A. Abrasives shall be expendable coal slag or aluminum oxide, free of silica, or a steel shot/grit mixture. Maintain abrasives free from dust, salts, and other impurities. Select the type and size of abrasive to yield a surface as specified in the Coatings Schedule.
- B. Provide moisture and oil separators or traps of adequate size in compressed air system to provide dry and clean air supply. Drain traps automatically during blasting operation. Remove oil and moisture accumulated in air receiver by regular purging.
- C. Remove weld splatter, slivers, laminations, and underlying mill scale which become visible after abrasive blasting, by grinding in accordance SSPC SP-3 and NACE RP0178. Follow grinding by final abrasive blast.
- D. Surfaces which cannot be properly cleaned by abrasive blasting because of their location may be prepared by power tool cleaning in accordance with SSPC SP-11 (Power Tool Clean to Bare Metal) in lieu of abrasive blasting, subject to Engineer's approval.
- E. After surface preparation but prior to priming inspect surface for corrosion. Remove corrosion products which become visible when viewed without magnification by re-blasting.
- F. Remove dust and blasting residue by blowing with clean, dry air, and vacuum cleaning with clean tools.

### **3.05 MIXING AND THINNING**

- A. All mixing shall be performed by mechanical paint shakers or mixers in strict accordance with the manufacturer's printed instructions.
- B. Do not use coating material which has livered, gelled, or otherwise deteriorated during storage. Thixotropic materials which obtain normal consistency when stirred are acceptable. Where a skin has formed in container, cut skin loose from sides of container and discard prior to mixing.

- C. Each component of multi-component materials shall be mixed individually before use. The material shall be mixed in a manner which will insure the break-up of all lumps, complete dispersion of pigment, and a uniform composition. Materials shall be inspected after mixing for uniformity and to verify that no unmixed pigment remains at the bottom of the container.
- D. The individual parts shall be mixed together in the proportions recommended by the manufacturer. The materials shall be mixed thoroughly before use and shall be agitated often enough during application to ensure a uniform composition.
- E. Mixed coatings shall be strained after mixing unless the application equipment is provided with strainers. Strainers shall be of a type to remove skins and undesirable matter without removing pigment.
- F. Thinner shall not be added unless required for proper application. Thinning shall be in strict accordance with the manufacturer's recommendations.
- G. Mixed coatings shall have pot life stated on label and indicated in approved Shop Drawing. When pot life limit is reached, discard material, clean equipment, and mix and induct new material.
- H. Store materials not in actual use in tightly covered containers. Maintain containers and equipment used in storage, mixing, and application in clean condition, free of foreign materials and residue.

### **3.06 COATING APPLICATION**

- A. Apply prime coat within eight hours of completion of surface preparation. If surface is degraded, contaminated, or wet by rain or moisture subsequent to surface preparation and prior to coating, restore surface in accordance with Specifications.
- B. Prior to applying each coat, remove dust with industrial vacuum cleaner using new filters, clean tools, and clean hopper. Remove residue or foreign matter on coating before applying additional coats by pressure rinsing with 1800-2000 psi water, when required by Engineer's representative.
- C. Apply coatings in accordance with applicable provisions of SSPC Paint Application Specification PA 1. Use equipment best suited for the coating material.
- D. Cloudiness, spotting, laps, brush marks, roller marks, runs, sags, drips, ropiness, voids, discontinuities, pinholes, and other surface imperfections are unacceptable.
- E. When spray application is approved by Engineer. Spare fittings, gun tips, gun parts, and other spray equipment shall be acceptable to Engineer.
- F. Stripe coat edges, welds, corners, crevices, and other surfaces difficult to coat before applying full coat in accordance with SSPC-PA 1.
- G. Coverage shall be in conformance with the manufacturer's instructions. The dry mil thickness of coatings shall be as specified in the Coating Schedule.

### 3.07 APPLICATION BY SPRAYING

- A. Application of coatings by spraying may be permitted in locations and on surfaces approved by the Engineer. The Contractor must submit for approval a written request giving the proposed locations and the coating manufacturer's instructions for spray application. Applicator and equipment must conform to the following paragraphs:
1. Spraying shall conform to the manufacturer's recommendations.
  2. Equipment:
    - a. The spray equipment used shall be suitable for the intended purpose, capable of properly atomizing the coating, and equipped with suitable pressure regulators and gages. The equipment shall be in good working order.
    - b. Spray equipment shall be kept sufficiently clean so that dirt, dried coating, and other foreign substances are not deposited with the coating.
    - c. All solvents used in cleaning the equipment shall be completely removed before use.
    - d. The equipment manufacturer's instructions for proper use shall be strictly followed.
  3. Air Spray:
    - a. Air caps, nozzles, and needles shall be those recommended by the manufacturers of the coating system and spray equipment being used.
    - b. Moisture and oil separators or traps shall be used in the compressed air system to provide a dry and clean air supply. The traps or separators must be of adequate size and must be drained periodically during the coating application.
  4. Airless Spray:
    - a. Fluid tips shall be of the proper orifice size and fan angle, and the fluid control gun of proper construction, as recommended by the manufacturer of the coating system and the spray equipment being used.

### 3.08 CURING

- A. Each coat shall be in a proper state of cure or dryness prior to the placement of the succeeding coat. Coating shall be considered sufficiently dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities such as lifting, wrinkling, or loss of adhesion of the undercoat. Where an overcoat will not properly adhere to an overly cured undercoat, it shall be applied within the time period recommended by the manufacturer.

- B. The curing times for the coatings shall conform to the coating manufacturer's recommendations considering ambient temperature and relative humidity.

### **3.09 FIELD QUALITY CONTROL**

- A. Thickness - The Contractor shall furnish the Engineer a suitable thickness detector of a type recommended by the coating manufacturer. Dry film measurements shall be taken in accordance with SSPC-PA 2.
- B. The color of the prime coat shall be beige when available. It shall be inspected before application of intermediate or finish coats.
- C. Intermediate Coats shall be the approximate shade of final coat; however, each coat shall be of a slightly different tint. Each coat shall be inspected and approved before the next coat may be applied; otherwise, credit will not be given and the Work shall be recoated.

### **3.10 PATCHING AND REPAIRS**

- A. All defective coatings shall be removed or repaired as the Engineer may direct. Surfaces with defective shop primer shall be repaired per the manufacturer's recommendations of the system in the Coating Schedule.
- B. Before final approval of the Work all damaged coating surfaces (field or factory applied) shall be cleaned and repainted or touched up as directed.

### **3.11 CLEANING**

- A. Remove coating and splatter inadvertently placed on items not scheduled to be coated. Remove splatter by washing or scraping, taking care not to scratch or otherwise damage finished surfaces.
- B. Remove and dispose spent abrasives, discarded coating materials, rubbish containers, rags, and other debris at the end of each work day.

### **3.12 MARRED EXISTING FINISHES**

- A. Existing buildings, pipelines, plumbing, etc., marred during construction by the Contractor shall be repainted to match the existing coating. Repainting shall be carried far enough to match the newly painted area with the existing coating.
- B. Surface preparation, primer, and finish coats shall be in accordance with the Coating Schedule.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 COLORS**

- A. The colors used shall be selected by the Owner and the Engineer, from the manufacturer's standard colors.

- B. All pipelines and associated equipment shall be color coded and banded as follows.
- C. Banding shall consist of 3-inch wide painted bands at 30-inch center to center.
- D. Color Schedule:

Item	Color
Raw Sewage Piping in Control Building and Wet Well	Light Gray
Vent Pipes	Safety Yellow
Pipe Bollards	Safety Yellow
Sluice Gate Operator Stands	Safety Yellow
Control Building Color Banding	See Specification Section 04200
Hoist Framing	Black

#### 4.02 COATING SCHEDULE

- A. The following coating schedules is provided a recommendation and may not cover minor painting items included in the Work. The coating systems manufacturers are listed in no particular order, any of the four listed systems, or equal may be used.

Wastewater				
	Carboline	Tnemec	AkzoNobel (International, Devoe, Glidden Professional)	Sherwin Williams
A.	Ferrous metals, except galvanized or stainless steel, submerged or partially submerged in wastewater or non-submerged exposed to splash or spill, including all tank mechanisms and tank mechanism support structures; clips, beams, and walkway supports; pipes, valves, sluice gates, scum baffles, and weirs:			
	Surface Preparation: SSPC-SP 10 (NACE 2) Near White Blast Cleaning with a 1.5-2.0 mil Profile	SSPC-SP 10 (NACE 2) Near White Blast Cleaning with a 2.0 mil Profile	SSPC-SP 10 (NACE 2) Near White Blast Cleaning with a 1.5-2.0 mils Profile	SSPC-SP 10 (NACE 2) Near White Blast Cleaning with a 1.5-2.0 mil Profile
	Primer: 1 coat, Carboguard 890 (4.0-6.0 mils DFT)	1 coat, N140 Pota-Pox Plus (DFT 3.0-5.0 mils).	N/A	1 coat, Macropoxy 240 (DFT 3.0-5.0 mils)
	Field Finish: 2 coats, Bitumastic 300m (8.0-16.0 DFT per coat)	2 coats, 46H-413 HB Tnemec-Tar, (DFT 8.0-10.0 mils per coat).	N/A	2 coats, Targuard Coal Tar Epoxy (DFT 8.0-16.0 mils per coat)
General Coating Schedule				
B.	Exterior nongalvanized, ferrous metal surfaces not submerged:			
	1. Subject to splash or spills or atmospheric:			
	Surface Preparation: SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5- 2.0 mils	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils
	Primer: 1 coat, Carbozinc 859 (3.0-5.0 mils DFT)	1 coat, 90-97 Tnemec-Zinc, (DFT 2.5-3.5 mils).	1 coat, CathaCoat 313 (DFT 2.0-4.0 mils)	1 coat, Corothane I Galvapac (DFT 2.0-4.0 mils)
	Intermediate: 1 coat, Carboguard 60 (4.0-6.0 mils DFT)	1 coat, 27 Typoxy, (DFT 2.5-4.0 mils).	1 coat, Devran 224HS (DFT 4.0-8.0 mils)	1 coat, Macropoxy 646 (DFT 3.0-5.0 mils).
	Final: 1 coat, Carbothane 134HG (2.0-2.5 mils DFT)	1 coat, 72/73 Endura-Shield (DFT 2.5-5.0 mils).	1 coat, Devthane 359 (DFT 3.0-5.0 mils)	1 coat, Hi-Solids Polyurethane (DFT 3.0-5.0 mils).

C. Interior wall surfaces of masonry block construction and precast concrete walls and ceiling surfaces:				
1. Concrete Masonry Block (CMU and AMU)				
	Surface Preparation:	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete), and ASTM D4261 (Block). Masonry shall be moisture free.	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete), and ASTM D4261 (Block). Masonry shall be moisture free.	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete), and ASTM D4261 (Block). Masonry shall be moisture free.
	Sealer/Surfacers:	1 coat, Sanitile 100 (5.0-20.0 mils DFT) depending on porosity must be pin hole free prior to applying	1 coat, 130 Envirofill (DFT 10.0-15.0 mils).	1 coat, Cement Plex 875 Masonry Filler/Sealer (DFT 13-25 mils).
	Finish:	2 coats, Carboguard 60 (DFT 4.0-6.0 mils per coat)	2 coats, N69 H.B. Epoxoline II (DFT 4.0-6.0 mils per coat).	2 coats, Macropoxy 646 (DFT 4.0-6.0 mils per coat)
2. Pre-Cast Concrete				
	Surface Preparation:	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete). Abrade precast concrete, if recommended by coating manufacturer, per ASTM D4259. ASTM D4263 (plastic sheet test method) to ensure concrete is moisture free. If moisture is detected, retest until dry.	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete). Abrade precast concrete, if recommended by coating manufacturer, per ASTM D4259. ASTM D4263 (plastic sheet test method) to ensure concrete is moisture free. If moisture is detected, retest until dry.	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete). Abrade precast concrete, if recommended by coating manufacturer, per ASTM D4259. ASTM D4263 (plastic sheet test method) to ensure concrete is moisture free. If moisture is detected, retest until dry.
	Filler:	Fill bug holes with Carboguard 501/510	Fill bug holes with 215 surfacing epoxy or 218 MortarClad	Fill all bugholes with Steel Seam FT 910 or Dura-Plate 2300 or cementitious repair mortar from AW Cook
	Finish:	2 coats, Carboguard 60 (DFT 4.0-6.0 mils per coat)	2 coats, N69 H.B. Epoxoline II (DFT 4.0-6.0 mils per coat).	2 coats, Macropoxy 646 (DFT 4.0-6.0 mils per coat)
D.	Interior concrete walls, columns, beams, and ceilings; concrete curbs; concrete bases for machinery and equipment; etc.:			

	Surface Preparation:	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete). Abrade precast concrete, if recommended by coating manufacturer, per ASTM D4259. ASTM D4263 (plastic sheet test method) to ensure concrete is moisture free. If moisture is detected, retest until dry.	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete). Abrade precast concrete, if recommended by coating manufacturer, per ASTM D4259. ASTM D4263 (plastic sheet test method) to ensure concrete is moisture free. If moisture is detected, retest until dry.	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete). Abrade precast concrete, if recommended by coating manufacturer, per ASTM D4259. ASTM D4263 (plastic sheet test method) to ensure concrete is moisture free. If moisture is detected, retest until dry.	SSPC-SP 13 (NACE 6) Remove surface contaminants per ASTM D4258 (Concrete). Abrade precast concrete, if recommended by coating manufacturer, per ASTM D4259. ASTM D4263 (plastic sheet test method) to ensure concrete is moisture free. If moisture is detected, retest until dry.
	Filler:	Fill bugholes with Carboguard 501/510	Fill bugholes with 215 Surfacing Epoxy or 218 MortarClad	Fill bug holes with Devfil 145 (16.0-22.0 mils DFT)	Fill all bugholes with Steel Seam FT 910 or Dura-Plate 2300 or cementitious repair mortar from AW Cook
	Primer:	1 coat, Carboguard 60 (DFT 4.0-6.0 mils)	1 coat, 27 Typoxy (DFT 2.5-4.0 mils).	1 coat, Devran 224HS (DFT 4.0-8.0 mils)	1 coat, Macropoxy 646 (DFT 3.0-5.0 mils).
	Final:	2 coats, Carboguard 60 (DFT 4.0-6.0 mils)	2 coats, N69 H.B. Epoxoline II (DFT 4.0-6.0 mils).	2 coats, Devran 224 HS (DFT 4.0-6.0 mils per coat)	2 coats Macropoxy 646 (DFT 4.0-6.0 mils).
E.	Interior, nongalvanized, ferrous metal surfaces of items such as pipe; machinery, equipment; doors and door frames; rolling doors; exposed ductwork; hoppers, chutes, pipe supports, trays, and hangers; walkway platforms; stairs; structural members; floor frames and covers; miscellaneous metal tanks shall be finished as follows:				
	Surface Preparation:	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils.	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils.	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5 to 2.0 mils.	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils.
	Primer:	1 coat, Carboguard 60 (DFT 4.0-6.0 mils)	1 coat, 27 Typoxy (DFT 2.0-4.0 mils).	1 coat, Devran 201H (DFT 2.0-3.0 mils)	1 coat, Recoatable Epoxy Primer, Macropoxy 646 (DFT 3.0-5.0 mils).
	Finish:	2 coats, Carboguard 60 (DFT 4.0-6.0 mils per coat)	2 coats, N69 H.B. Epoxoline II, or equal (DFT 4.0-6.0 mils per coat).	2 coats, Devran 224 HS (DFT 4.0-6.0 mils per coat)	2 coats, Macropoxy 646, (DFT 4.0-6.0 mils per coat).
F.	Ferrous metal surfaces of all chemical pipe supporting trays throughout the project and ferrous metal surfaces of items in chemical rooms such as pipes, machinery, equipment, doors, ductwork, hoppers, walkways, and stairs, but not structural wall panels and roof joists, shall be finished as follows:				



	Surface Preparation:	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils.	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5-2.0 mils.	SSPC-SP 6 (NACE 3) Commercial Blast Cleaning, surface profile 1.5 -2.0 mils.
	Primer:	1 coat, Carboguard 60 (4.0-6.0 mils DFT)	1 coat, 27 Typoxy, or equal (DFT 2.0-4.0 mils).	1 coat, Recoatable Epoxy Primer, Macropoxy 646 (DFT 3.0-5.0 mils).
	Finish:	2 coats, Carboguard 890 (4.0-6.0 mils DFT)	2 coats, N69 H.B. Epoxoline II (DFT 4.0-6.0 mils per coat).	2 coats, Macropoxy 646, (DFT 4.0-6.0 mils per coat).
G.	Exterior piping requiring color coding and made of galvanized ferrous, aluminum, fiberglass reinforced plastic, or other plastic and all exterior fiberglass reinforced plastic piping and galvanized conduit:			
	Surface Preparation:	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non- ferrous Metals	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non- ferrous Metals	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non- ferrous Metals
	Surface Preparation: FRP and Other Plastics:	Scuff sand to roughen surface	Scuff sand to roughen surface	Scuff sand to roughen surface
	Primer:	1 coat, Carboguard 60 (4.0-6.0 mils DFT)	1 coat, 27 Typoxy, or equal (DFT 2.0-3.0 mils).	1 coat, Macropoxy 646 (DFT 2.0-3.0 mils).
	Finish:	2 coats, Carbothane 134 HG (DFT 4.0-6.0 mils per coat)	1 coat, 72/73 Endura-Shield (DFT 2.0-4.0 mils).	1 coat Hi-Solids Polyurethane (3.0-5.0 mils DFT)
H.	Exterior wall surfaces of masonry block construction (Not previously Coated):			
	Surface Preparation:	SSPC-SP 13 (NACE 6) Remove surface contaminates per ASTM D4258 (Concrete), and ASTM D4261 (Block). ASTM D4261 (Block). Masonry shall be moisture free.	SSPC-SP 13 (NACE 6) Remove surface contaminates per ASTM D4258 (Concrete), and ASTM D4261 (Block). ASTM D4261 (Block). Masonry shall be moisture free.	SSPC-SP 13 (NACE 6) Remove surface contaminates per ASTM D4258 (Concrete), and ASTM D4261 (Block). Masonry shall be moisture free.
	Primer:	N/A	N/A	N/A
	Finish	2 coats, Flexide Elastomer (DFT 6.0-8.0 mils per coat)	2 coats, 180/181 Tneme-Crete (DFT 4.0-8.0 mils per coat)	2 coats Loxon XP (DFT 6.0-8.0 mils per coat).

END OF SECTION

**SECTION 09903  
CONCRETE FLOOR COATING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and application of protective coatings concrete flooring and concrete stair treads, as specified or as shown on the Drawings.
- B. Included in this Section is surface preparation, shop application inspection, and field touch up work as required to provide a complete protective coating system.
- C. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Coating manufacturer's product data and technical literature including:
      - 1) Catalog number.
      - 2) General classification.
      - 3) Coating material analysis.
      - 4) Detailed surface preparation guidelines.
      - 5) Mixing, thinning, and application instructions for each material.
      - 6) Induction time, pot life, viscosity, and drying and curing times for acceptable ranges of temperature and humidity.
    - b. Details of application equipment and procedures.
    - c. Samples of manufacturer's standard colors.
  - 2. Information for the Record:
    - a. Certification that materials meet or exceed Specifications and that coating systems are suitable for intended use.
    - b. Certification that coating systems are compatible with substrate, specified surface preparation, prime coats, sealants, and existing finishes.
    - c. Safety Data Sheets (SDS) for coating materials, thinners, diluents, abrasives, cleansers, and other materials.
    - d. Schedule of coating work showing each phase and step of Work.

**1.03 QUALITY ASSURANCE**

- A. Standards - Surface preparation, coating, and patching work performed under this Section shall conform to the applicable provisions and recommendations of the following standards.
  - 1. SSPC Steel Structures Painting Manual, Volume 1, "Good Painting Practice."
  - 2. SSPC Steel Structures Painting Manual, Volume 2, "Systems and Specifications."
  - 3. SSPC Vis. 1 and 2, visual standards and written guidelines.
  - 4. NACE Coatings and Linings Handbook.
  - 5. Applicable NACE standards and recommended practices including RP0178 and RP0184.
- B. Contractor Qualifications - Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.
- C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state, and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.
- D. Provide a written warranty from the manufacturer against defects of materials for a period of one year, beginning with date of substantial completion of the project.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery, storage, and handling shall be in accordance with Section 01350.
- B. Include the following information on container labels or packing slips:
  - 1. Manufacturer's name.
  - 2. Name or title of material.
  - 3. Batch numbers.
  - 4. Stock number and date of manufacture.
  - 5. Shelf life or expiration date.
  - 6. Contents by volume of pigment, binder, and vehicle.
  - 7. Thinning instructions when recommended.
  - 8. Application instructions.
  - 9. Color name and number.
  - 10. Safety Data Sheets (SDS).
- C. Provide controlled storage for coating materials and abrasives. Store coating materials in environmentally controlled enclosure with minimum ambient temperature of 55 degrees F. Store abrasives in dry area.

- D. Maintain inventory of coating materials, solvents, and cleaners.
- E. Condition the specified product as recommended by the manufacturer.

#### **1.05 SCHEDULING AND SEQUENCING**

- A. Notify Engineer two weeks in advance of surface preparation and coating application.
- B. Work systematically in accordance with submitted schedule.
- C. Sequence and coordinate abrasive blasting and coating application with Work of other sections. Do not interrupt plant process or interfere with Owner's operations.
- D. Coordinate coating work with installation of sealants specified in Section 07900.
- E. Furnish specified testing and inspection equipment to Owner a minimum of two weeks prior to beginning surface preparation and coating work.

#### **1.06 MANUFACTURER'S RECOMMENDATIONS**

- A. Apply coatings in strict compliance with manufacturer's recommendations and instructions as to environmental conditions, surface preparation, mixing, application, and curing. Where Specifications are more stringent than manufacturer's recommendations, Specifications shall prevail.
- B. Resolve conflicts between Specifications and manufacturer's recommendations and instructions by obtaining written agreement between Engineer and coating manufacturer prior to beginning Work.

#### **1.07 DESCRIPTION**

- A. Compatibility - The Contractor shall ensure the primer or finish coating applied in the shop is compatible with the specified field coatings. If the coatings are incompatible, the shop coatings shall be removed by abrasive blasting and coatings applied in conformance with this Section.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. The products shall be Sikagard 62, as manufactured by Sika Corporation, or approved equal. Materials selected for each coating system shall be the product of one manufacturer. The Contractor shall be responsible for the compatibility of all components of each coating system.
- B. Epoxy Resin Coating:
  - 1. Component A shall be an epoxy resin of diglycidylether of bisphenol A containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
  - 2. Component B shall be primarily a reaction product of a selected amine blend with an epoxy resin of the epichlorohydrin bisphenol A type containing suitable viscosity control agents, pigments, and accelerators.
  - 3. The ratio of Component A: Component B shall be 1:1 by volume B.

- C. Granules for slip-resistance shall be supplied by the manufacturer of the specified product and shall be able to be mixed into the coating and shall not settle during application.

## 2.02 PERFORMANCE CRITERIA

- A. Typical Properties of the mixed epoxy resin coating:
  - 1. Pot Life: 35- 40 minutes (60 gram mass).
  - 2. Tack FreeTime: Approximately 4 hours.
  - 3. Solids: 100% VOC g/l: 134 (A+B).
  - 4. Immersion & Chemical Exposure: min. Cure 3 Days.
- B. Typical Properties of the Cured Epoxy Resin Coating:
  - 1. Water Absorption (ASTM D-570) at 7days: 0.1% max. (2 hour boil), 24 hour immersion.
  - 2. Elongation (ASTM D-522) at 14 days: 5% min.
  - 3. Abrasion Resistance (ASTM D-968) at 14 days: 51 liters/mil.
  - 4. Adhesion Classification (ASTM 3359) at 14 days: 4A.
  - 5. Abrasion (Taber Abrader) at 7 days: Weight loss: 0.65 gm. max. (H-22 wheel; 1,000 gm weight; 1,000 cycles)
  - 6. Tensile Properties (ASTM D-638) at 14 days: Tensile Strength 5,400 psi (37.3 Mpa) / Elongation at Break 2.7%.
  - 7. Bond Strength (ASTM C-882) Hardened Concrete to Hardened Concrete.
  - 8. 2 Day (dry cure): 2,000 psi (13.79 MPa).
  - 9. 14 Day (moist cure): 1,500 psi. (10.34 MPa).

## PART 3 EXECUTION

### 3.01 ENVIRONMENTAL REQUIREMENTS

- A. Substrate must be clean, sound, and free of surface contaminants. Remove dust, laitance, grease, oils, curing compounds, form release agents and all foreign particles by mechanical means. Substrate shall be in accordance with ICRI Guideline No. 03732 for coatings.
- B. Environmental Conditions:
  - 1. Perform Work of this Section under the following environmental conditions.
    - a. Abrasive blast only when surface contamination can be prevented.  
Abrasive blast only when surface temperature is more than 5 degrees F above dew point and relative humidity is less than 85%.
    - b. No coating shall be applied when the air temperature, as measured in the shade, is below 40 degrees F or above 90 degrees F. No coating shall

be applied when the temperature of the surface to be painted is below 35 degrees F or as recommended by the paint manufacturer, whichever is greater. Coatings shall not be applied to wet or damp surfaces, when the relative humidity exceeds 85%, or when the surface to be painted is less than 5 degrees F above the dew point.

2. Coating work may proceed during inclement weather in environmentally controlled enclosures. Environment within enclosure shall comply with Specifications and manufacturer's recommendations. Provide adequate ventilation and illumination. Minimum illumination shall be 150-foot candles.
- C. Interior Painting may be done only when the building has been thoroughly dried, by natural or artificial heat, and when the Work area is properly heated and ventilated, clean, and as nearly dust free as possible. Room temperature shall be maintained within the manufacturer's recommendations during application and until coatings are dry.
- D. Dust - Coating shall not be applied in areas where dust is being generated.

### **3.02 PROTECTION**

- A. During the construction period, all electrical and mechanical equipment and other equipment and apparatus shall be protected from coating drippings by means of tarpaulins, burlap, wooden housings, or other protection.
- B. Finished work of other trades, surfaces not being coated concurrently or not to be painted, and factory finished lockers, toilet partitions, etc., that will not require field painting shall be protected at all times from paint spots and damage to the finish.
- C. Perform cleaning and coating operation in manner which prevents dust and contaminants from falling in newly applied coating.
- D. Protect portions of Work which are partially or entirely completed and which are adjacent to surfaces being prepared by abrasive blasting.
- E. Protect completed Work from solvents, contaminants, or other substances which may damage coating.
- F. Prominently display "Wet Paint" signs in sufficient number to protect newly applied coating.

### **3.03 PREPARATION OF SURFACES**

- A. General - All surfaces, of whatever material, which are to be painted shall be thoroughly cleaned of dirt, grease, rust scale, or other injurious substance, and, at the time of application of the coating, shall be clean and dry.
- B. Concrete and Masonry Surfaces:
  1. New concrete and masonry surfaces shall be allowed to become completely cured for at least 30 days at a temperature of 75 degrees F and, immediately prior to treatment, shall be thoroughly cleaned of all dirt, grease, form release agents and stains. Curing compounds shall be removed.

2. Concrete surfaces shall be pressure washed with solution of trisodium phosphate (4 ounce per gallon) and detergent in hot water. Water temperature shall be approximately 180 degrees F. Immediately flush surface with clean potable water until pH of surface meets acceptance criteria of ASTM D4262.
  3. If recommended by the coating manufacturer, on concrete surfaces less than six months old, one coat of zinc sulfate solution shall be uniformly applied and allowed to dry before application of the coating.
  4. Concrete surfaces shall be abrasive blasted with coarse, hard, and angular abrasive after cleaning. Air stream shall be free of moisture and oil.
  5. Acid etching is not permitted.
- C. Clean up all debris from the surface preparation operation.

### **3.04 MIXING & APPLICATION**

- A. Mixing - Premix each component. Proportion equal parts by volume of Component A and Component B into a clean, dry mixing pail. Mix thoroughly for 3 minutes min. with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its pot life (35 minutes at 73F). To minimize color difference, blend two complete Components B's together. Use only one of the blended Component B's to mix with a Component A. After the first Component B has been used, blend the second Component B with a new Component B and repeat the above procedure for the entire application.
- B. Placement Procedure - The epoxy resin coating shall be applied only to approved, prepared surfaces with high quality brushes, rollers, or spray equipment. Coating shall be applied at ambient and substrate temperatures between 50 and 90F. Application thickness shall be between 4 to 7 mils per coat. Subsequent coats shall be applied within 48 hours of the previous coat. Care is to be taken on vertical and overhead surfaces to avoid sags or runs. If this occurs, it must be sanded out and the area re-coated.
- C. If coating of horizontal surfaces that will receive traffic is specified, a slip-resistant aggregate, Sikagard 62 Granules or equal, shall be incorporated into the mixed epoxy resin coating at 1/2 lb./gallon or as directed by the Engineer.
- D. When applying the coating, if possible, never stop the application until the entire surface has been coated. If possible, always discontinue at an edge, corner, or joint. Never let a previously coated film dry. Always coat into wet film. Always apply the coating at a 45 degree angle to an edge, corner, or joint.
- E. Adhere to all limitations and cautions for the epoxy resin as stated in the manufacturers printed literature.
- F. Mixed coatings shall have pot life stated on label and indicated in approved Shop Drawing. When pot life limit is reached, discard material, clean equipment, and mix and induct new material.
- G. Store materials not in actual use in tightly covered containers. Maintain containers and equipment used in storage, mixing, and application in clean condition, free of foreign materials and residue.



- H. Stripe coat edges, welds, corners, crevices, and other surfaces difficult to coat before applying full coat in accordance with SSPC-PA 1.
- I. Coverage shall be in conformance with the manufacturer's instructions. The dry mil thickness of coatings shall be as specified in the Coating Schedule.

### **3.05 CURING**

- A. Each coat shall be in a proper state of cure or dryness prior to the placement of the succeeding coat. Coating shall be considered sufficiently dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities such as lifting, wrinkling, or loss of adhesion of the undercoat. Where an overcoat will not properly adhere to an overly cured undercoat, it shall be applied within the time period recommended by the manufacturer.
- B. The curing times for the coatings shall conform to the coating manufacturer's recommendations considering ambient temperature and relative humidity.

### **3.06 FIELD QUALITY CONTROL**

- A. Thickness - The Contractor shall furnish the Engineer a suitable thickness detector of a type recommended by the coating manufacturer. Dry film measurements shall be taken in accordance with SSPC-PA 2.
- B. Intermediate Coats shall be the approximate shade of final coat; however, each coat shall be of a slightly different tint. Each coat shall be inspected and approved before the next coat may be applied; otherwise, credit will not be given, and the Work shall be re-coated.

### **3.07 PATCHING AND REPAIRS**

- A. All defective coatings shall be removed or repaired as the Engineer may direct. Surfaces with defective shop primer shall be repaired per the manufacturer's recommendations of the system in the Coating Schedule.
- B. Before final approval of the Work all damaged coating surfaces (field or factory applied) shall be cleaned and repainted or touched up as directed.

### **3.08 CLEANING**

- A. Remove coating and splatter inadvertently placed on items not scheduled to be coated. Remove splatter by washing or scraping, taking care not to scratch or otherwise damage finished surfaces.
- B. Remove and dispose of discarded coating materials, rubbish containers, rags, and other debris at the end of each workday.

### **3.09 MARRED EXISTING FINISHES**

- A. Existing buildings, pipelines, plumbing, etc., marred during construction by the Contractor shall be repainted to match the existing coating. Repainting shall be carried far enough to match the newly painted area with the existing coating.

- B. Surface preparation, primer, and finish coats shall be in accordance with manufacturer.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 PAINTING OF EQUIPMENT AND STRUCTURES**

- A. Surface preparation shall be in accordance with the manufacturer's recommendations of the system in the Coatings Schedule.
- B. The scope of the coatings work includes:
  - 1. Control Building – All areas of concrete floor, equipment pads, curbs.

##### **4.02 COLORS**

- A. The colors used shall be selected by the Owner, from the manufacturer's standard colors.

##### **4.03 INSPECTION EQUIPMENT**

- A. The Contractor shall furnish the following testing equipment:
  - 1. SSPC Surface Preparation Specifications, SSPC Publication 91-08:
    - a. Quantity: 1 copy.
  - 2. SSPC Visual Standard for Abrasive Blast Cleaned Steel Surfaces, SSPC VIS 1-89:
    - a. Quantity: 1 each.
  - 3. Dry Film Thickness Gauges:
    - a. Positector 6000 Series, Model F2; Range 0 to 60 mils.
    - b. Quantity: 1 required.

END OF SECTION

**SECTION 11050  
COMMON EQUIPMENT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The Section includes the general requirements for all equipment installed under this Contract.
- B. Equipment items shall meet the requirements specified herein, plus the specific requirements noted in the technical sections.
- C. The specific requirements included under a particular section shall take precedence.
- D. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Specific equipment submittals are specified in the related sections.
    - b. Equipment shop drawings shall include outline and dimension drawings of the actual equipment being furnished.
    - c. With the shop drawings, the complete motor nameplate data shall be furnished as well as all information requested below which may not be on the motor nameplate:
      - 1) Manufacturer.
      - 2) Rated Horsepower.
      - 3) Operating Speed Range\*.
      - 4) Operating Voltage(s).
      - 5) Current Draws at Operating Voltage(s)\*.
      - 6) Operating Frequency (Hz).
      - 7) Service Factor.
      - 8) Type Enclosure.
      - 9) Frame Size.
      - 10) NEMA Design Designation.
      - 11) Locked Rotor Code Letter.
      - 12) Duty Rating.
      - 13) Minimum Full Load Efficiency.

- 14) Nominal Efficiency\*.
- 15) Power Factor\*.
- 16) Maximum Size Capacitor Permitted to be Connected to Motor.
- 17) Insulation Class.
- 18) Location of motor terminal housing (F1 or F2).
- 19) Motor no load sound pressure level of dB(A) weighted at 3 feet from motor.
- 20) Motor Full Load Sound Pressure Level of dB(A) - weighted at 3 feet from motor.
- 21) Bearing Ratings.
- 22) Full Load Torque.
- 23) Break Down Torque.
- 24) Locked Rotor Torque.

\* Provide data at following loads: Service factor (if greater than 1.0) times full load (i.e., 1.15 x full load), 100%, 75%, 50%, 25%, and no load.

- d. Minimum full load efficiency shall be tested in accordance with IEEE Standards 112 Test Method B as described in Section 6.4 of IEEE Standard 112. Polyphase motors larger than 125 horsepower shall be listed in accordance with IEEE Standard 112 with stray-load loss determined by direct or indirect measurements.

2. Information for the Record:

- a. Operation and maintenance manual.

### 1.03 QUALITY ASSURANCE

- A. Manufacturer's name, make, model number and other designations provided in the contract documents are to establish the significant characteristics, including but not limited to, type, function, dimensions and physical properties, performance, and appearance for the purpose of evaluating comparable products. Contractor shall verify product, equipment or system proposed meets or exceeds the requirements as specified or shown on the drawings.

### 1.04 ELECTRICAL AND CONTROL COORDINATION

- A. If the current requirement of any motor or piece of equipment is increased to such an extent that the wiring, conduit, and/or starter for that motor or equipment must be increased from that shown on the Electrical Drawings, the Contractor shall furnish and install the larger items. The increased wiring, conduit, and/or starter cost shall be included under the Contract and no additional compensation will be allowed.

- B. All electrical, instrumentation, and control equipment and panels furnished under this Contract shall conform to appropriate Sections of Division 16 of these Specifications. Equipment and panels shall be NEMA 4X, unless otherwise shown on the Drawings or Specifications.
- C. Certain equipment items shall be connected to the plant control system as shown on the Control (P&ID) Drawings. Those connections and any remote control connections shall be wired to clearly labeled terminal strips within the equipment control panel.
- D. Analog signals for input to a programmable controller system or other device shall be 4-20 mADC and where required, current to current transducers or other device shall be furnished to produce an isolated signal to the programmable controller analog input module.
- E. Digital input signal sources shall provide an isolated contact rated at 5-amp minimum, 115 VAC for AC programmable controller inputs or devices and 1 amp minimum 28 VDC for DC rated inputs or devices.

#### 1.05 PRODUCT HANDLING

- A. Unless otherwise specified in the individual sections, the Contractor shall deliver, handle, store, and maintain materials and equipment in accordance with the requirements of the manufacturer.
- B. Materials, equipment, and articles to be incorporated into the Work shall be stored so as to facilitate inspection and inventory and, in such manner, as to ensure the preservation of their quality and fitness for the Work. Stocked materials shall be subject to test and shall meet the requirements of the Specifications at the time of substantial completion of the Work.
- C. Where construction is in roads or streets, that portion of the right-of-way not required for public travel may be used for temporary storage purposes unless otherwise prohibited. Materials shall not be stored in areas where such storage creates a hazard. Any other additional space required for construction or storage of materials and equipment shall be obtained by the Contractor at his expense.
- D. The Contractor shall confine his equipment, the storage of materials and equipment, and the operations of his workers to areas permitted by law, ordinances, permits, and the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.
- E. Switchgear, motor control centers, panelboards, instrument control panels, fixtures, and like equipment shall be received and stored in a dry, clean, dust-free, heated area. If no such area is available at the time such equipment is received, such space shall be provided by the Contractor at no expense to the Owner. If equipment is stored in an area conducive to the formation of condensation, heaters shall be provided to prevent condensation. Once the equipment is installed in its final position, suitable protection shall be provided to prevent damage by falling material, dust, paint, dirt, and moisture.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. AC motor(s) shall conform to the latest applicable NEMA, IEEE, and ANSI standards.
- B. Motor installation shall not exceed 88 dB(A) weighted maximum level at 3 feet from the motor throughout the entire speed range and load range.
- C. Motor bearings shall be antifriction type, grease lubricated with a minimum L-10 rating of 17,500 hours for belted duty and 100,000 hours for direct coupled duty.
  - 1. Thrust bearings in vertical motors shall be adequate for the loading encountered.
  - 2. Belt-driven power systems with jackshafts, and couplings, to isolate the belt loadings from the motor bearings shall be regarded as direct coupled duty.
- D. Motor conduit boxes shall be sized with capacity to meet the requirements of the National Electrical Code. Motors shall be furnished in an "F1" terminal housing assembly (facing connection box, motor shaft extension is to the right) unless otherwise shown on Drawings or specified.
- E. Motor frames shall be cast iron construction with corrosion resistant hardware.
- F. Each motor shall be continuous duty rated NEMA Design B with normal starting torque, unless otherwise shown or specified.
- G. Output torque and speed characteristics of each motor shall be suitable to operate the connected load over the full range of operating speeds and load conditions without exceeding the nameplate current rating or temperature rise on a continuous duty basis.
- H. Insulation shall be Class F or Class H.
- I. Each polyphase squirrel-cage induction motor shall meet or exceed minimum and nominal efficiencies listed in NEMA MG-1, Table 12-10.

### **2.02 AC MOTORS UNDER 1 HP**

- A. Unless otherwise shown or specified, each fractional motor under 1/2 hp shall be designed for single phase, 115 and 230 volt, 60 Hz service.
- B. Unless otherwise shown or specified, each fractional motor 1/2 through 3/4 hp shall be designed for 3 phase, 208, 230, and 460 volt, 60 Hz service.

### **2.03 INTEGRAL AC MOTORS**

- A. AC motor(s) 1 hp and larger shall have a 1.15 service factor at a 40 degrees C ambient temperature. Motor shall be capable of operating at the 1.15 service factor rating on a continuous basis per NEMA MG1-12.42 Item 1b.
- B. Motor enclosure types shall be as specified in the equipment specifications and shall be of one of the following designations.

1. Open drip-proof protected (ODP).
  2. Totally enclosed non-ventilated (TENV), or totally enclosed fan cooled (TEFC).
  3. Explosion proof Class 1, Division 1, Group D.
  4. Submersible water cooled.
- C. Multi-speed motors shall have the energy efficient design designated for the high-speed winding operation.

#### **2.04 SPECIAL APPLICATION MOTOR(S)**

- A. Special application motor(s) are defined as those used on such devices as appliances, tools, unit heaters, door operators, refrigeration units and sump pumps.
- B. Manufacturer's standard motor may be approved by the Engineer where a redesign of the unit would be required to furnish energy efficient motors.

#### **2.05 DEFINITE PURPOSE MOTORS**

- A. Equipment requiring a motor drive with unusual characteristics shall be equipped with a definite purpose motor to meet the necessary requirements.
1. Definite purpose motors are hermetic refrigeration compressors, jet pumps, shaft mounted fans and blowers, submersible deep well pumps, submersible mixers, elevator, crane, close coupled pumps, and torque motors.
  2. If available, an energy efficient design motor shall be furnished on this application.

#### **2.06 MOTORS ON VARIABLE FREQUENCY DRIVES**

- A. Motors for use with a Variable Frequency Drive (VFD) shall be TENV, TEFC, or submersible, water cooled.
1. Design to meet or exceed the efficiencies listed in NEMA MG-1, Table 12-10.
  2. Motor shall be "Inverter Duty Rated", and so stamped on the nameplate.
  3. Motor shall have an insulation system that meets or exceeds the requirements of NEMA MG-1, Part 31.40.4.2, and is rated at 1600 volts peak to ensure that the motor is rated for operation with non-sinusoidal waveforms at 1.0 service factor.
  4. Bearings in motors greater than NEMA Frame size of 300 and controlled by variable frequency drives must be guaranteed against premature bearing failure caused by discharge current. All such motors shall be provided with a shaft grounding device.
- B. AC motor used with a VFD shall have internal thermal protectors guaranteed by the motor manufacturer to protect the motors against overheating from stalled or slow turning due to lack of adequate cooling at low motor speeds.

1. Thermal protection devices shall be imbedded within the motor windings with normally closed contacts to be used in series with the coil of the motor's magnetic bypass starter and the stop circuit on the VFD.
2. Thermal protection devices shall all be provided and housed within the motor housing, unless otherwise specified.
- C. Explosion proof motors shall use thermal protectors required by UL as covered by 2.08, and meet the requirements of 2.06 preceding, and shall be rated and labeled for "Inverter Duty".
- D. Tachometer generators when required by the Specifications or the P&ID Drawings shall be DC generators of the enclosure required for the particular motor location.

#### **2.07 DIRECT CURRENT MOTORS ON VARIABLE SPEED DRIVES (VSD)**

- A. Each motor shall be equipped with internal thermal protectors as covered in 2.06. Permanent magnet field DC motors are not acceptable.
- B. Motors and tachometer generators shall be in totally enclosed non-ventilated or totally enclosed fan cooled enclosures except where required to be explosion proof motors.

#### **2.08 EXPLOSION PROOF MOTORS**

- A. AC motors for use in a Class I, Division 1, Group D location shall meet the requirements of paragraph 2.01 above.
- B. Explosion proof motors 3 hp and larger shall have a 1.15 service factor. Such motors shall be capable of operating at the 1.15 service factor rating on a continuous basis per NEMA MG1-12.42 Item 1b.
- C. Each motor shall be furnished with internal thermal protectors with normally closed contacts that will open should the safe operating motor temperature be exceeded per UL requirements. These contacts shall be placed in series with each other and with the coil of the magnetic motor starter, and/or the VFD enable circuit if used with a VFD, on all applications.

#### **2.09 MOTOR SPACE HEATERS**

- A. Space heaters as specified or shown on the Drawings shall be factory installed by the motor manufacturer.

#### **2.10 RESERVED**

#### **2.11 COUPLED DRIVES**

- A. Coupled drives shall have the service factor recommended by the coupling manufacturer.
- B. Coupled drives shall be submitted with engineering data supporting the horsepower rating of each coupling.



## **2.12 SAFETY GUARDS**

- A. Installed equipment shall be equipped with all guards, shields, and devices to meet OSHA requirements.
- B. Chain and belt guards shall be totally enclosed steel construction, 14-gauge minimum for guards up to 60-inch center distance and 12-gauge minimum for larger guards.
- C. Guards shall include expanded metal inspection panels. Removable access panels shall be provided to perform routine maintenance.

## **2.13 MANUFACTURER'S NAMEPLATE**

- A. Equipment shall be identified by permanently attached nameplate of corrosion-resistant metal. Plates shall bear the following information:
  - 1. Manufacturer's name.
  - 2. Serial and model numbers.
  - 3. Rated capacity.
  - 4. Temperature, pressure, or other limitations.

## **2.14 ANCHOR BOLTS**

- A. Equipment anchor bolts shall be as specified in Section 05500.

# **PART 3 EXECUTION**

## **3.01 INSTALLATION**

- A. Equipment shall be installed in accordance with the manufacturer's instructions and Contract Documents. Required anchors, grout, and leveling shims shall be provided by the Contractor.
- B. Alignment procedures and acceptable runout tolerances on couplings shall be submitted.

## **3.02 ROTATING EQUIPMENT ALIGNMENT**

- A. To aid in the field alignment of all equipment base plate mounted rotating equipment, push bolts (jacking bolts) shall be furnished and welded to the base plate.
- B. All rotating equipment shall be field checked for alignment after installation and initial operation. The equipment shall be at operating temperature. The minimum method of indicating alignment will be the "16-point" method. Other proposed methods must be submitted for approval to the Engineer.
- C. The alignment results are to be submitted for record. They are to include the final set of indicator readings and a plan view sketch of the motor and driven machine base, and the thickness of shims for each shimmed anchor bolt. The thickness of shims shall not exceed 0.25 inches.

**3.03 INITIAL LUBRICATION**

- A. Initial lubrication required for start-up, field test operation, and normal operation prior to substantial completion shall be furnished and applied in accordance with the manufacturer's recommendations.
- B. Where lubricating points are not easily accessible, provide extensions as required for easy access with normal grease gun.

**3.04 PACKING**

- A. Each shaft containing a packing gland shall be checked for condition by backing the packing gland off and examining for proper grade, amount, and type of packing as recommended by the manufacturer.

**3.05 MAINTENANCE**

- A. The Contractor shall perform and log all preventive maintenance tasks as recommended by the manufacturer while the equipment is in storage and after installation until the equipment has been accepted by the Owner.

**3.06 TROUBLESHOOTING**

- A. Should a problem occur before acceptance, the Contractor shall determine the cause and recommend corrective actions to the Engineer. The Contractor shall correct equipment and installation deficiencies.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 11735  
PUMPING EQUIPMENT**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing and installing of pumping equipment as shown on the Drawings, as scheduled in Part 4, and as specified herein.
- B. The pumping equipment shall be furnished with all accessories and other appurtenances as specified or required for a complete installation and satisfactory operation, whether or not supplied by the pump equipment supplier.
- C. All Work performed under this Section shall be in accordance with all approved trade practices and manufacturers' recommendations.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's warranty.
    - b. Manufacturer certification/affidavit.
    - c. Manufacturer's literature.
    - d. Manufacturer's certified test curves
    - e. Information and data concerning the materials of construction, salient components and details of construction of equipment and components.
    - f. Motor data in accordance with Section 11050.
  - 2. Information for the record.
    - a. Manufacturer's installation instructions.
    - b. Operation and maintenance manuals.
    - c. Manufacturer's certification of installation.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer Warranty and Service Packages:
  - 1. Warranty Submittals - At the time of shop drawing submittal, the Contractor shall submit a written warranty from the manufacturer(s) covering workmanship and materials on all pumps
  - 2. Warranty period shall be a prorated five-year term.
  - 3. The warranty period shall commence on the date of Substantial Completion.

4. Under terms of this warranty, the manufacturer shall furnish and install all replacement parts for any defective component at no cost to the Owner. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in the General Conditions of these Specifications.

## **PART 2 PRODUCTS**

### **2.01 PUMPS**

#### **A. General:**

1. Each pump shall be designed and furnished to meet the operating conditions specified in Part 4 of this Section. The type of pump for each service is given in the Schedule in Part 4.
2. Each pump shall be of the manufacturer and model listed in Part 4 or equal.
3. Each pump shall be shop tested in accordance with standards of the Hydraulic Institute. Certified test curves shall indicate discharge rate, head, efficiency, brake horsepower, and speed. No pump shall be shipped to the job site until the test curves have been reviewed by the Engineer.
4. The pumping units, motors and specified accessories included herein are to be provided by the Pump Supplier. The Contractor shall perform all installation and field wiring not included or provided by the Pump Supplier.

#### **B. Submersible Pumps**

1. Submersible centrifugal pumps shall be in accordance with the requirements described in the following paragraphs and in Part 4 of this Section.
2. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities.
3. The motor shall be explosion proof and conform with Section 11050 and the following.
  - a. Submersible pumps shall have inverter duty rated motors
  - b. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T.
  - c. Motor Requirements
    - 1) The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. It shall be permanently submersible according standard IEC 60034 and protection class IP 68.
    - 1) The stator shall be insulated according moisture resistant Class H rated for 356°F. The stator windings shall be insulated with

- monomer-free polyester resin resulting in a winding fill rate of at least 96%. The design shall be inverter duty rated in accordance with NEMA MG1, Part 31
- 2) The motor shall be fitted with tandem mechanical shaft seals with two seal sets each set with independent springs. The lower (primary) seal between the pump and seal chamber shall contain one each stationary and positively driven rotating corrosion and abrasion resistant tungsten carbide ring. The upper seal located between the seal chamber at the inspection chamber shall be a leak-free seal.
  - 3) The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C.
  - 4) Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.
  - 5) The motors shall have moisture sensors to detect moisture from a primary seal failure.
  - 6) The motors shall have thermal overloads imbedded in the motor windings to provide overheating protection.
  - 7) The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable.
- d. Each pump/motor unit shall be equipped with an integral, closed-loop motor cooling system. The motor cooling jacket shall encircle the stator housing and shall be of Type 304 stainless steel. The closed-loop motor cooling system shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air in dry-pit installation mode. A high efficiency impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the system. The cooling liquid shall pass about the stator housing in the closed loop system between the motor housing and close-fitting guide sleeve in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C) in accordance with NEMA standards. Operational restrictions that limit the ambient or pumped liquid temperatures at levels less than 40°C are not acceptable.

- e. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
- f. Stainless steel nameplates shall be attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, speed, and all pertinent data.
- g. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.
- 4. The impeller shall be of grey cast iron, Class 35B, dynamically balanced, multiple-vane, double shrouded non clogging design.
- 5. The Contractor may wish to reference the Engineer's Quote number 032-072021-JM1 obtained from Flygt's representative, John Miller, 614-561-1770, [John.Miller@buckeyepumps.com](mailto:John.Miller@buckeyepumps.com), Buckeye Pump, 1311 Freese Works Place, Galion, OH 44833.
- 6. **The Contractor should be aware that the pump manufacturer may not include all the required accessories as part of a standard bill of materials and will be required to provide those items not supplied by the pump manufacturer.**

## 2.02 ACCESSORIES

- A. Manufacturer Provided Accessories – The following accessories shall be provided by the pump manufacturer.
  - 1. 8-inch diameter base elbow
  - 2. Main Switch Board
    - a. Square D Standard Switchboard 2-QED-2.
    - b. Dimensions: (2) 36" (W) sections x 24" (D) x 92" (H).
    - c. Switch board shall be designed and rested in accordance with UL 891/NATIONAL ELECTRIC CODE/NEMA PB-2
    - d. System Voltage - 480Y/277V 3Ph 4W 60Hz
    - e. System Ampacity - 1600A
    - f. Source Description - Single Main Lugs only.
    - g. Bussing - Aluminum Plated w/Tin and Copper Plated w/Silver
    - h. Neutral Bus - 100%
    - i. Max Available Fault Current (RMS) - 65kA
    - j. Enclosure - Type 1
    - k. Accessibility: Front Only

- l. Exterior Paint Color - ANSI 49
  - m. Ground Lug provided for each device Aluminum Ground Bus
  - n. Power Trip Unit, Long Time, Short Time, Instantaneous, Ground Fault Energy Reduction Maintenance Switch Feeders
  - o. 3 - 1000AT 480V 80% Rated 65 kA 3 Pole UL, Group Mounted Basic Electronic Trip Circuit Breaker: Type PJ
  - p. Common Feeder Features: Device Designation: 1200 AMP.
  - q. Review the design plans for wiring and accessories.
- 3. Flygt MAS 801 monitoring system will be installed in the pilot panel including the following:
  - a. Pump Memory
  - b. The motor shall be protected by following sensors:
    - 1) 3 bi-metal Thermal switches for thermal control of the stator
    - 2) 1 PT 100 thermal sensor (RTD) to monitor the stator temperature of 1 Winding
    - 3) 1 PT 100 thermal sensor (RTD) to monitor the temperature of the main bearing
    - 4) 1 Vibration sensor to monitor vibration on 3 axes from 10 – 600 Hz.
    - 5) 1 float switch in leakage chamber to monitor leakage in the leakage chamber.
    - 6) 1 float switch in the terminal connection housing to monitor any leakage thru the cables and the cable entries.
  - c. Pump Control Panel
    - 1) NEMA 12 Steel Enclosure with back panel.
    - 2) 120V Incoming power.
    - 3) 2 kVA Control Power Transformer with Primary Fuses.
    - 4) 2 – 30mm Hand Off Auto Switches
    - 5) 2 – 30mm Start / Stop Pushbuttons
    - 6) 2 – 30mm Push-To-Test Run Pilot Lights
    - 7) 1 – 30mm Push-To-Test Pilot Lights
    - 8) 2 – Elapsed Time Meters
    - 9) 2 – 30mm Push-To-Test Drive Fault Pilot Lights
    - 10) Flygt Duplex Pump Control Panel with MultiSmart Pump Station Manager (with spare for a third pump).

- 11) Specified Variable Frequency Drives.
  - 12) Installation and wiring outside of the panel will be performed by the Contractor.
4. Level Sensors
  - a. Primary Level Sensor
    - 1) MJK Expert 2100 Level Transmitter or approved equal pressure transducer. The measurement range shall be 0 to 100-feet corresponding to MJK Order No. 209926.
    - 2) Drawing Designation is LS-1.
  - b. Backup Level Sensor
    - 1) Flygt Level Probe – Multitrode. The Multitrode shall be 368-inches in length with 10 sensors.
    - 2) Drawing Designation is LS-2.
  - c. Cable lengths for level sensors shall be confirmed by the Contractor based upon planned in field routing.
5. Guide Rail System including cast iron base elbow, stainless steel guide rail brackets, stainless steel intermediate brackets and stainless-steel lifting cables. The base elbow and shall support the pump when the pump is in operational position. The pump shall be easily removed from its chamber to ground level for inspection or service without requiring dewatering of the chamber. This shall be accomplished by utilizing a sliding guide bracket attached to the pump, two guide bars adequately braced and spaced per the plans, a stainless-steel chain reaching ground level, and a specially formed discharge flange that will automatically and firmly connect and disconnect with the discharge pipe without bolts, nuts, fasteners, or extreme force. Pumps utilizing Flygt's Deep Lift Apparatus need not require a stainless-steel chain.
6. Deep Lifting Apparatus
  - a. The pump supplier shall provide pump installation and retrieval systems designed to operate with each pump units supplied.
  - b. The pump supplier shall have complete responsibility for the function of the pump retrieval system and shall provide a functional guarantee for the system.
  - c. The Deep Lift system shall be fabricated from ASTM-A36 steel and have a rating of no less than 13,500-pound capacity.
  - d. The unit shall be coated with a one-part epoxy paint system in the same color as the pump.
  - e. The Deep Lift system shall provide a simple method to facilitate the installation and retrieval of electric submersible pumps from the wet well regardless of station depth.



- f. The Deep Lift pump lifting device shall utilize the existing station hoist and hook. No accessory lifting chain or cable shall be required.
  - g. The unit shall have an integral set of guide rollers to facilitate vertical linear movement in the wet well along the pump guide bars. Upon meeting the pump lifting bail, the device shall automatically and securely engage the lifting bail. There shall be no possibility of release of the pump unit from the lifting device once engaged to the bail.
  - h. After the pump unit is placed upon the service floor, a manual release of the lifting pin shall be required to disengage the lifting device. When installing a pump unit, once the lifting pin is seated against the invert of the lifting bail, a counterweight shall be affixed to the lifting pin to facilitate its automatic release when the pump unit has properly seated upon the discharge connection within the station wet well.
  - i. Lifting devices that make use of springs to assist latching are not allowed. There shall be no need for station personnel to enter the wet well to install or retrieve pump units.
  - j. One deep lift apparatus shall be supplied for each pump.
- B. Special Tools - Each set of pumps shall be provided with one set of special tools required for complete service and maintenance.

## **2.03 VARIABLE SPEED DRIVES AND CONTROLS**

- A. Variable Frequency Drive:
  - 1. Variable frequency drives shall include a combination fused-disconnect starter, controller, controller enclosure, and motor.
  - 2. The controller and motor shall be standard products, furnished by the pump manufacturer as matched components, by a single manufacturer.
  - 3. The controller input and output current shall be three-phase, 460 volts, ungrounded, and 60 Hz. All drive components shall be sized to operate the pump at any point on the family of speed curves from 25% to 100% of the pump base speed without exceeding the nameplate rating of the motor and controller, and without requiring external cooling.
  - 4. In addition to the standard controller features, the following accessories (mounted and wired) shall be provided:
    - a. Plug-in tester card for use during start-up and for simplified trouble shooting. The tester card shall allow monitoring the different signals within the controller.
    - b. A through-the-door incoming line circuit breaker.
    - c. An output contactor.
    - d. A process controller interface to allow remote speed control from a process controller.

- e. Operator control devices:
    - 1) Start-stop push-buttons.
    - 2) Speed adjustment.
    - 3) LOCAL-REMOTE selector switch for selection of speed control. In the remote position, provide a separate contact block for a signal to the Plant Control System.
    - 4) Pilot light push to test type (running).
  - f. Auxiliary contacts to provide signals to a remote panel of the following occurrences:
    - 1) Fault condition (IET trip).
    - 2) Motor running.
    - 3) Motor stopped.
    - 4) Out of service (auxiliary contact on circuit breaker).
    - 5) Speed control selector switch in remote position.
  - g. Voltage to current transducer to provide an isolated 4-20 mA speed signal for remote monitoring.
  - h. Control transformer of sufficient capacity to operate all furnished accessories plus an additional capacity of 100 VA for external use.
  - i. All connections for the remote panel shall be wired to terminal blocks with positive identification of the function.
- 5. The controller and all accessories shall be mounted in a floor standing NEMA 12 enclosure.
  - 6. It is intended to control the speed of the motors remotely. The converter signal circuits shall be isolated from the power circuits and designed to accept a speed signal from the future process controller. The signal shall control the motor speed between adjustable minimum and maximum speed settings. Maximum speed shall be field adjustable to 100% of rated speed. A motorized reversible potentiometer (or equivalent) with adjustable speed control shall be provided to accept separate increase and decrease speed control signals from the process controller. All equipment and devices necessary to interface the variable speed control with the process controller shall be furnished and installed. A 4-20 mA signal, proportional to speed, shall also be provided.
  - 7. Variable Frequency drives shall be PowerFlex 755 with NEMA 12 MCC Style HMI rated for normal duty manufactured by Allen-Bradley. No alternative manufacturers will be accepted.
  - 8. Cabinet dimensions (for one drive) shall be approximately 87-inches (H) x 36-inches (W) x 24-inches (D). A separate cabinet shall be provided for each variable frequency drive.

B. VFD Schedule

VFD Name	Location	NEMA Rating	Approx. Size (HxWxD)	Notes
VFD-1	Control Building	See Section 11735	See Section 11735	*By Pump Supplier
VFD-2	Control Building	See Section 11735	See Section 11735	*By Pump Supplier

**2.04 RESERVED**

**2.05 SHOP PAINTING**

- A. Shop painting shall be in accordance with the requirements of Section 01350.

**PART 3 EXECUTION**

**3.01 ERECTION AND INSTALLATION**

- A. The equipment shall be erected and installation in accordance with the manufacturer's recommendations. Required grout and leveling shims shall be provided by the Contractor.

**3.02 INITIAL LUBRICATION**

- A. Initial lubrication required for start-up and field test operation shall be furnished and applied in accordance with the manufacturer's recommendations.

**3.03 INSPECTION, START-UP, AND TESTING**

- A. The Contractor shall furnish a qualified representative of the manufacturer to perform inspection, start-up, and training services. The manufacturer's representative shall be experienced in the installation, start-up, operation, and maintenance of the equipment.
- B. The representative shall check the installation and supervise final adjustments and initial start-up of the equipment. The representative shall certify that the installation is correct and that the equipment is operating satisfactorily.
- C. Within two weeks of start-up, the manufacturer shall submit to the Engineer a written report (minimum 4 copies) covering the representative's inspection and start-up of the equipment. This report shall include the manufacturer's certification that the installation is correct and that the equipment is operating satisfactorily.

- D. After the installation and operation of the equipment has been certified, the manufacturer's representative shall train the Owner's personnel for one, eight-hour day in the proper operation and maintenance of the equipment. The Owner may videotape the training.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 PUMP SCHEDULE**

- A. The following tables provide the operating conditions, type of pump, manufacturer name and model number, along with salient features specific to each manufacturer. The pumps listed are selected for the specified service and acceptable to the owner.
- B. The listed pumps, for the specified service, are intended to match the Owner's parts inventory. No equals will be permitted.

Description	Manufacturer 1
Quantity	2
Type	Submersible
Model No.	Flygt CP3240.866
Solids Diameter Passing	3-inch
Stator or Impeller Type	Enclosed
Impeller Trim	485 mm
Seal Type	Mechanical
Lubrication	None
Motor HP	455 HP
Pump RPM	1790 rpm
Inverter Duty (VFD)	VFD
Voltage	460
Phase	3
Minimum Pump Efficiency (at design point)	75.5%
Design Point (gpm/ft TDH)	5000gpm/250 ft at 60 Hz
Approximate Points (gpm/ft TDH) (on pump curve)	4000 gpm/180 ft at 50 Hz
Certified Test Curve (Yes/No)	Yes

##### **4.02 SPARE AND MAINTENANCE PARTS**

- A. No spare parts are required.

##### **4.03 PUMP OPERATING SCHEME**

- A. The pumps shall be initially programmed to function according to the following:
1. Pumps shall be programmed to operate in a conventional alternating lead / lag arrangement

2. The Lead Pump shall ramp up to 55 Hz over 30 seconds to delivering roughly 4500 gpm.
  3. The Lead Pump shall run at 55 Hz until the Pump Off Level is reached.
  4. The Lead Pump shall ramp down over a 30 second period.
- B. The Operational scheme provided above is for initial setup and the Owner may modify the programming once the pump station is in operation.

END OF SECTION



**SECTION 14320**  
**MONORAIL HOISTS AND SCALE**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing and installation of hoisting equipment, track systems, scale and associated equipment.
- B. All installations shall be complete and comply with manufacturer's erection details and applicable regulations.
- C. Additional product requirements are specified in Section 01350.

**1.02 QUALITY CONTROL**

- A. Suppliers of hoists and monorails shall be nationally recognized manufacturers specializing in these products.
- B. Design loads and fabrication of all structural members shall be in accordance with the latest recommendations of the Monorail Manufacturers Association (MMA).

**1.03 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
  - 2. Operation and maintenance manual.

**PART 2 PRODUCTS**

**2.01 RUNWAY AND MONORAIL TRACK SYSTEMS**

- A. Tracks may be a standard structural shape or a specially rolled or fabricated section. It shall be considered as a simply supported beam for determining its load carrying capacity.
- B. Suspension fittings such as hanger rods, clamps, and other necessary track fittings shall be furnished with the track.
- C. Allowable stresses, deflection, and hardness shall be limited in accordance with the Monorail Manufacturers Association Specifications 1973 - Section 2.

## **2.02 CARRIERS OR TROLLEYS**

- A. Carrier yokes shall be of the swiveling type. Wheels shall be drop forged or rolled steel with heat treated treads and flanges or cast iron with chilled tread and shall have a minimum tread hardness of 425 Brinell.
- B. Wheel bearings shall be single or double row, combination radial and thrust, anti-friction precision type. Bearings shall be pre-lubricated and sealed or provided with fittings and seals for pressure lubrication.
- C. Bearings shall be selected to provide a minimum B-10 life of 5,000 hours.
- D. Motor propelled carriers shall be driven by a driving head mounted on the load bar of the load carrying member with traction dependent on the wheel load of the driving heads.
- E. All gearing shall be made from material of adequate strength or durability to meet the requirements for the intended service class. All gearing except the final reduction at wheels shall run in oil or be splash lubricated.
- F. Stops shall be provided at the ends of the carrier travel. Stops shall be provided to resist impact forces of a fully loaded carrier traveling at a normal walking speed of 150 fpm or at 505% of the rated full load speed, if the carrier is motor driven.

## **2.03 BRAKES**

- A. Hoisting brakes shall be in accordance with Hoist Manufacturers Institute Specifications Section 100-4.9 and ANSI B30.16 Safety Code for Overhead Hoists.

## **2.04 ELECTRICAL EQUIPMENT**

- A. Wiring and equipment shall comply with the provisions of Article 610, ANSI C1 National Electric Code, current edition.
- B. Power for motors shall be as stated in Part 4.
- C. Power for control circuits shall not exceed 120 volts, single phase, 60 Hz.
- D. Unless otherwise specified, all functions on floor operated equipment shall be from a common pendant pushbutton station. The pushbutton station shall be suspended approximately 4-feet above the operating floor in a manner that will protect the electrical conductors against strain.
- E. Motors shall be rated on not less than a 30-minute basis with temperature rise in accordance with the latest NEMA standards for the class of insulation and enclosure used, unless otherwise specified.
- F. Motors shall be of the type suitable for hoist service and shall be provided with anti-friction bearings.
- G. Control systems shall be magnetic. Hoist and carrier controls shall be plain reversing unless otherwise specified. All reversing contactors shall be mechanically and electrically



interlocked. Unless otherwise specified, controls shall be mounted in NEMA Type 1 general purpose enclosures.

- H. Magnetic control shall have contactors of sufficient size for hoist duty consistent with the horsepower and voltage of the motor or motors with which they are used.

## **2.05 ELECTRIFICATION**

- A. Festooned System
  - 1. Power to the hoist and carrier shall be through an enclosed safety type festooned flexible cable tagline system sized for the power requirements of the monorail hoist and carrier.
- B. Reel System
  - 1. Power to the hoist and carrier shall be through a flexible cable arranged in loops and supported by ball bearing carriers in an enclosed track which is mounted on the monorail track beam.
  - 2. Cable shall be sized for the power requirements and of the length necessary for the intended use.

## **2.06 HOISTS**

- A. All hoists are specified in Part 4.

## **PART 3 EXECUTION**

### **3.01 ERECTION**

- A. The hoisting equipment and controls shall be erected in accordance with the manufacturer's recommendations.

### **3.02 INITIAL LUBRICATION**

- A. Initial lubrication required for start-up and field test operation shall be furnished and applied in accordance with the manufacturer's recommendations.

### **3.03 INSPECTION, START-UP, AND TESTING**

- A. After installation is completed, all equipment shall be tested in accordance with the provisions of the ANSI Safety Standards for Hoists.
- B. Scale shall be inspected and certified for service by a factory representative.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 MONORAIL SCHEDULE**

1. Wet Well
  - a. (1) 4 Ton Monorail with Single Speed Power Driven Trolley, Motorized Hoist at 12 fpm;. Lift shall be 67 ft – Bottom of Monorail El. 647.00-feet, Wet Well Floor El. 580.00-feet.
  - b. CMAA Class C Duty Class Minimum.
  - c. Power to crane shall be from Cable Reel. Provide Pendent Pushbutton Control Station.
  - d. Overall monorail headroom shall not exceed 21”.
  - e. Power shall be 208V 3 phase. Hoist and electrical components shall be rated for exterior use. Hoist shall have minimum NEMA 3R enclosure, unless noted otherwise.
  - f. An upper limit switch or other limit device shall be furnished on the electric hoist. It shall be designed to stop the hoist motor and apply the holding brake when the hook reaches its upper limit of travel.
  - g. Provide chain basket to support extra chain.
  - h. Cable length shall be of sufficient length to cover entire lift.

END OF SECTION

**SECTION 15010**  
**GENERAL MECHANICAL PROVISIONS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing mechanical accessories and requirements necessary for the completion of the Work whether or not specifically shown or specified.
- B. Items include, but are not limited to:
  - 1. Piping Hangers and Supports.
  - 2. Insulation Fire Retardant Requirement.
  - 3. Accessibility and Access Panels.
  - 4. Power Actuated Anchors.
  - 5. Rotating Equipment Alignment.
- C. Additional requirements are specified in Sections 01350 and 11050.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Descriptive information on all mechanical items.
    - b. Drawings locating anchors, inserts, and supports for piping, including vendor data for each component.
  - 2. Information for the Record:
    - a. Alignment procedures and acceptable runout tolerances for each piece of connected equipment.
    - b. Shaft and bore sizes and tolerances for couplings and instructions for coupling installation.
    - c. A report of coupling alignment readings for each coupling and driven machine combination, and sizes of all anchor bolt or equipment base shims.

## PART 2 PRODUCTS

### 2.01 PIPING HANGERS AND SUPPORTS

- A. The manufacturer's names and catalog numbers shown in the following paragraphs have been used as a guide to type, style, and materials of construction only. Anvill, Unistrut, or equal.
- B. Contractor shall furnish and install all pipe supports, hangers, harnessing, expansion joints, expansion loops, and inserts required to support the piping and valves. Supports shall be designed and spaced to secure pipe in place without sag or undue stress on any pipe, fitting, equipment, or valve. Piping that is close to the floor may be supported on concrete piers. Piping near walls may be supported by wall brackets. Piping at equipment and valves, etc., shall be supported so that the equipment and valves can be removed without additional pipe supports. Piping shall not introduce any strains or distortion to connected equipment. Overhead lines shall be installed directly on supports, or suspended by hangers or hanger rods. Where piping is supported from the ceiling, inserts shall be poured in the concrete slab flush with the bottom of the slab. Adequate lateral support shall be provided to prevent noticeable lateral movement of the piping either during operation, or from a lateral load of 300 pounds applied at any point. All hanger design, anchoring, support, etc. shall be the responsibility of the Contractor. Design loads shall not exceed the manufacturer's recommended loads.
- C. Types of Supports:
  - 1. All horizontal piping 4-inch and larger with inverts 2-feet or less from a finished floor shall be supported by concrete saddle supports, unless otherwise specified in Part 4 of this Section.
  - 2. Beam clamps shall be used where piping is supported from steel structure of building. Clamps shall be selected on basis of load to be supported. Beam clamps shall be malleable iron with bolt, nut, and pocket threaded for rod connection as required to fit beams. C-clamp type shall only be hung from truss panel points unless otherwise approved by the Engineer.
  - 3. In precast slab areas supports shall be hung from tabs. Tabs shall not be overloaded. Contractor shall not drill into precast slabs unless approved by the Engineer.
  - 4. Cast-in inserts shall be used for suspending hangers from concrete. For heavier loads, insert shall be ceiling type, individual inserts; Anvill CB - Universal concrete inserts, Figure 282, or equal. For lighter loads, inserts shall be Unistrut P-3200 series, or equal. The preformed channel members shall be 1-5/8-inch by 1-3/8-inch with a 12-gauge (.105 inch) material thickness. Anchors shall be at 4-inch on center maximum, and extend into concrete a minimum of 2-3/4-inch. End caps and/or end cap anchors shall be provided to prevent concrete seepage into channels. All channels shall have a pre-galvanized finish, and all accessories shall be electro-galvanized. Insert shall not be overloaded.

5. Vertical piping shall be supported at base by hanger placed in horizontal line near riser, or by base fitting set on pedestal or foundation. Risers shall be laterally supported at intermediate points with riser clamps with two-point bearing as required to make rigid. Riser clamps shall be wrought steel, with extension lugs, bolt, and nuts; Anvill Figure 261, or equal. Offset pipe clamps, Anvill Figure 103, or equal, may also be used. Use only in unfinished areas where approved by the Engineer. Anvill Figure CT-121, or equal, shall be used for copper pipe.
6. Unless otherwise noted, hangers shall be as follows:
  - a. Uninsulated piping 2-inch and smaller, Anvill Figure 97, or equal malleable iron adjustable nut and steel band.
  - b. Uninsulated piping 2-inch and larger, Anvill Figure 260, or equal, galvanized steel adjustable clevis type.
  - c. Uninsulated copper tubing, Anvill Figure CT-69, or equal, carbon steel ring and knurled swivel iron adjusting nut completely copper plated.
  - d. Insulated piping, Anvill Figure 260, Elcen, or equal, clevis hangers. An insulation protection shield, Anvill Figure 167, or equal, shall be installed over the insulation in 180-degree segment, minimum 12-inch long. The shield shall be galvanized steel and shall vary in thickness from 18-gauge to 12-gauge, according to pipe size, as required to prevent crushing of the insulation. Anchors and guides shall be installed as required. Where roller supports are required due to expansion or contraction, Anvill Figure 171 roller hangers, Anvill Figure 175 roller chairs, Anvill Figure 271 pipe roll stands, or equal shall be used.
7. Trapeze Hangers and Brackets:
  - a. Where several pipes occur at the same elevation, trapeze type hangers or other equivalent types may be used.
  - b. For heavier loads, trapeze hangers shall be structural steel channels suspended from threaded rods. Channels shall be galvanized and sized for specific loads. For 12-inch piping and larger, short pieces of angle (1/4-inch minimum thickness) shall be welded to the channel such that pipe circumference will be supported at 3 points approximately 30 degrees apart. Fabricated saddles supporting a 60-degree minimum segment of the pipe may also be used. Standard black carbon steel "U"-bolts, Anvill Figure 137, or equal, shall be used to secure piping up to 36-inch diameter to structural channels. For lighter loads, trapeze hangers shall be preformed channels. Channel members shall be 1-5/8-inch by 1-5/8-inch with a 12-gauge (.105) material thickness. They shall be Unistrut Series P-1000, or equal, with a pre-galvanized finish. All fittings, spring nuts, nuts, and bolts shall be electrogalvanized. Steel threaded rod hangers shall be galvanized.

- c. Brackets shall be Anvill Figure 195, or equal, as required for weight of pipe. Brackets for use with preformed Unistrut or equal channels shall be fabricated from 12-gauge material, compatible with the 1-5/8-inch square channel members. Unistrut or equal brackets shall be galvanized. All fabricated steel brackets used to support piping in or above tanks, channels, and flumes shall be hot dip galvanized after fabrication and all fasteners shall be galvanized.
- d. The following general rules shall be followed for attachments:
  - 1) Uninsulated steel piping, use Unistrut Series P-1109 through P-1126, or equal clamps.
  - 2) For copper tubing, use Unistrut Series P-2024CC through P-2070CC clamps, or equal.
  - 3) Insulated piping 2-inch and smaller, use Anvill Figure 167, 18-gauge galvanized steel shield over the insulation, in 180-degree segments minimum 12-inch long with Anvill Figure 271, or equal, clamps.
  - 4) Insulated piping 2-1/2-inch and larger, use a protection saddle, Anvill Figure 160 through 166, or equal, with Anvill Figure 271, or equal, roller supports.
- 8. In tunnels, pipe galleries, and where piping is racked on multiple hangers, supported with the use of prefabricated structural support channels, the piping attachments shall be as specified for Trapeze Hangers.
- D. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contraction movement to occur at expansion joints, loops or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchors shall be suitable for the location of installation and shall be designed to withstand not less than five times the anchor load. Vertical pipes shall be anchored by means of clamps welded around pipes and secured to wall or floor construction. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellow type expansion joints may be located adjacent to the joint.
  - 1. Pipe guides shall be provided adjacent to bellows type expansion joints. Guides shall be placed on both sides of expansion joints except where anchors are adjacent to the joint. Unless otherwise indicated on the drawings, one guide shall be within four pipe diameters from the joining and a second guide within 14 pipe diameters from the first guide. Pipe supports shall allow adequate movement; pipe guides shall not be used for support. Guide and spider shall be of sufficient size to clear pipe insulation and long enough to prevent overtravel of spider and cylinder. Pipe guides shall be Anvill Figure 255, or equal, and shall be installed as recommended by the manufacturer.

2. Unless closer spacing is indicated on the drawings, the maximum spacing for pipe supports and expansion joints shall be:

Type of Pipe	Pipe Support Max. Spacing, ft	Max Run Without Expansion Joint, Loop, or Bend, Ft	Expansion Joint Max. Spacing, ft	Type of Expansion Joints
Cast Iron/Ductile Iron	10 (Note 4)	80	80	Mechanical Couplings
Steel for hot water heating				
1-1/4-inch and smaller	7	30	100	Note 1
1-1/2- to 4-inch	10	30	100	Note 1
Over 4-inch	15	30	100	Note 1
Steel for other services				
1-1/4-inch and smaller	7	30	100	Note 1
1-1/2- to 4-inch	10	30	100	Note 1
Over 4-inch	15	80	80	Mechanical Couplings
Copper for hot water				
1-inch and smaller	5	20	100	Note 1
Over 1-inch	7	20	100	Note 1
Copper for other services				
1-inch and smaller	5	--	--	None required
Over 1-inch	7	50	100	Note 1
PVC				
1/8- to 1-inch	Continuous Support (Note 2)	20	60	Note 1
1-1/4- to 2-inch	4	20	60	Note 1
Over 2-inch	6	20	60	Note 1
Fiberglass reinforced plastic				
3-inch and smaller	6	60	100	Note 1
Over 3-inch	8	40	100	Note 1
Acid Waste				
Tempered glass	8 (Note 3)	--	--	None required
High silicon iron	15 (Note 4)	--	--	None required
Cast iron soil	10 (Note 4)	--	--	None required

Notes:

- Expansion joint fittings as specified in the applicable miscellaneous piping section.
- Hanger and bracket spacing may be increased where PVC pipe is provided continuous support.
- At least two properly padded supports for each pipe section.
- At least one support for each pipe section unless shown otherwise on the plans.
- Pipe expansion joints shall be installed within 5-feet of all structural isolation or expansion joints. Expansion joints shall be as specified in the appropriate section of this Contract, and submitted for approval.

- E. Expansion Loops - Where fabricated expansion loops are shown on the drawings or deemed by the Contractor to control the system, expansion loops shall be designed by the Contractor and submitted for approval.
- F. Use correct size hanger to allow for increased diameters of line caused by pipe covering. The Contractor will not be allowed to cut or reduce specified covering to allow application of hangers, unless otherwise specified.
- G. Galvanic Protection - A dielectric material shall be placed between pipe and supports when dissimilar metals are used. A flexible elastomer material, Unistrut unicushion P-2600, or equal, may be used. A thermoplastic elastomer cushion, the Unistrut Cush-A-Clamp or equal, may also be used. In general, if galvanized supports are used, all accessories shall be galvanized. If carbon steel supports are used, all accessories shall be carbon steel.
- H. Support mechanical coupling pipe at each joint.
- I. Other means of pipe supports not be used unless approved by the Engineer.
- J. Pipe supports shown on the Drawings shall be provided and do not relieve the Contractor of any of the requirements in this Section.

## **2.02 FIRE RETARDANT INSULATIONS**

- A. All insulation material (insulation, jackets, adhesives, cements, mastics, sealers, coatings, and finishes) shall have composite Fire and Smoke Hazard ratings as tested under ASTM E84, NFPA 255, and UL 723, not exceeding as follows: (unless noted otherwise in UBC)  

Flame Spread	25	Smoke Developed	50
--------------	----	-----------------	----
- B. All surfaces shall be clean, dry, and free of oil and grease before insulation, adhesives, or mastics are applied.
- C. All joints shall be tight with insulation lengths and segments tightly butted against each other. Where lengths or segments are cut, cuts must be smooth and square. All insulation shall be continuous through wall and ceiling openings. Insulation shall be continuous through pipe hangers. At pipe hangers, use rigid pipe covering finished the same as the adjacent pipe covering.
- D. Where vapor barrier jackets are used on cold surfaces, insulation must be applied with vapor seal integrity maintained throughout the entire system.
- E. All pipe insulation shall be pre-molded, and be split ready for application.

## **PART 3 EXECUTION**

### **3.01 ACCESSIBILITY AND ACCESS PANELS**

- A. Install work to be readily accessible for operation, maintenance, and repair. Minor deviations from Drawings may be made; however, major changes shall not be made without approval of the Engineer.



- B. Where valves, traps, or other specialties are concealed in the construction or behind a wall or ceiling surface, the Contractor shall furnish and install an access panel of adequate size to permit adjustment or service of concealed device. Panels shall be of a design suitable for installation in the material forming the finished surface in which each is mounted. Provide access doors in ductwork and equipment housing and wherever required for access to internals. Minimum door size shall be 24-inch by 24-inch unless duct is less than 24-inch wide, then door size to be same as duct width.
- C. Wherever practical, the Contractor shall group valves, traps, dampers, etc., in such a way as to be accessible from a single panel and eliminate as many access panels as possible.
- D. Ceiling access shall be required in gypsum wallboard, plaster, and other ceilings, etc., and in all locations as required to gain access or service mechanical components. Frames shall be constructed of 16-gauge steel. Panels shall be of the material used in the ceiling construction in which they are installed.
- E. Access doors in insulated walls, floors, or ceilings shall be insulated equally to their surroundings.

### **3.02 POWER ACTUATED ANCHORS**

- A. Power actuated anchoring devices shall not be used at floors, columns, beams, precast concrete, where so using causes cracking, spalling, or other deformation to these members. In no case, will such anchors be used less than 4-inch from any corner nor change in direction of concrete surface to which anchor is attached.

### **3.03 ROTATING EQUIPMENT ALIGNMENT**

- A. To aid in the field alignment of all equipment base plate mounted rotating equipment, push bolts (jacking bolts) shall be furnished and welded to the base plate.
- B. All rotating equipment shall be field checked for alignment after installation and initial operation. The equipment shall be at operating temperature. The minimum method of indicating alignment will be the "16-point" method. Other proposed methods must be submitted for approval to the Engineer.
- C. The alignment results are to be submitted for record. They are to include the final set of indicator readings and a plan view sketch of the motor and driven machine base, and the thickness of shims for each shimmed anchor bolt. The thickness of shims shall not exceed 0.25 inches.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 SUPPORT MATERIAL SCHEDULE**

- A. Exterior – All exterior supports shall be 304 stainless steel.
- B. In Chamber or Exposed to Wastewater – All supports shall be 304 stainless steel.

END OF SECTION



**SECTION 15210**  
**PIPING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing and installing of all pipelines 4-inch diameter and larger shown on the Drawings or as required to complete the Work.
- B. Piping less than 4-inch diameter, will be included under other Sections unless otherwise specified.
- C. Material to be furnished and installed, but not limited to:
  - 1. All pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joint restraints, joints and jointing materials.
  - 2. Pipe supports other than those specified in Section 15010.
  - 3. Granular material for bedding and encasement of pipelines.
  - 4. Class B concrete as specified in Section 03300 for blocking and encasement of pipelines.
  - 5. Make connections to all existing and/or new facilities and provide temporary services.
  - 6. Install temporary plugs and/or stoppers and harnessing.
  - 7. Test and clean pipelines.
  - 8. Sterilize water mains.
- D. The Contractor shall make adequate field measurements before new piping is fabricated.
- E. All wall, floor, and roof penetrations and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.
- F. Instruments which are to be located in pipelines 4-inch in diameter and larger shall be furnished under Division 16 and installed under this Section.

**1.02 QUALITY CONTROL**

- A. Laboratory Services - Laboratory testing services shall be provided as specified under Section 01410 of the Specifications.
- B. Field Inspection:
  - 1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered installed shall be removed and replaced with a sound one in a

manner satisfactory to the Resident Project Representative at the Contractor's expense.

2. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.

C. Field Testing:

1. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.
2. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications.

- D. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

### 1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300 showing: layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, and any special provisions required for assembly.
- B. Shop drawings shall be drawn to not less than 1/4-inch scale and show the laying length and piece mark for each section of pipe and fitting.
- C. Drawings shall show the position and elevation of valves, pumps, and/or other equipment served by the various pipe systems.
- D. The concrete pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification. The certificate shall be signed by an authorized agent of the manufacturer.
- E. If directed by the Engineer, each certificate shall be accompanied by a report showing test results compared to specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.
- F. Before fabrication of any concrete pressure pipe, fittings, or specials, the Contractor shall furnish to the Engineer at least six copies of the design calculations for the pipe showing the calculations to arrive at the gross wrapping stress in wire; initial and resultant stresses in concrete, cylinder, and wire; internal pressure when compression in concrete is zero; compression strength of concrete at time of wrapping; and calculations to show stress, conditions, and the core and steel when the pipe is simultaneously

subjected to the design pressure and external loads. The Contractor shall also furnish the full details of all pipe, specials, and fittings, and a laying schedule showing dimensions, details, and specifications of all pieces.

- G. Submit a schedule of all proposed pipe escutcheons.
- H. Other submittals may appear in Part 4 of this Section.
- I. Any proposed grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series number.

## **PART 2 PRODUCTS**

### **2.01 PROCESS AND PRESSURE PIPE**

- A. Ductile Iron Pressure Pipe (DIP):
  - 1. Ductile Iron Pressure Pipe (DIP) shall conform to ANSI A21.51 or AWWA C151 and shall be pressure class 350 psi for sizes 12-inch and below, and pressure class 300 psi for larger sizes unless otherwise specified herein.
  - 2. Flanged fittings shall be ductile iron and conform to ANSI A21.15 or AWWA C115. All fittings shall have a pressure rating of 250 psi for all pipe sizes unless otherwise specified.
  - 3. Ductile Iron pipe inside buildings or structures shall be joined with flanged, or mechanical joints as shown on the Drawings, or as indicated in the pipe schedule. All mechanical joints shall have retainer glands. Flanges shall comply with ANSI 21.15 or AWWA C115 and shall be ANSI 125-pound drilling, unless otherwise specified. Flanged joints shall have full face 1/8-inch rubber gaskets or of thickness and type approved by the Engineer. The pipe shall not be threaded or flanged in the field. Flanges shall be firmly bolted with machine, stud, or tap bolts of the proper size and number. Within buildings the bolts and nuts shall be of the best quality mild steel, with true threads, meeting the requirements of ANSI B16.1.
  - 4. Flange adapters for plain end pipe (not fittings), where specified, shown on Drawings, or approved by Engineer shall be a restrained flange adapter. The restraining mechanism shall be multiple gripping wedges set against the pipe wall. Twist off nuts shall be used to ensure proper actuation of the restraining device. The restrained flange adapter shall be Series 2100 Megaflange by Ebaa Iron, Inc., or equal.
  - 5. Couplings, if required or permitted, shall be Dresser Style 38, Rockwell, or equal. Restrained coupling shall be Dresser Style 167 Lock Coupling, Rockwell, or equal.
- B. RESERVED
- C. RESERVED
- D. RESERVED
- E. RESERVED

- F. RESERVED

## **2.02 PROCESS AND PRESSURE PIPE NUTS AND BOLTS**

- A. Nuts and bolts used on buried pressure pipe and fittings in contact with earth shall be Cor-Blue coated low alloy steel and have a minimum yield strength of 45,000 psi complying with ANSI A21.11 and AWWA C111.
- B. Nuts and bolts encased in grout on concrete pressure pipe shall conform to recommendations of the pipe manufacturer.
- C. All other nuts and bolts shall be low carbon steel in conformance with the chemical and mechanical requirements of ASTM A307, Grade B. Higher strength bolts will be acceptable.

## **2.03 PIPE HANGERS AND SUPPORTS**

- A. Pipe hangers and supports shall be as specified in Section 15010.

## **2.04 COATINGS AND LININGS OF PROCESS AND PRESSURE PIPE**

- A. Coatings and linings where required shall conform to the following requirements unless otherwise indicated in Part 4 of this Section or on the Drawings.
- B. Ductile Iron Pipe:
  - 1. Ductile iron pipe, and fittings unless otherwise specified, shall be lined on the interior with a standard thickness cement lining meeting ANSI A21.4 and AWWA C104. A seal coat of bituminous material shall be applied in conformance with the above Specifications. Piping used for compressed air shall not receive a cement lining.
  - 2. All pipe used within buildings and structures and which are to receive field coats of paint shall not be coated with any black bituminous paint. Such pipe, after proper cleaning, shall be painted with one coat of primer paint that is compatible with the field coats. Painting specifications shall be followed for cleaning and painting.
- C. RESERVED

## **2.05 PIPE ESCUTCHEONS**

- A. Split-type escutcheons shall be used for piping passing through finished wall, floors, or ceiling. Escutcheons shall be brass plated or chromium plated Model 3A by Ritter, Model 284 by Fee & Mason, or equal.

## **2.06 WALL PIPE AND SLEEVES**

- A. Type A Wall Pipe:
  - 1. Cast iron wall pipe shall be used where noted on the Drawings.

2. Wall pipe shall be cast in place with joints as indicated on the Drawings.
  3. Where wall pipe is flush with wall, bolt holes shall be tapped for studs.
- B. Type B Sleeve:
1. Type B sleeves are for use in exterior walls.
  2. Type B sleeves consist of casting in place a cast iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.
  3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.
- C. Type C Sleeve:
1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.
  2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links.
  3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of minus 40 degrees F to 250 degrees F. The pressure plates shall be of delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.
- D. Type D Floor Sleeve:
1. Type D sleeves are used for pipes passing through floors.
  2. Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.
- E. Type E Sleeve:
1. Type E wall sleeves shall be used where noted on the Drawings.
  2. Type E sleeves consist of casting in place a mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.
  3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting the requirements of AWWA C111 on both ends.
- F. Type F Sleeve:
1. Type F sleeves shall be used for passing through existing masonry walls.
  2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.
- G. Type G Sleeve:

1. Type G sleeves used for passing through gastight floors shall be similar to Type C sleeves with the addition of non-shrink grout as shown on the Drawings.
- H. Type H Sleeve:
  1. Type H sleeves shall be similar to Type G sleeves and used for passing through gastight walls.
  2. Type H sleeves shall be as detailed on the Drawings.
- I. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

## 2.07 EXPANSION JOINTS

- A. Expansion joints as specified below shall be installed as per Section 15010.
- B. Expansion joint construction shall include a neoprene inner tube extending through the bore to the outside edge of both flanges. The inner tube shall be covered with a flexible multiple layer fabric carcass of high strength rubber impregnated synthetic fibers with steel wire or reinforcement rings integral with the fabric to assure sufficient rigidity for vacuum service and high pressure. An outer cover coated with Hypalon paint shall cover the carcass and provide full protection against ozone and weathering.
- C. Flange faces shall be neoprene covered and drilled to match drilling in mating flanges. Flange faces shall also be backed by split steel flange retaining rings.
- D. All expansion joints shall be suitable for service temperatures of 225 degrees F.
- E. All expansion joints used for vacuum service shall be capable of withstanding a 30-inch Hg vacuum.
- F. Expansion joints shall have recommended working pressures compatible with the service for which they are installed.
- G. All expansion joints shall be equipped with control units to restrict excess axial compression and elongation. Control units shall consist of plates bolted to pipe flanges on each end of the expansion joint and long control bolts extending between pipe flanges.
- H. Expansion joints on pipes used for digester gas service shall be the open arch type.
- I. Expansion joints on sludge piping shall be of filled arch construction to prevent solids accumulation at the joint.
- J. Expansion joints on pipes used for fuel oil and digester gas service shall have Buna-N tubes.
- K. For those locations where expansion joints are used to replace valves, spool pieces, or other short sections, standard single arch expansion joints may be of insufficient length. At these locations double, triple, and quad arch expansion joints shall be used as required.
- L. Expansion joints shall be Mercer Rubber Company Style 500-700 or equal.



## PART 3 EXECUTION

### 3.01 PRODUCT HANDLING

- A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.
- B. Store all pipe on a flat surface so as to support the barrel evenly. It is not recommended that pipe be stacked higher than 4-feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from the sun's rays.

### 3.02 PIPE INSTALLATION

- A. General:
  - 1. All pipe shall be laid to lines and grades in conformance with Section 01800.
  - 2. Wherever piping passes through walls or floors, a wall casting pipe or sleeve of the type indicated on the Drawings shall be installed. Escutcheons shall be provided for pipe passing through finished walls, floors, or ceilings.
  - 3. Pipe Anchoring:
    - a. Approved joint restraints shall be installed for the distance from each side of each bend, valve, plug, tee, or wye in locations shown or scheduled on the Drawings.
- B. Connections to Existing Pipes
  - 1. Unless otherwise specified, shown on the Drawings, or directed, connections to existing sewers shall be made in conformance with the jointing materials manufacturer's recommendations and as directed by the Resident Project Representative.
  - 2. Where new piping is to be connected into an existing joint, said joint shall be cleaned sufficiently to result in a liquid- or gastight seal. If applicable, a new gasket shall be supplied and installed.
- C. Process and Pressure Pipe:
  - 1. Pipe and appurtenances shall be installed true to line, grade, and location; with joints centered, spigots home; pipe properly supported and restrained against movement; and all valve stems plumb.
  - 2. All elbows, tees, plugs, etc., shall be properly anchored, blocked, or otherwise restrained to prevent movement of the pipe in the joints due to internal or external pressure.

3. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug to the approval of the Resident Project Representative before leaving the Work for the night, and at other times of interruption of the Work. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.
4. Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The finished cut must be approved by the Resident Project Representative.
5. Joints:
  - a. Gaskets - Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. The pipe is then forced "home" firmly and fully. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

### **3.03 SLEEVES AND WALL PIPE**

- A. Type A wall pipes shall be provided for all pipes passing through the exterior walls unless other sleeve types or wall pipes are designated on the Drawings. Type C sleeves shall be provided in interior walls unless designated otherwise on the Drawings.
- B. At all points where piping passes through floors, Type D sleeves shall be provided, unless otherwise designated on the Drawings.
- C. Other sleeve types and wall pipe shall be provided as indicated on the Drawings.
- D. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

### **3.04 PRESSURE AND LEAKAGE TESTS FOR PROCESS AND PRESSURE PIPE**

- A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all lines including the joint between existing and new pipes unless otherwise directed by the Engineer.
- B. Tests shall be conducted on all pipelines or valved sections thereof as directed by the Resident Project Representative. Testing of pipelines laid in excavation or bedded in concrete shall be done prior to backfilling or placing concrete cover, except restrained sections of pipe which shall be backfilling prior to testing, unless otherwise permitted by

the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

- C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The test pressure shall be maintained two hours minimum and additional time as required for thorough inspection to find any leaks or defects in the force main and appurtenances. Unless indicated otherwise in Part 4, the test pressure shall be 100 pounds per square inch or 50% above the normal operating pressure, whichever is greater. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.
- D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water added to the pipe under test to maintain the required test pressure for a specified time. The leakage test pressure shall be not less than the maximum operating pressure of the section under test. The duration of the leakage test shall be not less than two hours. Allowable leakage for buried piping shall not exceed 9 gallons per inch of pipe diameter per mile of pipe in 24 hours. For piping not buried, any leakage during the test is unacceptable.
- E. Lines that conduct fuel oil, gasoline, or chemicals that would have a deleterious effect upon the pipeline or process when mixed with water shall be purged after the pressure and leakage tests. Purging shall be performed with air or an inert gas such as nitrogen or carbon dioxide. Purging shall be continued for a minimum of two hours after all visible water has disappeared.
- F. Testing of lines governed by other authorities, i.e. natural gas, shall be witnessed and approved by the authority.

### **3.05 RESERVED**

### **3.06 INSTRUMENTATION CONNECTIONS**

- A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.
- B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.
- C. Thermowells complete with all appurtenances listed in Division 16 shall be furnished and installed under that Division. Thermowells complete with all appurtenances which are not included in the list in Division 16 and are to be installed in piping under this Section, shall be furnished and installed under this Section.
- D. Instrumentation and Controls are furnished and specified under various Sections including Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

#### PART 4 SPECIAL PROVISIONS

##### 4.01 LEAKAGE TESTING

- A. The leakage testing requirements of this section are waived. A visual inspection of the piping placed into service shall be performed to test the pipe for leakage

##### 4.02 PIPE LAYOUTS

- A. The final pipe layouts shall be prepared based upon piping measurements, field confirmed by the Contractor and submitted for approval by the Engineer in the form of a shop drawing.

##### 4.03 PIPING SCHEDULE

- A. Schedule:

Service	Size	Pressure Class / Thickness Class	Material	Remarks
Wastewater	6" – 12"	Class 350	Ductile Iron Pipe	See Section 2.01, A
Wastewater	16"	Class 300	Ductile Iron Pipe	See Section 2.01, A

- B. See Section 02555 for buried pipe.

##### 4.04 PIPE HARDWARE

- A. All fastening hardware and brackets within the wet well shall be 304 or 316 stainless steel.
- B. Connections shall be made using similar materials with proper insulation provided.

END OF SECTION

**SECTION 15211**  
**SMALL PIPING AND VALVES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing all pipelines and valves less than 4-inch in diameter as shown on the Drawings or as required for a complete piping system for each service or combination of services except the piping and valves included in Section 15400 and Section 15500.
- B. Each piping system shall be adequate to conduct and control the flow of process water, plant water, non-potable water, instrument air, compressed air, vacuum, natural gas, sewage gas, propane, fuel oil, chemicals, sewage, sludge, sampling or other uses as specified or shown on the Drawings.
- C. This Section includes, but is not limited to:
  - 1. Securing and bearing the cost of all permits, certificates, and inspection as required by local regulations and state codes.
  - 2. All pipe, fittings, and connections for water supply to equipment and waste to drains.
  - 3. Valves less than 4-inch in diameter, control devices, pipe hangers, anchors, supports, and sleeves for the piping systems covered under this Section.
  - 4. Hose bibbs, sill cocks, and hydrants.
  - 5. Non-potable water supply, drain lines, and connections to boilers, pump priming systems, pump gland seals, valve operating cylinders, or other equipment requiring these services.
  - 6. Compressed air piping, valves, connections to valve operators, and other equipment requiring compressed air.
  - 7. Compressed air, non-potable water, natural gas, propane, vacuum, deionized water, and other services as required for laboratory service.
- D. The Contractor shall remove all existing pipelines and valves less than 4-inch in diameter that are indicated on the Drawings to be removed except piping and valves included in Section 15400 and Section 15500. Removals shall be done in accordance with the requirements of Section 02110.
- E. The Contractor shall relocate existing piping and valves less than 4-inch in diameter, except piping and valves included in Section 15400 and Section 15500, which interfere with Work under this Section or any Section of the Specifications.
- F. The Contractor shall furnish, install, and remove all temporary piping and valves that are required to maintain processes in operation during construction.
- G. All wall, floor, and roof penetration and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.

- H. Instruments which are to be located in pipelines to be furnished under Division 16 shall be installed under this Section.

## 1.02 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Drawings shall include plan dimensions to and elevations of sleeves, inserts, and anchors, the size and location of each run of pipe, and the location of valves and unions.
    - b. Manufacturer's literature, catalog data, specifications, and illustrations shall be bound in a brochure which includes a complete bill of materials.
  - 2. Information for the Record:
    - a. Operation and maintenance manual.

## PART 2 PRODUCTS

### 2.01 PIPING MATERIALS

- A. Steel Pipe, unless otherwise noted, shall be used for all aboveground natural gas, digester gas aboveground only, aboveground fuel oil, and scum. Pipe shall be ASTM A53 Schedule 40, unless otherwise noted or where code requirements differ, with standard weld or malleable iron fittings. Unions shall comply with ANSI B16.3.
  - 1. Steel piping installed above ground, unless otherwise noted, shall be Schedule 40 pipe with standard malleable iron screwed fittings. Unions shall be 250 pound screwed malleable iron with iron to iron seats. On pipes 2-inch and larger, ASTM A105 companion flanges shall be used in lieu of unions. For natural gas through 2-inch, fittings shall be 3,000-pound forged steel socket weld. For natural gas, digester gas, and fuel oil, pipe 2-1/2-inch and larger, ASTM A234 weld fittings and ASTM A105 flanges shall be used.
  - 2. Steel piping installed underground, unless otherwise noted, shall be Schedule 40 plastic coated at the factory with Scotchkote 212 by 3M or equal. Pipe fittings through 1-1/2-inch shall be 3000-pound forged steel socket weld, and 2-inch and larger shall be ASTM A234 weld fittings. Joints shall be welded, primed, and wrapped double the manufacturer's recommended thickness with Tapecoat TC Primer and Tapecoat CT, or equal.
  - 3. Where couplings are called for on gas piping, they shall be Dresser Style 38, or equal. The couplings shall be specifically designed for digester or natural gas, middle ring width shall be 5-inch long.
- B. Stainless Steel Pipe:
  - 1. Stainless steel pipe less than 4-inch in diameter shall be designed and fabricated in accordance with ASTM A312. The interior surface of the pipe shall be smooth

- with no protrusions, stiffeners, or bracing. The pipe and fittings shall be constructed of 304L stainless steel, or as specified on the Drawings.
2. Stainless steel pipe shall be minimum Schedule 40S, unless otherwise noted on the Drawings.
  3. Fittings shall conform to ASTM A403 and shall have the same wall thickness and structural properties as the pipe. All bends shall be long radius smooth type. Mitered bends will not be acceptable.
  4. Flanges where required shall be ASTM A182-F304L flanges with full facing gaskets and centering rings. Flange bolts shall be stainless steel.
  5. Wherever possible, butt weld fittings shall be used for field welding. All welds shall be made by a certified welder and shall conform to procedures for which the welder has been certified. The Contractor shall submit certification statements for the welders and the methods employed. Belled end fittings may be used in lieu of butt weld fittings on air lines.
  6. All welds shall have full penetration and be smooth and without protrusions on the interior of the pipe. Weld metal shall be equal to or greater than the parent metal. Any cracks or blow holes appearing on the surface of a welding bead shall be ground away before depositing the next bead.
  7. All stainless-steel surfaces shall be passivated by the following procedures:
    - a. All outside weld areas shall be wire brushed to remove weld splatter. Brushes shall be stainless steel and used only on stainless steel.
    - b. All stainless-steel assemblies and parts shall be completely immersed in a pickling solution of 6% nitric acid and 3% hydrofluoric acid at 140 degrees F for a minimum of 15 minutes. Parts shall be free of iron particles or other foreign material after this procedure.
    - c. Previously pickled parts shall be neutralized by immersion in a trisodium phosphate rinse.
- C. PVC Pipe and fittings shall be composed of Class 12454-B rigid PVC compound in conformance with ASTM D1784 (formerly classified Type I, Grade 1). Pipe shall be Schedule 80 with a design stress of 2000 psi in conformance with ASTM D1785. All joints, unless otherwise shown on the Drawings, shall be solvent welded in conformance with ASTM D2855. Joint solvent shall be as recommended by the pipe manufacturer and shall comply with ASTM D2564. In pressure or vacuum lines and in gravity drains 1-inch diameter and less, the fittings shall be Schedule 80 and shall conform to ASTM D2467. For gravity drains greater than 1-inch diameter, the fittings shall conform to the requirements of ASTM D2665. PVC pipe shall be used for acid-resistant services and all lines carrying chlorine solution, sodium hypochlorite, De-ionized (DI) water and other chemicals unless otherwise shown on the Drawings or specified.
- D. CPVC Pipe shall be composed of Class CPVC 23447-B plastic as defined in ASTM D1784 (formerly classified Type IV, Grade 1). Pipe shall be Schedule 80 chlorinated polyvinyl chloride pipe in accordance with ASTM F441. Fittings shall be schedule 80 and shall

conform to ASTM F439. All joints, unless otherwise shown on the Drawings, shall be solvent welded in conformance with ASTM D2896. Joint solvent shall be as recommended by pipe manufacturer and shall comply with ASTM F493. CPVC pipe shall be used where designated in Part 4 or on the Drawings.

## 2.02 VALVES

- A. Unless otherwise specified or shown on drawings, valves installed in pipelines 3-1/2-inch diameter and smaller for process water lines shall be gate valves; for compressed air and vacuum, globe valves; for natural and sewage gas lines, lubricated plug or eccentric nonlubricated plug valves; and for gas lines less than 2-inch diameter tapered nonlubricated plug cocks; for fuel oil, ball valves; for sludge, eccentric nonlubricated plug valves. Valves for other types of services when required will be specified under that Section.
- B. Gate Valves shall be 150-pound, all bronze, rising stem, solid wedge disc furnished with screwed or flanged ends as required. Gate valves shall be Crane No. 431, Jenkins No. 47-U, Powell No. 514/515, or equal.
- C. Quick Opening Gate Valves shall be used at locations as shown on the Drawings. Quick opening gate valve shall be Crane 432 or equal.
- D. Globe Valves shall be 150-pound, all bronze body with renewable plug-type disc of 500 Brinell Hardness Stainless Steel. The seat ring shall be screwed-in and of the same material as the disc. Globe valves shall be Powell No. 2600, Crane No. 14-1/2P, Jenkins No. 2032, or equal.
- E. Ball Valves through 2-inch shall be screwed end bronze, two-piece, 125 psi, Teflon seats, bronze trim, and blowout-proof stem, Nibco No. T-580-BR-Y-20, or equal.
- F. Butterfly Valves shall be AWWA, Class 150 B, wafer body equipped for ANSI 125-pound flanges. Butterfly valves shall provide bubble-tight shutoff to 150 psig cold water pressure. The valve body shall be made from ASTM A126, Grade B cast iron or equal. The valve disc shall be made with nickel-coated cast iron, bronze, or equal. Valve shall have bronze shaft bearings, O-ring shaft seals, and EPDM valve body seat Keystone Figure 239, or equal. Valves shall be hand lever actuated.
- G. Check Valves shall be 200-pound, all bronze body with bronze disc, Y-pattern, with flanged or screwed ends as required. The check valves shall be Crane No. 36, Powell 560-Y/561-Y, Jenkins 762-A, or equal. Non-slam check valves shall be used on all pipelines operating at 25 psig or higher pressure and shall be Valve and Primer Corporation, Series 300 or equal.
- H. Nonlubricated Plug Valves shall be 150-pound, all bronze body and plug, with synthetic rubber faced plugs and have screwed or flanged ends as required. They shall be DeZurik Figure 120, or equal. Valves shall operate with nonremovable lever type handles.
- I. Lubricated Plug valves 3-1/2-inch and smaller shall be 150-pound solid bronze body and plug, lever operated, furnished with screwed or flanged ends as required, and with nonremovable lever operating handles. Lubricated plug valves shall be Rockwell



Permaturn Figure 114, or equal. Each valve shall be equipped with a giant button head coupler for use with a hydraulic hand lubrication gun. One gun shall be furnished.

- J. Plug Cocks shall be nonlubricated tapered plug type cocks, furnished with a square operating nut and wrench. Plug cocks 1-inch diameter and smaller shall be all bronze; larger sizes shall be furnished with bronze plug and washer and iron body. Plug cocks shall be designed for 125-pound working pressure, Walworth 554, Hays 1275, or equal.
- K. Sampling Cocks shall be Ernest Gage Co. Fig. 29, Conbeaco, or equal.
- L. Pressure Regulator shall be Watts U5HP, or equal.
- M. Corporation Stops shall be brass and comply with AWWA C800 as manufactured by Ford Meter Box Co., Inc. or equal. Corporation stops shall be provided with inserts, saddles, and curb boxes as required. Saddles shall be brass with double straps and be placed over a molded rubber gasket.

**2.03 RESERVED**

**2.04 RESERVED**

**2.05 RESERVED**

**2.06 RESERVED**

**2.07 RESERVED**

**2.08 RESERVED**

**2.09 RESERVED**

**2.10 RESERVED**

**2.11 SLEEVES**

- A. Type B Sleeve:
  - 1. Type B sleeves are for use in exterior walls.
  - 2. Type B sleeves consist of casting in place a black wrought iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.
  - 3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.
- B. Type C Sleeve:
  - 1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.

2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links by Link-Seal, or equal.
  3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of minus 40 degrees F to 250 degrees F. The pressure plates shall be of Delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.
- C. Type D Floor Sleeve - Type D sleeves consist of casting in place a steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.
- D. Type E Sleeve:
1. Type E wall sleeves shall be used where noted on the Drawings.
  2. Type E sleeves consist of casting in place mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.
  3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting all requirements of AWWA C111 on both ends.
- E. Type F Sleeve:
1. Type F sleeves shall be used for passing through masonry walls, except as otherwise noted on the Drawings.
  2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.
- F. Type G Sleeve - Type G sleeves used for passing through gastight floors shall be similar to Type C sleeves with the addition of non-shrinking grout as shown on the Drawings.

## **2.12 PIPE ESCUTCHEONS**

- A. Split-type escutcheons shall be used for piping through finished walls, floors, or ceilings. Escutcheons shall be of brass or chromium plated Model 3A by Ritter or equal.

## **2.13 RESERVED**

## **2.14 RESERVED**

# **PART 3 EXECUTION**

## **3.01 INSTALLATION**

- A. Cutting of all pipe shall be done with sharp tools. The ends of each pipe shall be reamed until all burrs or fins are removed. Full tapered threads shall be used throughout and threaded joints shall turn up perfectly tight without the use of filling substances. A

standard pipe joint paste or tape suitable to use of pipe shall be used on the male threads only, and none shall be allowed to accumulate on the inside of the pipes. All connections between pipe, pipe hangers, and equipment shall be made with an approved dielectric insulating material. Dielectric unions or insulated couplings shall be installed between any dissimilar metallic piping materials or at connections between dissimilar metallic pipes and equipment, tanks, etc.

- B. Pipe joints shall conform to respective industry standards.
- C. Expansion and contraction of the piping system shall be provided for by the use of swing joints, right angle loops, or approved expansion joints. Branch connections shall have three elbow spring pieces to allow for movement. Unless specified in Part 4, the piping system shall provide for the expansion as required in Section 15010. An expansion joint is also required at all building isolation or expansion joints.
- D. Interior and exterior pipelines shall be installed and graded in accordance with State and/or Local Codes. Interior pipes shall run at right angles or parallel to building walls, placed as close as practicable to the ceiling and/or walls, and supported according to Section 15010. Drain valves shall be installed at all low points.
- E. Pipe groups shall be run parallel with pipes of other trades, and wherever practicable, all piping shall be supported on common group hangers unless pitch of pipe as hereinbefore mentioned is required.
- F. The piping shall be installed in a workmanlike manner and shall avoid interference with columns, beams, equipment, and other piping or fixed construction. A minimum of 7-feet of headroom shall be maintained at any point including stairs.
- G. Type C wall sleeves shall be provided for all pipes passing through exterior walls unless other sleeve types are noted on the Drawings. Type C sleeves shall also be provided in interior walls where indicated on the Drawings, Type D floor sleeves shall be used where piping passes through floor. Other sleeve types shall be used where shown on the Drawings.
- H. Buried pipe shall be firmly bedded the full length with the exception where bell holes are required. Buried piping located less than 3-feet below a building slab or footing shall be encased in concrete. Where unstable soil conditions occur under buildings, support shall be made from the underside of the structural slab by an approved type hanging device embedded in the concrete.
- I. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 42-inch. Pressure piping which carries gases shall be installed with a minimum cover of 3-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation or horizontal alignment, the Contractor shall install the new piping at a deeper elevation or new alignment to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation or alignment shall be made either by installing fittings or by deflecting joints in accordance with the pipe manufacturer's recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade shall be approved by the Engineer.

- J. Where PVC piping is laid in a trench, the bottom of the trench shall be well graded and compacted to insure even bearing for the full length of the pipe and the pipe shall be snaked at approximate 50-foot intervals to provide for expansion or contraction. Prior to testing the pipe, the pipe shall be center loaded with backfill between joints before testing to prevent the pipe from arching or whipping under pressure. During backfill the line shall be pressurized to 25 psi to minimize impact damage.
- K. All valves shall be installed with their stems horizontal or above. As far as possible, all valves of the same type shall be of the same manufacturer.
- L. Solenoid operated valves shall be installed in horizontal lines with the solenoid mounted vertically and upright.
- M. The T-drill method manufacturing tees in continuous copper tubing is not acceptable.

### **3.02 EQUIPMENT CONNECTIONS**

- A. The Contractor shall make all connections where required between the various piping systems and all pieces of equipment. This shall include adapters, traps, backwater valves, or other fittings required when not furnished with the equipment.
- B. Unions - Provide a union or flange in piping connections to each valve, device, or item of equipment, and elsewhere as required to makeup or disconnect piping. Each union shall be so installed as to permit the removal of parts and equipment for inspection and cleaning, and shall be installed in a position which will permit the valve device or part to be removed without disconnection of any piping except unions. Union and flange shall be installed in such a position as will be accessible for disconnection items which are to be screwed. All ground joint unions on copper lines shall be cast brass or bronze. Wrought copper unions are not to be used. All unions, where possible, shall be brass to MPT type.

### **3.03 INSTRUMENTATION CONNECTIONS**

- A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.
- B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.
- C. Thermowells complete with all appurtenances listed in Division 16 shall be furnished and installed under that Division. Thermowells complete with all appurtenances which are not included in the list in Division 16 and are to be installed in piping under this Section, shall be furnished and installed under this Section.
- D. Instrumentation and Controls are furnished and specified under various Sections including Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

3.04 RESERVED

3.05 RESERVED

3.06 RESERVED

3.07 RESERVED

**PART 4 SPECIAL PROVISIONS**

**4.01 PRESSURE AND SUCTION GAUGES**

- A. Pressure gauges shall be 4-1/2-inch in size with fiberglass reinforced polypropylene case, phosphor bronze bourdon tube, 6-inch or 4-1/2-inch dial faces with black lettering, micrometer type pointers and an accuracy of plus 1% of scale range. Pressure gauge shall be H.O. Trerice No. 450 series, Ashcroft 2462 series, or equal.
- B. Gauges shall read in feet with graduations as listed below.
  - 1. Range: 0 – 200 feet
  - 2. Major Graduation: 10-feet
  - 3. Minor Graduation: 1-foot
- C. All pressure gauges unless otherwise directed shall include a brass pressure snubber and a needle type shut-off valve.
- D. For sanitary sewer applications, pressure gauges shall have diaphragm seals. The gauges, seals, and snubber shall be factory assembled and filled with fluid. The diaphragm seal shall be Type 316 stainless steel with a stainless-steel housing. Diaphragm seal shall be an Ashcroft 101 series, H.O. Trerice 877-2 series, or equal.

END OF SECTION



**SECTION 15250  
VALVES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing and installing valves, flap gates, and shear gates 4-inch and larger.
- B. Floor stands, floor boxes; valve boxes; gears, manual, hydraulic, and electric operators; extension stems; stem guides and supports; brackets; gaskets; bolts and nuts; and other accessories shall be provided as necessary to complete the Work.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Scaled dimensional drawings.
    - c. Wiring schematics with termination point identification.
    - d. Piping schematics.
    - e. Materials of construction.
    - f. Manufacturer's catalog data.
    - g. General Arrangement Drawings.
    - h. Motor information per Section 11050.
  - 2. Information for the Record:
    - a. Operation and maintenance manual.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. All valves and appurtenances shall be of standard make approved by the Engineer and shall have the name, monogram, or initials of the manufacturer cast thereon. They shall be built and equipped for the type of operation shown on the Drawings, specified herein, or as directed by the Engineer.
- B. Opening Direction - Unless otherwise specified in Part 4, valves with screw stems shall open by turning counterclockwise, the direction being indicated by an arrow cast where easily visible to operator.

- C. Connections - Valves shall be provided with hubs, spigots, flanges, mechanical groove-type, screw, or other connections compatible with the pipe in which they are installed or scheduled in Part 4.
- D. Unless otherwise specified, a stuffing box packed with O-ring seals shall be used to seal the stem of the valve. The seal system used shall be replaceable without removing bonnet or rotating element. Gaskets shall be of either Buna or a rubber composition.
- E. Bolts and nuts on buried valves shall be a low alloy steel cathodic to the valve body and having a minimum yield strength of 45,000 psi. All other nuts and bolts shall be low carbon steel conforming with the mechanical and chemical requirements of ASTM A307, Grade B.

## **2.02 RESERVED**

## **2.03 CHECK VALVES**

- A. Check valves shall close water-tight to prevent return flow in the piping system.
- B. Valve is to be tested by the manufacturer as a complete assembly per AWWA C508.
- C. Valve shall be a full body flanged type check valve with domed access cover and two moving parts, a flexible disc and disc accelerator.
- D. Body and cover shall be ductile iron ASTM A536 Grade 65-45-12 coated with fusion bonded epoxy per NSF-61 on all internal and external surfaces.
- E. Disc shall be flexible Buna-N rubber per ASTM D2000-BG with steel and nylon reinforcement. Disc accelerator shall be an internal one-piece type of stainless steel 302. No springs are allowed. Flanges shall be drilled in accordance with ANSI B16.1, Class 125 and rated for 250 psi minimum cold working pressure (CWP).
- F. A threaded port shall be provided in the bottom of the valve and in the access cover fitted with a threaded backflow actuator.
- G. The valve shall be tight seating and shall operate without hammer and shock through a 35-degree disc stroke, 45-degree seat angle and disc accelerator. The disc shall be cycle tested 1,000,000 times and the flex portion warranted for 25 years.
- H. Valve shall provide 100% unrestricted flow at any flow rate and be suitable for both horizontal and vertical pipelines with flow upward.
- I. Valve shall be the Series 500A Swing-Flex Check Valve as manufactured by Val-Matic Valve & Mfg. Corp., APCO CRF-100A Rubber Flapper Swing Check Valve manufactured by DeZurik, or equal.

## **2.04 RESERVED**

## **2.05 PLUG VALVES**

- A. Plug Valves shall close tight for pressures as specified to stop flow in the piping system.



- B. Valve Bodies and covers shall be Cast Iron ASTM A126 Class B or ASTM A536 Grade 65-45-12. Ports shall be rectangular and 100% Port. The valve port area shall meet or exceed standard pipe area per ASME/ANSI B36. 10M. Round ports are not acceptable.
  - 1. Bearings shall be sleeve type and made of sintered, oil impregnated permanently lubricated type 316 stainless steel for sizes 4-18"
  - 2. Bearings shall be ASTM A473 Grade CF8M for sizes 20-36".
  - 3. In valves larger than 36", the upper and lower plug journals shall be fitted with ASTM A 240 type 316 stainless sleeves with body bearings of ASTM B30, Alloy C95400 aluminum bronze.
- C. Plugs shall be solid one piece, Cast Iron ASTM A126 Class B or Ductile Iron ASTM A536 Grad 65-45-12. The plug shall have a cylindrical seating surface eccentrically offset from the center of the shaft. Plug shall not contact the seat until at least 90% closed. Resilient plug facing shall be Chloroprene (CR). Spherical shaped plugs are not acceptable.
- D. Seats shall be 1/8" thick welded overlay of not less than 95% pure nickel. Seat shall be at least 1/2" wide, 1/8" thick through entire width and raised. The raised surface shall be completely covered with nickel to ensure that the resilient plug face contacts only the nickel seat.
- E. Adjustable packing shall be Acrylonitrile-Butadiene (NBR) multiple V-ring type with a packing gland follower. Packing gland shall permit inspection, adjustment, or complete replacement of packing without disturbing any part of the valve or actuator assembly, except the gland follower. Non-adjustable packing or packing requiring actuator removal to replace the packing, is not acceptable. Both the packing and bearings in the upper and lower journals shall be protected by Buna-N shaft seals located on the valve shaft to minimize the entrance of grit into the bearing journal and shaft seal areas.
- F. Pressure ratings shall be 175 psi on valve sizes through 12" and 150 psi for 14" and larger. Every valve shall be given a certified hydrostatic shell test and seat test, with test reports being available upon request.
- G. All valves larger than 6" shall be installed with worm gear actuators. All gearing shall be enclosed in a cast iron housing, with outboard seals to protect the bearings and other internal components. The actuator shaft and gear quadrant shall be supported on permanently lubricated bronze bearings.
- H. Plug Valves shall meet or exceed the latest revisions of AWWA C517 and other applicable standards. End Connections shall be flanged drilled per ASME B16.1 per AWWA C111.
- I. When specified, valves shall be NSF/ANSI 372 certified lead-free and NSF/ANSI 61 certified for drinking water.
- J. Handwheels shall be 12-inches in diameter, positioned as show on the design plans.
- K. Valves shall be clearly marked with the seat end.
- L. All valve bolts shall be 316 stainless steel.

- M. Plug valves in wastewater applications shall be mounted with the plug in the horizontal position to prevent the accumulation of debris in the bottom of the valve.
- N. Plug Valves shall be Dezurick PEF Full Port eccentric plug valves, Val-Matic 100% Port Plug Valve or approved equal.
- O. Seats shall be placed on the higher-pressure side of the valve.
- P. All valves shall be shop coated with 4 mils (minimum) of epoxy paint on the exterior with SP10 surface preparation.

## 2.06 SURGE RELIEF VALVES

- A. Surge Relief Angle Valves shall be normally closed against the system pressure by external springs in compression and shall open quickly to relieve pressure when the system pressure exceeds the pressure relief setting. The pressure relief setting shall be factory set and field adjustable by adjusting the spring compression. The valve will begin to close when the system pressure subsides below the pressure relief setting. The closing speed shall be adjustable, lockable flow control valve.
- B. Body shall be 90-degree elbow design conforming to the center-to-face dimension for long-radius elbows per ASME B16.1 and ASME B16.42. Valve shall be a compact design.
- C. Body and cover shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. Body seat shall be 316 stainless steel. Flanges shall be flat faced and conform to ASME B16.42 Class 150. Valve shall be proof-of-design tested to 5,000 cycles.
- D. A self-contained, sealed hydraulic system shall provide closing speed control. The valve cover shall provide an air gap between the line fluid and the hydraulic oil that will indicate seal wear and prevent contamination of line fluid or hydraulic oil. The valve shall be capable of being mounted in any position without modification or customization of the hydraulic system components. A mechanical stroke counter with manual reset shall provide local indication of total valve cycles.
- E. External springs located on the valve cover in a protective steel enclosure shall provide closing force. Springs shall be sized to optimally match customer-specified relief pressure setting to minimize pressure rise above the set-point in order to fully open valve. A single adjustment screw shall be provided for field adjustment of relief pressure setting.
- F. Valve disc shall be 316 stainless steel and have a replaceable seat ring of acrylonitrile-butadiene (NBR).
- G. All valve bolts shall be 316 stainless steel.
- H. The Relief Pressure Set Point (psi) for the valve shall be 65-200 psi with an initial setting of 80 psi.
- I. The valve shall be a 8-inch APCO model SRA-3000A Surge Relief Angle Valves as manufactured by DeZurik, or Fig. 624-D Sewage / Wastewater Surge Relief Valve by GA Industries or approved equal.

## **2.07 MANUAL OPERATION**

- A. Valves shall be equipped with nut, hand wheel crank, chain, gears, floor stand, and other appurtenances as required for manual operation as specified or scheduled. Operators shall be in accordance with AWWA specifications except as modified herein.
- B. Each valve with a manual operator within a building which is more than 5-feet-6-inch above the floor to the rim of the manual operator shall have a chain wheel with galvanized chain looping 3-feet-6-inch from the floor. The valve shall be oriented to permit chain wheel operation or intermediate pulleys shall be installed to facilitate chain operation.
- C. Operation shall be designed so that the effort required to operate the hand wheel, lever, or chain shall not exceed 25 pounds applied at the extremity of the wheel or lever. The hand wheels on valves 4-inch and larger shall not be less than 12-inch in diameter.
- D. Gears for valve operation shall be installed in such a manner that the stuffing box will be accessible for packing.

## **2.08 RESERVED**

## **2.09 SHOP PAINTING**

- A. All iron parts shall be painted before leaving the shop.
- B. Unless otherwise specified, all internal ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of epoxy paint.
- C. Unless otherwise specified, all exterior ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of a universally compatible primer or in the case of valves buried or submerged, with two coats of epoxy paint.

## **2.10 SOURCE QUALITY CONTROL**

- A. Each check, gate, butterfly, and ball valve shall be submitted to operation and hydrostatic tests at the manufacturer's plant as specified in applicable AWWA Standards.
- B. Other valves shall be tested in conformance with applicable specifications in Part 4 of this Section.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. All valves shall be carefully installed in their respective positions free from distortion and stress. Connecting joints shall conform to applicable requirements of Section 15210.
- B. Stem guides shall be accurately aligned.

- C. Double disc gate valves shall not be installed with the bonnet more than 90 degrees from an upright position.
- D. Accessories:
1. Valve Boxes shall be installed in a plumb position and in alignment with the operating nut.
  2. Extensions stems and stem guides shall be in alignment with operating nut and prevent binding and stresses on connecting pins.
  3. When there is a change to the grade elevation, valve boxes new and existing shall be adjusted to the new grade elevation.

### 3.02 RESERVED

### 3.03 TESTING

- A. All valves shall be tested in place by the Contractor as far as practicable under the conditions for the pipelines in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Project Field Representative.

## PART 4 SPECIAL PROVISIONS

### 4.01 VALVE SCHEDULE

- A. The following letter designations are used in the Valve Schedule:

Type Designation	Connection Designation	Operator Designation
CV - Check Valve	F - Flanged	FB - Floor Box
GV - Gate Valve	W - Wafer	TW - Tee Wrench
PV - Plug Valve	MJ - Mechanical Joint	G - Gear
BV - Butterfly Valve	PE - Plain End	HW - Handwheel
3PV - 3-Way Plug Valve	C - Clamp	C - Chain
MV - Mud Valve		M - Motor
PR - Pressure Relief Valve		L - Lever
FG - Flap Gate		VB - Valve Box
SG - Shear Gate		FS - Floor Stand
A - Air Vacuum Valve		
DB - Duckbill		
Use Designation	Service Designation	
RW - Raw Wastewater	O-C - Open-Close	
D - Drain	M - Modulation	

- B. The Valve Schedule is as follows:

Valve Number	Size (in.)	Type	Connection	Operator	Use	Service	Location
PV-1	16	PV	F	HW/G	RW	O-C	Control Building
PV-2	16	PV	F	HW/G	RW	O-C	Control Building

Valve Number	Size (in.)	Type	Connection	Operator	Use	Service	Location
PV-3	8	PV	F	HW/G	RW	O-C	Control Building
PV3-1	16	PV	F	HW/G	RW	O-C	Flow Meter Chamber
PV3-2	16	PV	F	HW/G	RW	O-C	Flow Meter Chamber
PV3-3	16	PV	F	HW/G	RW	O-C	Flow Meter Chamber
CV-1	16	CV	F	-	RW	O-C	Control Building
CV-2	16	CV	F	-	RW	O-C	Control Building
DB-1	4	DB	C	N/A	D	N/A	Wet Well
DB-2	6	DB	C	N/A	D	N/A	Wet Well
DB-3	4	DB	C	N/A	D	N/A	Wet Well
SRV-1	8	SRV	F	N/A	RW	O-C	Control Building

- C. Schedules are not guaranteed to be complete. All valves shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.
- D. This procurement is subject to the requirements of American Iron & Steel.
- E. Handwheels shall be positioned as shown on the design plans. Handwheels shall be 6-inches in diameter for valves 4-inches and smaller and 12-inches in diameter for valves larger than 4-inches in diameter.

#### 4.02 DUCKBILL CHECK VALVES

- A. Duckbill check valves shall be Tideflex TF-1 or approved equal.
- B. Duckbill check valves shall open with 3-inch head pressure.

#### 4.03 CHECK VALVE ACCESSORIES AND SPARE PARTS

- A. One backflow actuator for the 16-inch Val-matic Series 500 Swing-Flex Check Valves shall be provided.
- B. Two sets of spare parts to include discs, disc hinges, o-rings and grease packet shall be provided.

#### 4.04 VALVES REQUIRING STARTUP

- A. The following valves require the startup-services of the manufacturer
  - 1. Surge Relief Valves.

END OF SECTION



**SECTION 15260  
SLUICE GATES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes wall thimbles, gate frames, slide gates, roller gates, constant level gates, floor stands, extension stems, stem guides, operating devices, position indicators, wall brackets, floor boxes, anchors, and all appurtenances.
- B. Motors and electrical work incidental to installation and operation of the gates shall be included herewith unless specified otherwise.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Scaled dimensional drawings.
    - b. Wiring schematics with termination point identification.
    - c. Materials of construction.
    - d. Manufacturer's catalog data.
    - e. Motor information per Section 11050.
  - 2. Information for the Record:
    - a. Operation and Maintenance manual information.

**1.03 QUALITY ASSURANCE**

- A. Slide gates and their appurtenances shall conform to applicable portions of AWWA C560, C561, C562, or C563, depending upon materials of construction.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Slide Gates (Stainless Steel)
  - 1. All slide gates shown on the Drawings or listed in the specifications shall conform in all respects to the latest version of AWWA C561, with the noted changes and additions. Materials used in construction of slide gates and appurtenances shall conform to the following specifications:
    - a. Frame, Slide, Yoke, and Reinforcing: Stainless Steel, ASTM A240/A240M, Type 304L, or ASTM A240/A240M, Type 316L
    - b. Stainless Steel for stems: ASTM A276, Type 304.

- c. Stainless Steel for fasteners: F593/F594, Alloy Group 1, 2 (SS304, SS316)
  - d. Invert seals and compression load pad: Neoprene, ASTM D2000, 60 Durometer, with a stainless-steel ASTM A276, Type 304L, or Type 316L retainer bar.
  - e. Side Seals: Ultra High Molecular Weight (UHMW) Polymer, ASTM D4040
  - f. Top Wedges: Type 316 stainless steel ASTM A351-CF8M.
- 2. The gate frame shall be an integral unit of structural shapes, rigidly assembled to form the waterway opening. The head channels shall be welded or bolted to the gate frame. Guide members that consist of two or more bolted structural members are not acceptable. Guide member designs where water loads are transferred through the assembly bolts are not acceptable. The channels shall be sufficiently spaced to allow removal of the gate slide. The primary slot of the frame shall contain polymer guide liner retained in grooves, to prevent metal-to-metal contact between slide and frame.
  - 3. Gate slide shall be not less than 1/4-inch thickness and shall be reinforced such that deflection under full head shall be limited to 1/720 of the span. Gates over 24 inches wide shall have adjustable top wedges in order to prevent deflection in the slide resulting from over closure.
  - 4. Slide gates where required shall incorporate a flush-bottom seal of neoprene that is mechanically fastened to the bottom frame invert member.
  - 5. Side seals of UHMW polymer shall be provided. Seals shall be securely fastened to the frame with non-corrosive retainers and shall be replaceable and adjustable without removing the gate from the installed position. A compression device shall be set behind the UHMW seal to allow for a self-adjusting seal system.
  - 6. The operating stem shall be of a size to safely withstand, without buckling or permanent distortion, the stresses resulting from at least two times the rated output of the floor stand or bench stand with a 40-pound effort on the crank or handwheel. The threaded portion of the stem shall have cold rolled threads. Stainless steel couplings, threaded and keyed to the stems, shall join stems of more than one section. Manually operated, rising stem type gates will be provided with an adjustable stop collar on the stem to prevent over-opening of the gate.
  - 7. On slide gates with a width greater than twice the height and the width is greater than 48 inches, a tandem stem arrangement shall be used.
  - 8. Gate lifts shall be handwheel or geared crank type as shown on the Drawings. Lifts shall operate the gate with a maximum pull of 40 pounds on the handwheel or crank, the center of which shall be located approximately 36 inches above the operating floor. All lifts shall have thrust bearings, bronze lift nuts, and an aluminum stop nut to limit the downward travel of the stem and slide. All



geared lifts shall have cast or ductile iron housings and pedestals. All lifts shall be rising stem type. Stem covers made of clear polycarbonate with position indication shall be furnished for all lifts. Lifts shall be grease lubricated through grease zerk fittings.

9. Where indicated on the Drawings or specified, motorized gate operators shall be furnished and installed.

## **2.02 LIFT ASSEMBLIES**

- A. Floor stands shall be of the enclosed gear pedestal lift type with single or double gears as required, and with thrust bearings above and below the flange on the bronze lifting nut. Bevel and pinion gears shall be steel with cut teeth, and spur gear shall be cast iron with cut teeth. Bearings for the gear and pinion shaft shall be bronze brushed. The lift shall operate on a 40-pound pull on the crank. A heavy-duty translucent PVC pipe stem cover shall be provided.
- B. The guides on self-contained gates shall extend above the operating floor. They shall be sufficiently strong so that additional reinforcing is not necessary. The yoke to support the operating bench stand will be formed by two channels across the top of the guides. They shall be sufficiently spaced to allow removal of the gate sluice. All lifts shall have thrust bearings, bronze lift nut and a stop nut.
- C. Where the head frame extends higher than 4-feet above the operating floor, the gate operator shall include a bevel gear assembly. The center of a crank or handwheel operator shall be centered approximately 36 inches above the operating floor and shall have a maximum pull of 40 pounds.

## **2.03 ELECTRIC GATE OPERATOR - RESERVED**

## **2.04 GATE OPERATION**

- A. Opening Direction - Unless otherwise specified in Part 4, gates with screw stems shall open by turning counterclockwise, the direction being indicated by an arrow cast where easily visible to operator.

## **2.05 ACCESSORIES**

- A. Operating stems and extensions shall be ASTM A276 stainless steel with high finish corrosion-resistant restraint threads and shall operate without binding or jamming in the lift nut. Stems shall be of sufficient cross section to withstand the normal forces created during gate operation.
- B. Stems shall be rising with a transparent plastic stem cover.
- C. Adjustable cast iron stem guides with bronze bushings shall be provided at the spacing recommended by the manufacturer.
- D. Gates shall be provided with foot plate wall brackets mounted in accordance with the manufacturer's recommendations.

- E. All fasteners and hardware for mounting shall be 304 stainless steel.

## 2.06 SHOP PAINTING

- A. Shop painting shall be in accordance with the requirements of Section 01350.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Installation shall be as shown on the Drawings and in conformance with AWWA C560 for cast iron sluice gates, AWWA C561 for fabricated stainless-steel sluice gates, AWWA C562 for fabricated aluminum sluice gates or AWWA C563 for fabricated composite sluice gates.

### 3.02 TESTING

- A. After installation, the Contractor shall test each gate for satisfactory operation and water tightness against maximum operating pressure insofar as practicable.

## PART 4 SPECIAL PROVISIONS

### 4.01 SCHEDULE

- A. The following letter designations are used in the Gate Schedule:

Mark Designation	Frame Type
SG - Sluice Gate	R - Rectangular, Flanged
RG - Roller Gate	RF - Rectangular, Flat
CLG - Constant Level Gate	C - Circular, Flanged
FSG - Fabricated Slide Gate	CF - Circular, Flat

Bottom Type	Operation Designation
CON - Conventional	OS - Operating Stand
F - Flush	HC - Hand Crank
D - Downward Opening	HW - Handwheel
	CH - Chain
	M - Motor (Open-Close)
	MOD - Motor (Modulating)

Mount Type	Material Designation
TR - Thimble, Rectangular	CI - Cast Iron
TC - Thimble, Circular	FRP - Fiberglass Reinforced Plastic
E - Embedded	AL - Aluminum
F - Face	SS - Stainless Steel

Mark Designation	(in.)	Frame Type	Bottom Type	Mount Type	Material Designation	Operation	Location Designation	Seating Head	Unseating Head
SG-1	66x66	RF	F	F	SS	HC	Wet Well	20	30

- B. Schedules are not guaranteed to be complete. All gates shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the following schedule.

END OF SECTION



**SECTION 15400**  
**PLUMBING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing all necessary plumbing components, connecting piping, and accessories, and a complete plumbing system for each service or combination of services.
- B. Each system shall be adequate to conduct and control the flow of hot and cold potable water, sanitary lines, vents, roof drains, or other uses as specified or shown on the Drawings.
- C. Plumbing is defined to include all potable water and all building sanitary drainage and vents, and all building storm drainage of every size located in all buildings and up to a point, 5-feet -0-inch outside each building.
- D. Work includes, but is not limited to:
  - 1. Securing and bearing the cost of all permits, certificates, and inspection as required by local regulations and state plumbing codes.
  - 2. All pipe, fittings, and connections to sanitary fixtures for potable water supply and waste, including vents, roof drains, floor drains, equipment drains, traps, cleanouts, and backwater valves.
  - 3. Pressure gauges, thermometers, control devices, pipe hangers, anchors, supports, hose bibbs, sill cocks, and sleeves.
  - 4. Potable water supply to boiler makeup water stop valves, or other equipment requiring these services.
  - 5. Pipe insulation complete with jacket as required by Section 15504.
  - 6. Floor and equipment drains, condensate drainage, and accessories.
  - 7. Sanitary fixtures, sinks, lavatories, backflow preventer valves, water coolers, acid neutralizing basins, oil and grease separators, and water heaters.
- E. Additional product requirements are specified in Section 01350.
- F. All equipment, materials, and Work shall comply with Federal, State, and local plumbing codes. Equipment materials and Work specifically required by Federal, State, or local plumbing codes whether or not shown on the Drawings or specified shall be provided by the Contractor at no change in Contract Price.

## **1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's literature.
  - 2. Information for the Record:
    - a. Material certificates.
    - b. Licenses and permits.
    - c. Operation and maintenance manual.

## **1.03 CONTRACT DRAWINGS**

- A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping.
- B. The exact location of apparatus, fixtures, equipment, and piping shall be ascertained by the Contractor in the field, and the Work shall be laid out accordingly. Should the Contractor fail to ascertain such locations, the Work shall be changed at his own expense when so ordered by the Engineer. The Engineer reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost to Owner.

## **1.04 PROTECTION FROM DAMAGE**

- A. Delivery, Handling, and Storage:
  - 1. Material delivery, handling, and storage shall meet the requirements of Section 01350.
  - 2. All plastic fixtures and pipe, if stored outside, shall be covered with an opaque material to protect them from the sun's rays.
  - 3. All plastic fixtures and pipe, if stored outside, shall be covered with an opaque material to protect them from the sun's rays.
- B. After Installation:
  - 1. Suitable covers and guardrails shall be placed to protect against chipping enamel or denting the surfaces of any equipment after it is installed and during the final days of construction.
  - 2. Before acceptance, all covers, and protective material shall be removed, and the fixtures and equipment cleaned and ready for use.

## **1.05 PLUMBING PIPE REQUIREMENTS**

- A. Sanitary Drain, Waste, and Vent (DWV): PVC schedule 40 gravity pipe.
  - 1. Control Building: Sanitary drain, waste, and vent and condensate drainage piping from FC-1.
- B. Domestic Hot and Cold Potable Water (DHW & DCW):
  - 1. Control Building: Copper pipe.

## **PART 2 PRODUCTS**

### **2.01 PIPING MATERIALS**

- A. Copper Pipe and Tubing shall be manufactured in accordance with ASTM B88. Type L hard temper shall be used above ground and inside of structures for hot and cold potable water and other services unless another type of pipe is specifically called for. Type K soft temper shall be used where underground piping is installed. Fittings shall be cast bronze or wrought copper with solder joints. Unions shall be cast bronze solder joint fittings manufactured in accordance with ASTM B62 with ends complying with ANSI B16.18. Unions shall be installed adjacent to valves and equipment and as required to assemble the piping but not less than one union shall be included in each run. Threaded adapters shall be installed on each side of valves in copper lines. Where joints are made between pipes of different materials, dielectric couplings shall be installed. Pipe nipples shall be standard weight seamless red brass pipe ASTM B43. Solder joints shall be made in conformance with ASTM B828 Flux conforming to ASTM B813 shall be applied. Materials used for solder joints in all potable water services shall contain less than 0.2% lead and comply with ASTM B32.
- B. DWV Schedule 40 PVC Gravity Pipe:
  - 1. Pipe: ASTM D2665.
  - 2. Fittings: PVC.
  - 3. Joints: ASTM 2855, solvent-weld with ASTM 2564 solvent cement.

### **2.02 VALVES**

- A. Unless otherwise specified, valves installed in pipelines 3-1/2-inch diameter and smaller for potable water lines shall be gate valves.
- B. Gate valves shall be 150 pounds, all bronze, rising stem, solid wedge disc furnished with screwed or flanged ends as required. Gate valves shall be Crane No. 431, Jenkins No. 47, Powell No. 514, or approved equal.
- C. Check valves shall be 200 pounds, all bronze body with bronze disc, y-pattern, with flanged or screwed ends as required. The check valves shall be Crane No. 36, Powell 560-Y, Jenkins 762-A, or approved equal. Non-slam check valve shall be used on all

pipelines with 25 psi or more pressure and shall be Valve and Primer Corporation, Series 300, or approved equal.

- D. Ball valves through 2-inch shall be screwed end bronze, two-piece, 125 psi, Teflon seats, bronze trim, and blowout-proof stem, Nibco T-580-BR-Y-20 or approved equal.
- E. Plastic Ball Valves for PVC or CPVC Schedule 80 Pressure Pipe:
  - 1. Manufacturers: Chemtrol, Spears Manufacturing, or approved equal.
  - 2. True Union Ball Valves: All thermoplastic ball valves shall be true union standard type, schedule 80 full-port design, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.
- F. Plastic Check Valves for PVC or CPVC Schedule 80 Pressure Pipe:
  - 1. Manufacturers: Chemtrol, Spears Manufacturing, or approved equal.
  - 2. True Union Ball Check Valves: All thermoplastic check valves shall be true union ball type suitable for horizontal or vertical installation, schedule 80 full-port design, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. Valve stem shall have an O-ring stem seal. All handles shall be of polypropylene construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.
- G. Plastic Unions for PVC or CPVC Schedule 80 Pressure Pipe:
  - 1. Manufacturers: Chemtrol, Spears Manufacturing, or approved equal.
  - 2. Unions: All thermoplastic unions shall be schedule 80, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.

## 2.03 STRAINERS

- A. Strainers shall be provided where shown on the Drawings and as required to meet local and State codes. Strainers shall also be provided in all water lines ahead of all solenoid valves, pressure regulators, and pilot valves.
- B. Unless otherwise specified or required by code, strainers shall be Leslie Mode 7000, Mueller Muessco Model 11, or approved equal. Strainer shall have a Y-pattern cast iron body and a 40-mesh stainless steel screen.
- C. The Contractor shall provide a plug cock for blow-off purposes.



## 2.04 ROOF DRAINS

- A. Roof drains for flat roofs shall be dura-coated cast iron with large sump and flange, with screwed or caulk bottom outlet, integral increaser with minimum length at least twice the diameter of the downspout, removable cast iron, or aluminum dome and sediment cup, a non-puncturing flashing clamp device integral with gravel stop, and integral underdeck clamp. Roof drains shall be Josam Series No. 21000, Zurn Series Z-100, or approved equal.
- B. Roof drain conductor pipe shall be cast iron soil pipe or as permitted by the governing authority. Pipe sizes and slopes noted on the drawings are minimum requirements.

## 2.05 FLOOR, EQUIPMENT, AND AREA DRAINS

- A. Floor Drains:
  - 1. Manufacturers: Zurn Model ZN-550, Josam Manufacturing Co., J.R. Smith Mfg. Co., or approved equal.
  - 2. Construction: ANSI A112.21.1; round top drain, latex-coated, cast iron, two-piece body with bottom outlet; seepage pan and polished nickel-bronze, anti-tilt, slotted grate, and combination membrane flashing clamp and frame. Provide P-traps for floor drains suitable for connecting to the type of pipe furnished for the respective piping classifications.
- B. Floor drainage systems shall be vented where required.
- C. Cleanouts located in poured concrete floors or slabs shall be Zurn Heavy Duty CO No. Z-145001 or approved equal with round, scoriated, cast iron, non-tilt top.
- D. All PVC sanitary line components shall be as provided by Plastic Oddities, Shelby, NC, or equal.

## 2.06 SLEEVES

- A. Type C Sleeve:
  - 1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.
  - 2. Type C shall be a modular mechanical type of seal of interlocking synthetic rubber links.
  - 3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of 40-degree F to 250-degree F. The pressure plates shall be of Delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.
- B. Type D Floor Sleeve - Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the

service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.

C. Type E Sleeve:

1. Type E wall sleeves shall be used where noted on the Drawings.
2. Type E sleeves consist of casting in place mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.
3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting all requirements of AWWA C111 on both ends.

D. Type F Sleeve:

1. Type F sleeves shall be used for passing through masonry walls.
2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.

## 2.07 MISCELLANEOUS PRODUCTS

- A. Water Hammer Arresters - Josam "Absorbotron," Zurn, Precision Plumbing Products, or equal, as noted on the Drawings. Conformance with ANSI A112.26.1, sized in accordance with PDI WH-201. Seal bearing approval from Plumbing and Drainage Institute, stainless steel construction with pre-charged suitable for operation in temperature range -40 to 300 degrees F and maximum 250 psig working pressure.
- B. Relief Valves - All brass, Crane No. 2606, Kennedy, or approved equal, pipe to floor.
- C. Pipe Escutcheons - Split-type escutcheons shall be used for piping through finished walls, floors, or ceilings. Escutcheons shall be of brass or chromium plated.
- D. Cleanouts - Zurn Z-1440-1, Josam 58710, or approved equal, for wall mount. Zurn Z-1425-27, Josam 58140, or approved equal, for floor mount.
- E. Vent Stack Sleeve - Zurn Z-196, Josam, or approved equal.

## 2.08 BARRIER-TYPE TRAP SEAL

- A. Manufacturers: Everflow Supplies Green Drain, Sure Seal, or approved equal.
- B. Construction: ASSE 1072 tested and certified, inline floor drain, barrier type trap seal with UV ABS plastic frame, silicone rubber sealing flapper, and four flexible sealing ribs. Trap seal shall open to allow drainage and close when there is no flow. Trap seals shall be in compliance with the Ohio Plumbing Code.

**2.09 RESERVED**

**2.10 BACKFLOW PREVENTERS**

- A. Reduced pressure type backflow preventers shall conform to AWWA C511, ASSE Standard 1013 and shall be a model which has been approved by the State Department of Public Health, the State Plumbing Board, and the State Department of Labor-Construction Code, Northwestern Water & Sewer District or the State agency with EPA primacy.
- B. All backflow preventers are to include an inline strainer between the stop valves and include an air gap fitting for the relief drain.

**2.11 PLUMBING FIXTURES**

- A. Plumbing fixtures shall be a product of one of the following manufacturers:

Item	Manufacturer
Water Closets	American Standard, or equal
Lavatories	American Standard, or equal
Lavatory Faucet	American Standard, or equal
Service Sinks	UTILATUB, or equal
Flush valves	Sloan, Delany, or equal
Fittings	Crane, American Standard, or equal

- B. The model numbers and manufacturers listed are to establish the type, style, quality, and materials of construction required. All individual shower mixing valves shall be ANSI/ASSE 1016 approved and be identified as a Type T (automatic water temperature regulations) or a Type P (automatic pressure balancing) regulator. All primary temperature actuated mixing valves shall be ANSI/ASSE 1017 approved.
  - 1. Water Closets (Floor Mounted):
    - a. Construction: ASME A112.19.2, American Standard Model Cadet 2467.016, low-consumption 1.6 gallons per flush, vitreous china, elongated bowl, two bolt caps, pressure-assisted siphon jet flush action, bowl rim at 16-1/2 inches for accessible applications, with metal chrome trip lever.
    - b. Seat: American Standard Model 5900.100, white, elongated heavy duty bowl open front seat less cover, constructed injection molded solid polypropylene with large molded-in bumpers, and external check hinge with 304 series stainless steel hinge posts seat 11 degrees beyond vertical.
  - 2. Urinal (Wall Hung):
    - a. Construction: ASME A112.19.2, American Standard Model Washbrook 6590.501, ADA compliant, low-consumption 0.5 gallons per flush,

vitreous china, ultra-high efficiency, flushing rim, elongated 14-inch rim from finished wall, washout flush action, extended sides, 3/4-inch inlet spud, 2 inch threaded (NPTF) outlet connection, with strainer included. Urinal shall include 2 wall hangers, 3/4-inch I.P.S. angle stop with back-flow protection and vandal-resistant cap, sweat solder kit including cover tube and wall flange, high pressure vacuum breaker with down tube, and spud coupling and flange for 3/4-inch top spud.

- b. Flush Valve: American Standard Model 6045.051, self-cleaning brass piston with integral wiper spring prevents clogging and reduces maintenance, non-hold open handle, positive seal, durable chrome-plated cast brass construction, chloramine-resistant EPDM seals, adjustable tailpiece, for 3/4-inch top spud, 0.5 gpf.
- 3. Lavatories (Wall Hung):
  - a. Construction: ASME A112.19.2, American Standard Model Decorum 9134004EC, ADA compliant, 21 inches x 20-1/4 inches, white vitreous china, wall hung lavatory, drillings on 4-inch centers, rear overflow, recessed self-draining deck with minimal splash, with concealed arm or wall support.
  - b. Faucet: ANSI A117.1, American Standard Model Monterrey 7500.175, 4-inch centerset faucet, rigid/swivel gooseneck spout, vandal-resistant wrist blade handles, cast brass construction with shank nuts and brass coupling nuts. Water conserving vandal resistant 0.5 gpm, pressure compensating, multi-laminar spray.
  - c. Accessories: Chrome plated 17-gauge brass P-trap with cleanout plug and arm with escutcheon, offset waste with perforated open strainer, wheel handle stops, flexible supplies, with water supplies, trap, and waste insulated to meet ADA compliance.
- 4. Utility Sink:
  - a. ASME A112.19.1, E.L. Mustee & Sons, Inc., Model UTILATUB 19F molded thermoplastic resin with heavy gauge steel legs.
  - b. Faucet: ANSI A117.1, American Standard Model Monterrey 7500.175, 4-inch centerset faucet, rigid/swivel gooseneck spout, vandal-resistant wrist blade handles, cast brass construction with shank nuts and brass coupling nuts. Water conserving vandal resistant 0.5 gpm, pressure compensating, multi-laminar spray.

## 2.12 EMERGENCY EYE/FACE WASH UNIT

- A. Eye/Face Wash Unit:
  - 1. Manufacturer: Bradley Corporation Model S1944011BBC, or equal.

2. Type: Conformance with ANSI Z358.1 and certified. Quick access, used as a stationary emergency eye/face wash spray or hand-held spray for eyes and face or body rinsing.
  3. Construction: 4.5 GPM, ABS plastic dual perforated sprayheads, soft flow for flooding large areas as well as eyes only. Sprayheads shall include protective covers. Chrome-plated brass valve activated by an extended handle which keeps the valve open once the handle is squeezed. 12-foot yellow reinforced thermoplastic, self-coiling drench hose with a maximum working pressure of 170 psi. Burst strength shall be 3 times the maximum working pressure. Supply connection shall be 1/2" female NPT. Provide sprayhead/valve assembly with a stainless-steel metal wall bracket. Unit shall be equipped with a flow switch rated for 4.5 GPM.
  4. Flow Switch: Manufacturer to provide a 115/1/60 flow switch for activation of an alarm condition whenever eye/face wash is activated. Switch must be able to activate at low flows.
- B. Thermostatic Mixing Valve
1. Manufacturers: Bradley Corporation Model Navigator S19-2000 EFX8, or equal.
  2. Function: Control and maintain the temperature of the tepid water delivered to the emergency eye/face wash unit.
  3. Construction: ASSE 1071 certified, factory assembled and tested, liquid-filled thermal motor and piston control mechanism with positive shutoff of hot water when the cold water supply is lost. Valve allows cold flow in event of loss or interruption of hot water supply or thermostat failure. Valve controls outlet temperature over wide flow range and is suitable for drench shower and eyewash applications. Valve includes vandal-resistant temperature adjustment, dial thermometer, integral strainer, and check stops. Provide with a surface mounted, metal wall cabinet with access door to house the thermostatic mixing valve.
    - a. Inlet Water Temperature: Maximum 180 degrees F.
    - b. Maximum Operating Pressure: 125 PSI.
    - c. Tempered Water Setting: Factory preset, 85 degrees F.
    - d. Temperature Range: 65 to 95 degrees F.
    - e. Valve Flow Rate at 45 PSIG Pressure Drop 9.4 GPM.
    - f. Inlets and Outlet Connections: 1/2-inch NPT.

## 2.13 WATER HEATER

- A. Manufacturers: Lochinvar Model JEA030KD, A.O. Smith, Bradford White, or equal.
- B. Type: Electric, vertical storage type water heater, UL listed and certified.

- C. Construction: Tank shall be rated for 150 psi working pressure and tested at 300 psi. The tank shall be glass lined and fired to 1600 degrees F to ensure molecular fusion of glass and steel. A 400-degree F rated high temperature dip tube shall be used to introduce incoming cold water to the bottom of the tank. To meet the requirements of the latest addition of ASHRAE 90.1b Energy Efficiency Standards, the tank shall be insulated with non-CFC polyurethane closed cell foam insulation to minimize heat loss. The jacket shall heavy gauge steel with baked enamel finish.
- D. Heating Element: Zinc-coated, copper sheath, immersion type heating element, threaded for easy service and replacement.
- E. Controls: Adjustable electric thermostat for element control with automatic overheat safety control.
- F. Accessories: Brass water connections, high density magnesium tank saver anode for corrosion protection, ASME rated factory supplied temperature and pressure relief valve, and brass tank drain valve.
- G. Capacities:
  - 1. Storage Capacity: 26 gallons.
  - 2. Element: 4.5 KW.
  - 3. Recovery Rate: 21 gallons per hour at 90 degrees F water temperature rise.
  - 4. Electrical Power: 208/1/60.

#### **2.14 THERMAL EXPANSION TANK**

- A. Manufacturers: Amtrol, Therm-X-Trol, Model ST-5C-DD; Watts Regulator, Model DET; State Industries, Inc.; or equal.
- B. Construction: Deep drawn welded carbon steel, dished heads, factory applied primer coat, rated for a maximum working pressure of 150 psig and maximum working temperature of 200 degrees F, flexible heavy duty butyl diaphragm sealed into tank, antimicrobial polypropylene-lined with anti-legionella protection water reservoir, air-charging fitting (Schrader valve) for field adjustment, pre-charged to 55 psig, designed for potable hot water systems. With a 2.1-gallon tank volume.

#### **2.15 WATER METER**

- A. Northwestern Water & Sewer District Standard.
- B. ¾" Meter
- C. Meter Transmitter to be provided by the Owner.

**2.16 EXTRA STOCK**

- A. Furnish enough valve washers and strainers to replace all the originals on the project one time and include one set of wrenches required to do the Work.

**2.17 RESERVED**

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Cutting of all pipes shall be done with sharp tools. The ends of each pipe shall be reamed until all burrs or fins are removed. Full tapered threads shall be used throughout and threaded joints shall turn up perfectly tight without the use of filling substances. A standard pipe joint paste shall be used on the male threads only, and none shall be allowed to accumulate on the inside of the pipes. All connections between pipe, pipe hangers, and equipment shall be made with an approved dielectric insulating material.
- B. Pipe joints shall conform to respective industry standards.
- C. Expansion and contraction of the piping system shall be provided for using swing joints, right angle loops, or approved expansion joints.
- D. Interior and exterior pipelines shall be installed and graded in accordance with State and/or Local Plumbing Codes. Interior pipes shall run at right angles or parallel to building walls, placed as close as practicable to the ceiling and/or walls, and supported by hangers or brackets. All hangers and inserts or other approved method of pipe supports shall be provided. The inserts or anchor bolts shall be located according to Drawings and Specifications and installed in the concrete at the time it is placed.
- E. Drain valves shall be installed at all low points. Vent valves shall be installed at all high points.
- F. Pipe groups for plumbing shall be run parallel with pipes of other trades, and wherever practicable, all piping shall be supported on common group hangers unless pitch of pipe as hereinbefore mentioned is required.
- G. The piping shall be installed in a workmanlike manner and shall avoid interference with columns, beams, equipment, and other piping or fixed construction. A minimum of 7-feet of headroom shall be maintained at any point including stairs.
- H. Type C wall sleeves shall be provided for all pipes passing through exterior walls unless other sleeve types are noted on the Drawings. Type C sleeves shall also be provided in interior walls where indicated on the Drawings, Type D floor sleeves shall be used where piping passes through floor. Other sleeve types shall be used where shown on the Drawings.

- I. Provide a system of vents from each plumbing fixture and drain, extended to drain at the bottom, and through the roof, providing equalized pressure on every trap. As a minimum the system shall be as indicated on the Drawings, but in no case, shall the complete system be less than required by the State and local Plumbing Codes.
- J. Sanitary waste and vent piping indicated may, in some instances, exceed the code requirements. If Drawings indicate individual wastes for each fixture, then the Drawings and Specifications shall hold precedence over the code even though it exceeds the prescribed waste and vent code minimum.
- K. Each vent stack shall be carried through the roof whether in combination with its parallel soil stack or in multiple combination with other vent stacks. Each vent or stack shall be increased one pipe size before passing through roof, but in no case, shall a vent through the roof be less than 4-inch.
- L. All vents through the roof less than 18-inch from an outside wall shall be offset by means of 1/4 bends to permit proper flashing.
- M. Stacks enclosed in wall chases in finished rooms shall have extension pieces placed in tees set to bring the cleanout plugs just back of the finished wall line and finished at the wall line with chromium plated cleanouts, Zurn No. 1440-1, Josam, or approved equal.
- N. Buried pipe shall be firmly bedded the full length with the exception where bell holes are required. Unless shown otherwise on the Drawings, all pipelines shall be installed with a minimum cover of 5-feet. Where unstable soil conditions occur under buildings, support shall be made from the underside of the structural slab by an approved type hanging device embedded in the concrete.
- O. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 5-feet. Pressure piping which carries gases shall be installed with a minimum cover of 4-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation, the Contractor shall install the new piping at a deeper elevation to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation shall be made either by installing fittings or by deflecting joints in accordance with the pipe manufacturer's recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade shall be approved by the Engineer.
- P. Extend downspout laterals from each roof drain and riser to storm drainage system. Make direction changes with TY fittings or Y fittings and 1/8 bends as required. Install cleanouts at each direction change, and the base of each riser, and at 50-foot intervals in horizontal straight runs.
- Q. Horizontal piping shall be suspended to a grade of not less than 1/8-inch per-foot wherever possible, and as close to construction as practicable to ensure maintenance of schedule ceiling heights and avoid interferences. Direction changes, junctions, etc., shall be made with TY fittings or Y fittings and 1/8 bends as required. Provide cleanouts at all directions, changes, dead ends, and at 50-foot intervals on straight runs.



- R. Install cleanout fittings at the base of each vertical pipe used for sanitary drains, roof conductors, or vent stacks, and at each change of direction of the building drain greater than 45 degrees F.
- S. The ends of all horizontal drain lines shall be extended to cleanouts as specified above with top of plug set level with the finished floor.
- T. Underground traps, except "P" traps, into which floor drains with removable strainers discharge, shall be provided with accessible and removable cleanouts.
- U. Where PVC piping is laid in a trench, the bottom of the trench shall be well graded and compacted to insure even bearing for the full length of the pipe and the pipe shall be snaked at approximate 50-foot intervals to provide for expansion or contraction. Prior to testing the pipe, the pipe shall be center loaded with backfill between joints before testing to prevent the pipe from arching or whipping under pressure. During backfill the line shall be pressurized to 25 psi to minimize impact damage.
- V. All valves shall be installed with their stems horizontal or above. As far as possible, all valves of the same type shall be of the same manufacturer.
- W. The T-drill method of manufacturing tees in continuous copper tubing is not acceptable.

### **3.02 EQUIPMENT CONNECTIONS**

- A. The plumbing contractor shall make all connections where required between the various piping systems and all pieces of equipment. This shall include adapters, traps, backwater valves, or other fittings required when not furnished with the equipment.
- B. Unions - Provide a union or flange in piping connections to each valve, device, or item of equipment, and elsewhere as required to makeup or disconnect piping. Each union shall be so installed as to permit the removal of parts and equipment for inspection and cleaning, and shall be installed in a position which will permit the valve device or part to be removed without disconnection of any piping except unions. Union and flange shall be installed in such a position as will be accessible for disconnection items which are to be screwed. All ground joint unions on copper lines shall be cast brass or bronze. Wrought copper unions are not to be used. All unions, where possible, shall be copper to MPT type.

### **3.03 TESTING AND ACCEPTANCE**

- A. Each pressure pipe system shall be tested hydrostatically at 150% of its operating pressure, unless otherwise stated in the Code. Test pressures and durations will be set by the Engineer and each test will be approved only after he has witnessed satisfactory pressures at the end of each test run.
- B. The drains and vent lines shall be tested by filling the entire system with water to the highest point of overflow. After the pipes have stood full for 15 minutes, all joints and connections to fixtures shall be observed.

- C. After all leaks have been repaired and approved, the lines and plumbing fixtures shall be flushed clean with hot water and left in a sanitary condition. The outside surfaces of pipes and equipment shall be cleaned of grease and dirt by a cleaning compound, then washed with water and allowed to dry.
- D. The working temperature and pressure conditions shall be imposed on piping systems for a sufficient length of time to ensure that flanges and bolts or studs have reached a point of constant temperature and have attained such changes in dimensions as will take place, after which all flanged joints and fittings on all equipment shall be retightened by the Contractor.

END OF SECTION

**SECTION 15500**  
**HEATING, VENTILATING, AND AIR CONDITIONING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing all materials, equipment, labor, and supervision related to the heating, ventilating, air conditioning, and foul air conveyance systems and control necessary for the completion of the Work in accordance with the Contract Documents.
- B. Section included controls, control wiring, and control wiring conduit for HVAC equipment less than 115 volts. Power wiring, power electrical conduit, power distribution panels, and circuit breakers, for HVAC equipment 115 volts and greater is included in Division 16.
- C. Buildings to be served include the following:
  - 1. Pump Station Control Building.
- D. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.
- E. This Section shall include but not limited to, all equipment, piping, ductwork, insulation, sleeves, plates, inserts, hangers, brackets, supports required for complete installation.
- F. All wall, roof, and floor penetrations for any building modifications which are required for the installation of the Work under this Section shall be provided by this Section. Sleeves for penetrations for new Work shall be provided by this Section and installed by others.
- G. Equipment with a suitable factory finish shall not be painted unless the finish is damaged, or the color does not match that of adjacent equipment. If the finish is damaged or the color does not match, the equipment shall be field painted under this Section in accordance with the requirements of Section 09900.
- H. Certain electrical starters, disconnects, and wiring will be provided and connected to the electric motors and equipment under Division 16. The Contractor shall refer to the Electrical Drawings and Specifications for Work included under Division 16. All control wiring shall be included in this Section and shall be installed as required in Division 16.
- I. Concrete curbs and bases required for equipment specified herein will be provided under this Section and installed by procedures in Sections 03200, 03300, 03310, and as detailed on the Drawings.
- J. Prefabricated roof curbs and prefabricated duct supports shall be furnished and installed under this Section. Flashing and roofing to be under Section 07800 and/or Section 07600.
- K. Hangers, anchors, and supports provided by this Section shall be in accordance with Section 15010.

- L. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.
- M. Provide and install all equipment specified within this Section. The Contractor shall perform all electrical installation for all voltages less than 115 volts.
- N. All electrical work for all voltages, 115 volts and greater, shall be performed under Division 16, including but not limited to, motor operated dampers, motor operated valves, control panels, and line voltage thermostats provided by this Contractor.
- O. Certain equipment furnished under this Section shall be connected to the plant control system by others as shown on the P&ID Drawings. Those connections and any remote-control connections shall be clearly labeled terminal strips within the equipment control panel.
- P. Additional product requirements are specified in Section 01350.

#### **1.02 DESCRIPTION OF SYSTEMS**

- A. Pump Station Control Building:
  - 1. Control Room: Heated and cooled by a fan coil and condensing unit split system with electric resistant heating coil with supply, return, and outside air ductwork.
  - 2. Restroom: Heated and cooled by the same unit serving the Control Room. Exhaust ventilation via a ceiling mounted exhaust fan interlocked with the room light switch.

#### **1.03 GENERAL SCOPE**

- A. Contractor to provide all labor, material, apparatus, expendable equipment, and all other services required for the construction of complete systems as outlined above, herein, and within the Drawings.
- B. Although a portion of the equipment described herein and, on the Drawings, may be installed by others, this Contractor shall be responsible for coordinating the Work performed by others so that the system or systems described herein are complete and perform as intended.
- C. The Drawings and Specifications are intended to describe the intent of the Work, and each are both complementary and independent in presenting the Work to be accomplished under this Contract.

#### **1.04 PERMITS AND INSPECTION**

- A. The Contractor shall obtain all necessary permits including the HVAC Permit, shall have all Work inspected by the proper authorities, and shall furnish such certificates of inspection and test as are required by local, State, and Federal regulations. Cost of such permits and inspections shall be included in this Section.
- B. Unless otherwise specified, Contractor shall notify Owner's representative of tests and inspections at least twenty-four hours in advance.

#### 1.05 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Descriptive information of all mechanical and electrical items used in providing a complete job.
    - c. Drawings locating anchors, inserts, and supports.
    - d. Complete list of accessories and appurtenances included with each item, complete with manufacturer's name and model number.
    - e. General arrangement and dimension drawings.
    - f. Section assembly drawings.
    - g. Materials of construction.
    - h. Certified capacity data.
    - i. Manufacturer's schematic wiring diagrams and electrical load requirements.
    - j. Shop Drawings shall include data for all equipment, piping, and valves, controls, accessories, and electrical apparatus to be supplied with equipment.
  - 2. Information for the Record:
    - a. (List material, installation, or calibration certificates).
    - b. (List any other information for the record).
    - c. Operation and maintenance manual.

#### 1.06 DRAWINGS

- A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.
- B. The exact location of apparatus, fixtures, equipment, and piping shall be ascertained by the Contractor in the field, and the Work shall be laid out accordingly. Should the Contractor fail to ascertain such locations, the Work shall be changed at his own expense when so ordered by the Engineer. The Engineer reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost to Owner.

### **1.07 ELECTRICAL EQUIPMENT REQUIREMENTS**

- A. All equipment shall be powered electrically and wired as required in Division 16.

### **1.08 AUTOMATIC TEMPERATURE CONTROL**

- A. Automatic temperature control shall include electric temperature control for heating, ventilating, and air conditioning system. Controls shall include all necessary transformers, thermostats, motor operated dampers, switches, relays, motor operated valves, contactors, control and interlock wiring, conduit, junction boxes, and all required accessories.
- B. All control wires wherever located on the project shall have wire identification on both ends of each control wire.
- C. The Contractor shall perform all electrical work as required by the National Electric Code and Division 16 of this Contract.

### **1.09 GENERAL REQUIREMENTS**

- A. Fans shall be AMCA certified.
- B. Drawings show general location of ducts, grilles, and registers. Contractor shall check electrical, architectural, and piping drawings for possible interferences and shall coordinate installation with other contractors.
- C. Equipment shall be as indicated in the Specifications and on the Drawings.

## **PART 2 PRODUCTS**

### **2.01 DAMPERS**

- A. Galvanized Volume Control Dampers:
  - 1. Ruskin Model CD-35, Arrow, or approved equal. Minimum 16 gage galvanized steel frames and steel blades with V-shaped, reinforced centers and edges. Blades shall overlap 3/8 inch when closed. Linkage constructed of heavy steel. Blade and linkage bearings of molded synthetic. Dampers shall include extended shafts with exterior locking quadrants. File mark shafts to permanently indicate damper blade positions. Dampers 12 inches and over in height shall be opposed blade type.

### **2.02 SUPPLY REGISTERS AND EXHAUST/RETURN GRILLES**

- A. Supply Registers:
  - 1. Titus Model 272FS, Anemostat, Carnes, or approved equal. Streamlined with individually adjustable blade type register, front blades parallel to the short dimension, to discharge air along the face of the register with two-way deflection. Frame and blades constructed of aluminum extrusions. Damper constructed of aluminum, with integral, gang-operated opposed blade type with removable key operator, operable from face. Finish shall be clear anodized.

- B. Exhaust/Return Grilles:
  - 1. Titus Model 50F, Anemostat, Carnes, or approved equal. Fixed type grille with 1/2 by 1/2 by 1/2-inch eggcrate core. Frame and eggcrate core constructed of aluminum extrusions. Damper constructed of aluminum, with integral, gang-operated opposed blade type with removable key operator, operable from face. Finish shall be clear anodized.
- C. The Drawings show approximate location of grilles and registers. Carefully check electrical and architectural drawings for proper placing of grilles, and registers and be responsible for exact location and size of openings required.

## 2.03 CONTROLS

- A. Each thermostat shall offer remote controlling of temperature settings into SCADA.
- B. Single-stage thermostats shall be line voltage Mercoid Series 860 or approved equal and NEMA and UL rated at or above the voltage and amperage required by the unit.
- C. Exhaust Fan Thermostats:
  - 1. Exhaust Fan Thermostat:
    - a. Manufacturers: Honeywell T631C, Johnson A19JNC-2, or approved equal.
    - b. Metal enclosure with a minimum range of 70 to 90 degrees F. Line voltage type rated for 10 amperes at 115 VAC and pilot duty at 115 volts, single-phase.
  - 2. Corrosion Resistant Exhaust Fan Thermostat:
    - a. Manufacturers: Honeywell T631F, Chromalox WCRT-100, or approved equal.
    - b. Corrosion resistant, NEMA 4X, with a minimum temperature range of 40 to 100 degrees F. Line voltage type rated for 16 amperes at 120 VAC with externally set point adjustment.
    - c. Shielded sensing bulb attached to the exterior of the thermostat.

## 2.04 SPLIT SYSTEM FAN COIL (FC) AND CONDENSING UNIT (CU)

- A. Split system fan coil unit shall consist of an indoor fan unit with remotely located air cooled condensing unit, field installed refrigerant piping and control wiring between the indoor and outdoor units.
- B. Units shall be Trane Model TWE for indoor units and Model TTA for outdoor units, Carrier, York, or equal.
- C. Fan Coil (Indoor Unit):
  - 1. General: Completely factory assembled for horizontal configuration.

2. Casing Construction: Zinc coated, heavy gauge, galvanized steel, capable of withstanding elevated static pressure, weather resistant baked enamel finish, access panels with captive screws. Complete unit insulated on the interior with foil faced, cleanable, fire retardant, permanent, odorless fiber material with captured or sealed insulation edges. Electrical and refrigeration bushings or plug connections.
  3. Evaporator Coil: Draw-through airflow, internally enhanced copper tube mechanically bonded to lanced aluminum plate fins. Factory pressure leak tested to 449 psig. Interlaced/intertwined dual circuits. Double sloped, removable, cleanable, composite drain pan.
  4. Fan Section: Double inlet, double width, forward curved, centrifugal type with adjustable belt drive and permanently lubricated bearings.
  5. Fan Motor: Shall meet energy policy of 1992 (EPACT). Permanently lubricated bearings, adjustable motor sheaves, and thermal overload protection.
  6. Refrigeration System: Dual circuit with distributors and thermal expansion valves (TXVs).
  7. Filters: Two inch, pleated, throwaway filters, for slide on rack installation, with access from side panels.
  8. Electric Heaters: Heavy duty nickel chromium elements for installation on fan discharge. Single point power connections with internal terminal strip connections with two stage control. Internally wye connected with automatic line break high limit controls.
  9. Mounting Subbase: Used for vertical floor mount configuration constructed of heavy gauge sheet metal casing matching air handling unit.
  10. Vibration Isolators: Neoprene-in-shear or spring flex for floor or suspended applications.
- D. Air Cooled Condensing Unit (Outdoor Unit):
1. General: Weatherproofed steel mounting/lifting rails, hermetic scroll compressors, plate fin condenser coils, fans, and motors, with operating range down to 0 degrees F, with low ambient accessory, certified and rated in accordance with AHRI and DOE standards and certified to UL 1995.
  2. Casing: Zinc coated, heavy gauge, galvanized steel, with weather resistant baked enamel finish. Shall meet ASTM B117, 672-hour salt spray test. Removable single side maintenance access panels. Lifting handles in maintenance access panels.
  3. Refrigeration System: Two separate and independent refrigerant circuits with each refrigeration circuit equipped with integral sub-cooling circuit. Two direct drive hermetic scroll compressor. Suction gas-cooled motors with plus or minus 10 percent voltage utilization range of unit nameplate voltage. Crankcase heaters, internal temperature and current sensitive motor overloads, factory installed liquid line filters, phase loss/reverse rotation monitor, liquid, and



- suction line service valves with gauge port, external high and low pressure cutout devices, evaporator defrost control, and loss of charge protection (discharge temperature limit).
4. Condenser Coil: Internally enhanced copper tube mechanically bonded to lanced aluminum plate fins, factory pressure tested to 600 psig.
  5. Condenser Fan: Propeller type fans, direct drive, statically and dynamically balanced.
  6. Vibration Isolators: Neoprene-in-shear or spring flex.
  7. Controls: Centralized microprocessor; indoor and outdoor temperature sensors drive algorithms, making decisions for all heating, cooling, and ventilation; and integrated anti-short-cycle timer and time delay between compressors. Completely internally wired, contactor lugs or terminal block, and single point entry. Low ambient modulating control provides unit cooling operation to outdoor ambient of 0 degrees F with discharge line pressure controls condenser fan operation.
- E. System Operational Control: Programmable thermostat, two stage heat/two stage cool, with automatic changeover.

## 2.05 VIBRATION ISOLATORS

- A. Furnish and install vibration isolators for all mechanical equipment as scheduled below.
- B. Vibration isolation equipment shall be furnished to reduce transmission of vibration between rotating mechanical equipment and the building structure, an isolation efficiency of 90% or more to be provided in all cases. Isolators shall be protected from moisture, oil, or surrounding damaging materials by an approved method of sealing the material.
- C. Vibration isolation equipment shall be as manufactured by Peabody Noise Control Corporation, Korfund, Mason, Vibrating Eliminator Company, or approved equal. Isolators and supporting bases shall be supplied by a single manufacturer. The isolation equipment shall be selected considering equipment, weight, loading, rotating speeds, and size of equipment.
- D. Type 1 - Fiberglass isolators shall be pre-compressed molded glass fibers individually coated with a flexible, moisture impervious elastomeric membrane. Isolator to provide load bearing capacities from 1 to 500 PSI. Isolator pads shall be Peabody Type 1, fiberglass isolation media.
- E. Type 1F - Floor mounted neoprene mount with cast-in tapped steel load plate.
- F. Type 2H - Combination spring and fiberglass hangers incorporating 2-inch thick neoprene jacketed fiberglass inserts in series with springs. Units shall be Peabody Model SFH.
- G. Type 3 - Vertically restrained spring type isolators to be the limiting type to restrain movement caused by reduced weight or wind loads. Units shall have 1-inch thick Type "1" fiberglass noise stop pad bonded to bottom load plate. Units shall be Peabody FLS.

- H. Type 4 - No base required; isolators attached directly to machine.
- I. Type 6 - Reinforced concrete inertia base. Bases shall be large enough to support suction fitting or elbow and discharge elbow. Bases for pumps may be "T"-shaped. Concrete for inertia pad will be under another section of this Specification. Contractor shall grout in all pumps, fans, etc., as required by the Equipment Manufacturers, with non-shrinking grout.

### **PART 3 EXECUTION**

#### **3.01 GENERAL INSTALLATION**

- B. Heating, ventilation, and air conditioning systems shall be installed complete as shown on the Drawings and as specified.
- C. Details of material and equipment installation shall conform to manufacturer's latest printed instructions, where not covered by the Drawings and Specifications.

#### **3.02 SUPPLY REGISTERS AND RETURN GRILLES INSTALLATION**

- B. Install registers and grilles in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards – Metal and Flexible.
- C. Check location of registers and grilles and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangements.

#### **3.03 FAN COIL AND CONDENSING UNIT INSTALLATION**

- B. Install in accordance with manufacturer's instructions.
- C. Install fan coils with vibration isolation.
- D. Install condensing unit on a concrete pad.

#### **3.04 CLEANING**

- B. Upon completion of installation, steam, condensate, hot water, and condenser water systems constructed of ferrous materials shall be thoroughly cleaned by circulating 10% caustic solution through systems for four hours after which systems shall be flushed out with clean water and repeated a second time.
- C. Systems shall be washed out, as prescribed, a third time after operation for three weeks and repeated as many more times as may be necessary to remove all oil, dirt, and grease from systems.
- D. Upon completion of installation of water-based systems constructed of copper and brass materials, the systems shall be thoroughly cleaned by circulating a non-corrosive chemical such as Mitco BL-5 furnished by Mitco Water Treatment of Grand Rapids, MI, 616-241-4684, or approved equal, partially drained, and recharged, circulated for six hours, flushed until clear as required by the Vendor.

- E. The system shall be refilled immediately with water and a corrosion inhibitor as prescribed by Mitco or approved equal.

### **3.05 EQUIPMENT CONNECTIONS**

- B. The Contractor shall make all connections where required between the various piping systems and all pieces of equipment. This shall include adapters, traps, or other fittings required when not furnished with the equipment.
- C. Unions - Provide a union or flange in piping connections to each valve, device, or item of equipment, and elsewhere as required to makeup or disconnect piping. Each union shall be so installed as to permit the removal of parts and equipment for inspection and cleaning and shall be installed in a position which will permit the valve device or part to be removed without disconnection of any piping except unions. Union and flange shall be installed in such a position as will be accessible for disconnection items which are to be screwed. All ground joint unions on copper unions shall be cast brass or bronze. Wrought copper unions are not to be used. All unions, where possible, shall be copper to MPT type.

### **3.06 OPERATING INSTRUCTIONS**

- B. Instruct Owner's representative in proper operation and routine maintenance of equipment. Owner's representative shall be present during equipment start-up and testing.
- C. Mount under glass at locations in each building as directed by Engineer, temperature control and interlock wiring diagrams showing operating sequence.

### **3.07 ACCEPTANCE**

- B. The working temperature and pressure conditions shall be imposed on piping systems for a sufficient length of time to ensure that flanges and bolts or studs have reached a point of constant temperature and have attained such changes in dimensions as will take place, after which all flanged joints and fittings on all equipment shall be retightened by the Contractor.
- C. Where system operating temperature is above 200 degrees F, joints shall be retightened after 200 hours of service at operating conditions.

### **3.08 OPENINGS AND SLEEVES**

- B. All penetrations through an exterior surface above grade level shall be sealed and made watertight as shown on the Drawings. For metal panels, use a sealant around the penetration on both sides of the wall.
- C. All penetrations through the fire resistance rated walls or floors shall be fire stopped as required by the NEC using the approved method as recommended by the manufacturer. Fire stops (e.g., caulk) shall have a 3-hour fire resistance rating and shall be made by the 3M Company, or approved equal.

### **3.09 CONCRETE**

- B. The Contractor shall furnish and install all concrete and reinforcing steel necessary to complete the electrical work, including foundations and all materials for concrete and reinforcing steel work wherever required. All concrete and concrete reinforcement used in the Work shall conform in quality of ingredients, mixture, strength, method of installation and workmanship to the requirements specified in Section 03300 of specifications.
- C. Concrete Slabs for Electrical Equipment - Slabs shall be provided as shown. Unless otherwise indicated, slabs shall be of 12-inch thick, 3,000 psi concrete, project 3-inch above the highest-grade point, have No. 5 reinforcing bars 12-inch on center both ways top and bottom, and set on 12-inch of No. 67 selected stone fill on top of compacted soil.
- D. Where shown on the Drawings, the Contractor shall provide a purchased concrete pad.

### **3.10 MOUNTING AND ATTACHMENT**

- B. The Contractor shall provide all devices and materials such as expansion bolts, foundation bolts, screws, channels, angles, and other attaching means required to fasten all equipment and materials to be installed on or in concrete bases or structures which are existing or provided under other sections of the Contract. Foundation bolts shall be set by using manufacturer's templates.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 NUTS AND BOLTS**

- B. All nuts and bolts used under this Section shall be (Type 304 stainless steel or higher grade) as specified or shown on the Drawings.

END OF SECTION

This page was intentionally left blank.



**SECTION 15502**  
**TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing all materials, equipment, labor, and supervision to test, adjust, and balance all heating, ventilating, air conditioning, and foul air conveyance systems necessary for the completion of the Work in accordance with the Contract Documents.
- B. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

**1.02 ADJUSTMENTS AND BALANCING**

- A. General:
  - 1. The Contractor shall engage the services of an independent test and balance agency, hereinafter called the Balancing Subcontractor, that specializes in and whose business is limited to the testing and balancing of heating, ventilating, and air conditioning systems. The agency selected shall be a fully certified member of the Associated Air Balance Council (AABC), or an independent firm whose principals are registered Professional Engineers.
  - 2. Testing and balancing of all air conditioning and refrigeration systems shall be performed in complete accordance with the AABC "Standards and Instrumentations Form No. 81226, Volume I" as published by the AABC, including all current revisions thereto and/or ANSI/ASHRAE 110.
- B. Workmanship:
  - 1. All Work shall be done by technicians skilled in the particular field involved under the direct supervision of a Registered Professional Engineer and with the best modern practices and equipment.
  - 2. All instruments used for measurement shall be accurate and calibration for each instrument shall be available for examination. The Engineer may request instrument recalibration, or the use of other instruments, where accuracy of readings is questionable.
  - 3. The Balancing Subcontractor shall consult all drawings, construction details, job site, and confer and cooperate with others to avoid interference.
  - 4. The Balancing Subcontractor shall check all control interlocks and cooperate with the control Subcontractor in adjusting and calibration of control equipment.
  - 5. Any ceiling tile that is damaged by the Balancing Subcontractor shall be replaced with new tile identical to that damaged.

**1.03 RESPONSIBILITY FOR PROPER BALANCING AND TESTING**

- A. The final testing, adjusting, and balancing and the test and balance data shall be witnessed by the Engineer's Project Representative if required by the Owner.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

**3.01 EVALUATION OF SYSTEM**

- A. The Balancing Subcontractor shall furnish all materials and equipment necessary to properly measure the air capacity of the system, the electrical voltage and current, fan speeds, static pressures, air velocity, water pressure drops, refrigeration pressures, and all other readings normally necessary to evaluate the performance of a system, adjust the quantities to those called for, and test the system.

**3.02 COMPONENT IDENTIFICATION**

- A. The Contractor is responsible for the identification of the equipment.

**3.03 TESTING ACCESSES**

- A. The Contractor shall provide and/or arrange for all labor and material such as valves, tap holes, and plugs in the location required to perform the Work.

**3.04 INITIAL BALANCING - AIR SYSTEMS**

- A. As soon as electrical power is available, the Balancing Subcontractor shall check all equipment for electrical problems, check rotation of motors, read voltage and current in each leg of each motor, heater, etc., and check the readings against the nameplate.
- B. The Balancing Subcontractor shall operate all fan powered units (with filters in place) and adjust the units for maximum air supply by reading motor power supply. Supply outlets shall be adjusted to the required air quantity. If the air quantity at this point does not meet design requirements, the Contractor shall notify the Engineer.
- C. The return air system shall then be adjusted to design capacity with the proper outside air.
- D. Each exhaust system shall be checked and balanced to the design air quantity.
- E. After supply and return air are in balance and the quantity correct, the outside air dampers shall be adjusted to the air quantity shown on the Drawings. If economizer control is specified, check for proper setting of the controls and for proper operation of the dampers (outside air and relief).



### 3.05 READINGS REQUIRED TO BE REPORTED

- A. The following readings shall be made and reported to the Engineer after the building is balanced and all equipment is operating properly. Measurement shall be made with a cone with a calibrated outlet and velometer equal to Alnor.
- B. All readings shall be recorded for each supply and return opening, including exhaust hoods and openings. All readings made shall be recorded, and if any readings are invalid, they shall be identified as such. Any invalid readings shall be explained by a note on the print.
- C. Actual air quantity readings shall include:
  - 1. Each supply register outlet.
  - 2. Each return or exhaust grille inlet.
  - 3. Duct system losses based on the supply and the sum of the discharges. The equivalent losses are to be calculated for return duct in each system.
- D. Temperature readings required as above are:
  - 1. Outside air at equipment.
  - 2. Return air at unit.
  - 3. Supply air leaving unit.
  - 4. Mixture of outside and return air before entering the cooling or heating coil or heater. Readings 1, 2, and 4 allow the determination of the outside air/return air ratio.
- E. Electrical readings required are:
  - 1. Measured voltage and amps on each phase of each major motor (compressor), evaporator fan, condenser fan(s), roof exhaust fans, etc.) while the equipment is under maximum normal load.
  - 2. The nameplate voltage and current for each of the above motors.
- F. Refrigeration readings required are:
  - 1. Suction and discharge pressure of each compressor or, in the case of packaged condensing units, the suction and liquid line pressure.

### 3.06 CONTROL SEQUENCE

- A. All control sequencing electrical interlocking shall be tested and verified. This Work shall be accomplished with a representative of the heating, ventilating, and air conditioning Contractor and temperature control Contractor present and assisting.

### 3.07 INSTALLATION TOLERANCES

- A. Air Handling Systems:
  - 1. Adjust system to within  $\pm 5$  percent of design for supply systems.

2. Adjust system to within  $\pm 10$  percent of design for return and exhaust systems.
- B. Air Outlets and Inlets:
  1. Adjust total to space within + 10 percent and -5 percent of design to space.
  2. Adjust individual outlets and inlets in space to within  $\pm 10$  percent of design.

### 3.08 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

## PART 4 SPECIAL PROVISIONS

### 4.01 BALANCE REQUIREMENTS

- A. Balance all air systems to the amounts shown in the HVAC equipment schedules, HVAC plans, and airflow schematics.

### 4.02 MISCELLANEOUS TESTS

- A. The Balancing Subcontractor shall perform building pressure tests with outside temperature and wind velocity noted at points of typical location inside building on both lee and windward side of building. Tests to be made with all supply and exhaust systems in normal operation and with supply systems at minimum outside air at approximately nominal wind velocity outside.

END OF SECTION

**SECTION 15503  
FANS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing fans as shown on the Drawings, as scheduled in Part 4, and as specified herein.
- B. The fans shall be furnished with all drives, belts, guards, support brackets, curbs, anchor bolts, vibration isolators, dampers, motor and temperature controls, and all other equipment as required on the Drawings and schedules in Part 4 of this Section.
- C. All Work performed under this Section shall comply with and be in accordance with all approved trade practices and manufacturer's recommendations.
- D. The fans required shall serve the systems as described in Section 15500.
- E. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Shop Drawings.
    - c. Shop drawings shall include certified fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
    - d. Manufacturer's literature including accessories.
  - 2. Information for the Record:
    - a. Certification that units are licensed to carry the AMCA "A" Seal.
  - 3. Operation and maintenance manual.

**1.03 MOTOR AND EQUIPMENT REQUIREMENTS - WIRING, CONDUIT, AND STARTER**

- A. All wiring, including factory prewired units, shall conform to NEC Standards.
- B. Motors, controls, and disconnects shall be furnished as required in Part 4 of this Section.
- C. All fans and motors required for explosion hazard areas shall be shipped prewired from the factory or shall be able to be connected in the field as required by the National Electrical Code for the NEMA class specified.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Fan motor starters and wiring to fan motor and damper operators, including interlocks shall be installed as required under the Division 16.
- B. Prefabricated curbs are to match fan requirements and are as specified in Section 15505.
- C. Vibration isolators shall be provided for all supports.
- D. Provide duct companion flanges for round duct connections to the unit. Provide back-draft dampers of the gravity type for units discharging to the outside or against any pressure from other sources.
- E. Controls shall be installed as specified in Section 15500.
- F. Units in exposed locations shall be provided with weather protection.
- G. Motors required for explosion hazard areas shall meet Class 1, Division 1, Group D classification as required per the NEC.
- H. All fans required for explosion hazard areas shall meet AMCA 99-0401-66, Type A construction.

### **2.02 FANS GENERAL**

- A. Fans shall be as indicated in the HVAC equipment schedules on the drawings as manufactured by Loren Cook, Greenheck, Penn, or approved equal.

### **2.03 CEILING MOUNTED EXHAUST FAN**

- A. Manufacturers: Loren Cook Model GC-148, Greenheck, Penn or approved equal.
- B. Fan Unit: Direct-driven, ceiling mounted, forward curved fan, centrifugal type. Injection molded from a specifically engineered resin exceeding UL requirements for smoke and heat generation, and motor isolation mounted to a one piece galvanized stamped steel integral motor mount/inlet.
- C. Fan Wheel: Wheel shall be centrifugal forward curved type, injection molded of polypropylene resin. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
- D. Electrical Characteristics and Components:
  - 1. Motor: Follow NEMA MG1. Heavy-duty type with permanently lubricated sealed bearings. Provide built-in overload protection for single-phase fractional horsepower motors.
  - 2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

3. Disconnect Switch: Provide integral mounted and pre-wired NEMA 1 lockable disconnect switch.
- E. Accessories:
  1. Grille: White, high impact styrene injection molded grille.
  2. Backdraft Damper: Integral, gravity-actuated, aluminum frame and multiple-blade construction, felt edged with nylon bearings.
  3. Wall Cap with Damper: Minimum 0.020 aluminum construction with closed cell foam tape and stainless steel spring on damper door, stainless steel pivot rod, and wind guard for door updraft protection.
  4. Fan Speed Controller: Integrated circuitry, solid state, variable speed, pre-wired, integrally mounted, fan speed controller, for use in balancing proper airflow.
  5. Vibration Isolators: Rubber in shear type for ceiling mounting.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Unit shall be installed as recommended by the manufacturer using the proper supports and isolators for quiet operation.
- B. Proper rotation of the fan shall be verified.
- C. Belts or speed control shall be adjusted to provide the design system air quantity at the system static pressure.
- D. The current draw shall be measured and compared to the nameplate current shown.
- E. The installation is not complete until the system has been balanced to provide the correct air quantity and has been tested to demonstrate the correct system performance. See Balancing and Testing, Section 15502.

#### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

This page was intentionally left blank.

**SECTION 15504**  
**MECHANICAL SYSTEMS INSULATION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing all materials, equipment, labor, and supervision to install insulation work including insulation, cements, mastics, adhesives, attachment pins, studs or clips, covering, lagging, jackets, hardware, flashing, and finishes.
- B. Work shall be complete, in full conformance with the material manufacturer's requirements and recommendations, applicable national standards, the National Insulation Contractors Association, National Commercial, and the Industrial Insulation Standards.
- C. All insulation as applied shall meet or exceed the requirements of this Section or ASHRAE/IES 90.1 whichever is greater.
- D. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. A complete description of each insulation system.
    - c. Plate submittals for tanks and vessels as identified by NICA, Current Edition.
    - d. Vendor information and catalog data detailing each component of the system including the method of fastening.
    - e. Design information for fiberglass duct systems including size and spacing of reinforcement system proposed.
  - 2. Information for the Record:
    - a. Substantiation of vendor compliance with codes, standards, or test methods noted herein.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Materials furnished under this specification shall be standard, catalogued products, new and commercially available, suitable for service requiring high performance and reliability with low maintenance, and free of all defects.

- B. Materials include insulation materials, accessories (staples, bands, mesh, wire, clips, pins, tape, anchors, corner angles, and similar recommended accessories) and compounds (cements, adhesives, coatings, sealers, protective finishes, and similar items recommended for the applications indicated).
- C. The Contractor, unless clearly otherwise stated, shall supply materials which meet the owner's requirements with respect to the design criteria, thermal conductivity, and standards.
- D. The Contractor shall warrant that materials furnished and installed be free of defects for a period of one year from the time the system is completed.
- E. If a defect occurs in materials, workmanship, or application within the stated time, the Contractor shall promptly repair or replace the defect. Damages caused by others shall be repaired at the expense of the damaging party.
- F. Specified components of the insulation system, including facings, mastics, and adhesives should have a fire hazard rating not to exceed 25 for flame spread, and 50 smoke developed, as tested under ASTM E84.
- G. All accessories and materials (i.e., coatings, adhesives, sealers, etc.) are to be shipped to the job site in marked, unopened containers as received from the manufacturer.
- H. Provide and install insulation, cements, mastics, adhesives, covering, lagging, flashing, and finishes in full conformance with the material manufacturer's requirements and the recommendations, applicable national standards, the National Insulation Contractors Association, and the Industrial Insulations Standards.

## **2.02 PIPING SYSTEMS**

- A. Solid foamed closed cell (Insulation Class CG) shall be constructed of closed cell glass bubbles conforming to ASTM C552, Pittsburgh Corning Foamglass, or approved equal. Conductivity shall be 0.33 Btu-inch per hour-square feet-degrees F.
- B. Flexible foamed plastic closed cell (Insulating Class FP) shall conform to ASTM C534, Armstrong Armaflex II, Manville Rubatex, or approved equal. Conductivity shall be 0.28 Btu-inch per hour-square feet-degrees F. Outside installation finish shall be two coats of Armaflex Finish or Rubatex 374. Insulation shall not be constructed of polystyrene, polyisocyanurate, or polyethylene/polyolefin materials.
- C. Calcium Silicate (Insulation Class HT) shall conform to ASTM C533, Manville, Owens Corning, Pittsburgh Corning, CertainTeed Manson, or approved equal. Conductivity shall be 0.45 Btu-inch per hour-square feet-degrees F at 500 degrees F.
- D. Fiberglass (Insulating Class MT) shall conform to ASTM C489, Owens Corning 25, CertainTeed or Manson, or approved equal. Insulation cement shall conform to ASTM C193. Insulation and adhesives or cements, and finishes shall have composite smoke and fire ratings as tested under ASTM E84, NFPA 255, and UL 723 not exceeding a flame spread of 25 and Smoke Developed rating of 50. Conductivity shall be 0.30 Btu-inch per hour-square feet-degrees F at 200 degrees F. The required jacket shall be ASJ, SSL, or FRJ as specified.



- E. Fiberglass (Insulating Class LT) shall conform to CertainTeed Manson Alley-K Snap-On Fiber Glass Pipe insulation with factory applied all service jacket and self-sealing lap. The insulation shall be one-piece with a k value of 0.23 Btu-inch per hour-square feet-degrees F at 75 degrees F.
- F. Duct insulation (Insulation Class DW3) shall conform to ASTM -1136 and ASTM C612, 3 pounds per cubic foot density, CertainTeed Manson, Malvern, PA.; IB 300, Great Lakes Textiles, Walton Hills, OH; Rigid Wrap, or approved equal. Interior installations shall be faced with FSK. Conductivity shall be 0.23 Btu-inch per hour-square feet-degrees F at 75 degrees F.
- G. Insulation thickness shall be as specified in Part 4.
- H. Aluminum lagging shall be 0.016-inch thick with banding straps on minimum 18-inch centers and at each joint.
- I. Plastic lagging or jacketing shall be Manville Zeston 2000 PVC, CertainTeed Manson, or approved equal.

## 2.03 DUCT INSULATION

- A. Unless noted on the Drawings, all ducts shall be covered with insulation.
- B. Manufacturers: Owens Corning, Johns Manville, Knauf, or approved equal.
- C. Flexible Glass Fiber External Wrap:
  - 1. Type: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
  - 2. Thermal Conductivity: ASTM C518, 0.25 Btu-inch per square feet-hour-degrees F at 75 degrees F.
  - 3. Maximum Operating Temperature: 250 degrees F.
  - 4. Density: 1.5 pound per cubic foot.
  - 5. Thickness: 2 inches.
- D. Rigid Glass Fiber External:
  - 1. Type: ASTM C612, Type IA or IB, rigid glass fiber, commercial grade with factory applied reinforced aluminum foil facing meeting ASTM C1136, Type II.
  - 2. Thermal Conductivity: ASTM C518, 0.23 Btu-inch per square feet-hour-degrees F at 75 degrees F.
  - 3. Maximum Operating Temperature: 450 degrees F.
  - 4. Density: 3.0 pound per cubic foot.
  - 5. Thickness: 1 inch.
- E. Flexible Glass Fiber Duct Liner:
  - 1. Type: ASTM C1071. Type I, flexible, glass fiber duct liner with coated air side. Must meet the requirements of fungi and bacteria resistance.

2. Thermal Conductivity: ASTM C518, 0.23 Btu-inch per square feet-hour-degrees F at 75 degrees F.
  3. Maximum Operating Temperature: 250 degrees F.
  4. Density: 3.0 pound per cubic foot.
  5. Maximum Air Velocity: 6,000 feet per minute.
  6. Thickness: 1 inch.
- F. Flexible, Closed Cell Elastomeric:
1. Type: ASTM C534, Type II, flexible closed sell elastomeric insulation, sheet.
  2. Thermal Conductivity: ASTM C518, 0.27 Btu-inch per square feet-hour-degrees F at 75 degrees F.
  3. Service Temperature Range: Minus 58 to 180 degrees F.

## **2.04 DUCTWORK INSULATION JACKETS**

- A. Aluminum Duct Jacket:
1. ASTM B209.
  2. Thickness: 0.032 inch thick sheet.
  3. Finish: Embossed.
  4. Joining: Longitudinal slip joints and 2 inch laps.
  5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
  6. Metal Jacket Bands: 3/8 inch wide, 0.015 inch thick aluminum.
- B. Vapor Retarder Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Water Vapor Permeance: ASTM E96; 0.02 perms.
  3. Secure with pressure sensitive tape.
- C. Canvas Duct Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

## **2.05 DUCTWORK INSULATION ACCESSORIES**

- A. Vapor Retarder Tape:
1. Kraft paper reinforced with glass fiber yarn to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof type.

- D. Liner Fasteners : Galvanized steel; self-adhesive pad, impact applied, or welded with integral or press on head.
- E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- H. Adhesives: Compatible with insulation.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.
- B. The Contractor shall be responsible for coordination and cooperation with the Owner and other trades so that the installation is performed with minimum interference and conflict.
- C. The final appearance of the insulation work shall be a neat, workmanlike and attractive insulation system.
- D. Progressive testing of systems to be insulated shall have been completed, inspected, and approved by Owner's representative before insulation is applied.
- E. Insulation shall not be applied until all surfaces are clean, dry, free of dirt, dust, grease, frost, moisture, and other imperfections.
- F. Suitable application temperature and conditions shall be provided by others.
- G. Insulation shall be protected from moisture and weather during storage and installation. Applied insulation which has become wet shall be thoroughly dried before it is sealed or jacketed.
- H. The Contractor shall not arc-weld brackets, clips, or other devices to ASME coded pressure vessels or piping. Insulation pins or studs shall be as specified and installed in accordance with acceptable standards.
- I. Insulation, fabric, and jacketing shall be protected from mechanical damage during construction. Damage by the insulator shall be repaired without cost to the Owner.
- J. Contractor is responsible for proper material storage at the Work site.
- K. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the Contractor without cost to the purchaser.
- L. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns, and walls have been provided.

- M. All insulation at handholes, access doors, or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.
- N. Where insulated pipes or ducts pass through sleeves or openings, the full specified thickness of the insulation shall pass through the sleeve or opening.
- O. Vapor barriers shall be continuous through sleeves, hangers, etc. If pierced, vapor barriers shall be covered and suitably resealed.

### 3.02 INSTALLATION

- A. Pipe insulation shall include all fittings, valves, (including bonnets) piping specialties, pumps, tanks, and heat exchangers.
- B. Prior to insulating, all required inspections, examinations, and tests (such as hydrostatic tests, air pressure tests, and heat tracing tests) shall be successfully completed.
- C. All insulation shall be well secured to the item being insulated, by means of wire, clips, studs or other proven fasteners.
- D. All fittings, flanges and valves shall be insulated with block, preformed or sectional insulation of the same material as adjacent pipe material, except on sizes up to 3-inch, two or more layers cemented in place may be used to obtain the required thickness of insulation.
- E. The insulation and its covering shall be applied free of gaps or voids. All joints, cracks and depressions shall be pointed with cement. When irregular or compound shapes require insulation be cut and fit, all gaps shall be filled. Cut and fit jacketing shall be free of jagged edges and shall provide complete coverage.
- F. Insulation of any pipe line or any other item shall include insulation of all take-off connections (including those for instruments, controls, vents, drains or sampling) and all branch connections, up to and including the first valve in the take-off connection or branch connection.
- G. Double layer insulation shall have staggered joints. Each layer shall be wired in place.
- H. Insulation on vertical pipes shall have provisions which preclude eventual gaps in the insulation as a result of pipe expansion, settling, or shrinking of the insulation, or other causes. The provision may be intermediate supports, insulation "expansion joints" or other means approved by the Engineer.
- I. All welding (including stud welding and other attachment on boiler, pressure vessels, piping systems and equipment) shall conform to applicable codes and standards.
- J. At each pipe hanger or support, the insulation shall accommodate the hanger or supports and its anticipated movement.
- K. Insulation work on all items (including boilers, pumps, vessels, etc.) shall conform to the requirements and recommendations of the respective manufacturers.
- L. Insulation work of all of the following items shall be blankets which are designed to allow removal, reuse and replacement of the insulation work:
  - 1. Flanges, 6-inch NPS or larger.

2. Manholes, handholes, and other access devices.
- M. Insulation on heat traced pipe lines shall be such that the specified nominal thickness of insulation is uniformly maintained around the pipe.
- N. The Contractor shall identify and insulate all Personnel Protection Areas and insulate as necessary in accordance with the following:
  1. All points where personnel can easily come in contact with hot surfaces.
  2. Areas are to include all hot surfaces within an elevation of 7-feet and with 2-feet of the sides of all access zones, walkways, platforms, working areas, or stairways and ladders.
- O. Insulation Class DW shall be installed as noted in National Commercial & Industrial Insulation Standards - 1988, as published by Midwest Insulation Contractors Association. The method shown on plate 19 shall be used for interior ducts, and that shown on plate 20 shall be used for exterior ducts. Staple - stitching shall not be used.
- P. Roof drain systems shall be insulated when located within any building.
- Q. Ducts carrying 100% outside air from a conditioning unit within 20 feet of the building served are not required to be insulated.
- R. All external lines insulated above ground shall be enclosed with Class CG insulation and aluminum lagging. All external insulated lines belowground shall be enclosed with Class CG insulation and coated with Pittcote 300 and Pitwrap SSII.
- S. The insulation and its covering shall be applied free of gaps or voids. All joints, cracks, ends, and depressions shall be pointed with cement or mastic as recommended.

### 3.03 DUCT INSULATION

- A. Duct dimensions indicated on the Drawings are finished inside dimensions.
- B. Insulated ductwork conveying air below ambient temperature:
  1. Provide insulation with vapor retarder jackets.
  2. Finish with tape and vapor retarder jacket.
  3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
  1. Provide with or without standard vapor retarder jacket.
  2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor: Finish with canvas sized for finish painting or aluminum jacket.

- E. External Glass Fiber Duct Insulation:
  - 1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
  - 2. Secure insulation without vapor retarder with staples, tape, or wires.
  - 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
  - 4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
  - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- F. External Elastomeric Duct Insulation:
  - 1. Adhere to clean oil-free surfaces with full coverage of adhesive.
  - 2. Seal seams and butt joints with manufacturer's recommended adhesive.
  - 3. When application requires multiple layers, apply with joints staggered.
  - 4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
  - 5. Lift ductwork off trapeze hangers and insert spacers.
- G. Duct Liner:
  - 1. Adhere insulation with adhesive for 100 percent coverage.
  - 2. Secure insulation with mechanical fasteners. Comply with SMACNA Standards for spacing.
  - 3. Seal and smooth joints. Seal and coat transverse joints.
  - 4. Seal liner surface penetrations with adhesive.
  - 5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
- H. Duct Exterior to Building:
  - 1. Install insulation according to external duct insulation or duct liner per installation instructions above.
  - 2. Provide external insulation with vapor retarder jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
  - 3. Finish with aluminum duct jacket.
  - 4. Caulk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.
  - 5. Prepare duct insulation for finish painting. Refer to Section 09900.

### 3.04 OWNER'S ACCEPTANCE

- A. All materials, accessories, and methods of installation and fabrication are subject to the Owner's inspection and approval during any phase of the Work.

## PART 4 SPECIAL PROVISIONS

### 4.01 PIPE INSULATION SCHEDULE

- A. The pipe insulation system requirements schedule is as follows:

PIPE INSULATION SYSTEM REQUIREMENTS SCHEDULE						
Pipe Line	Size	Pipe Class*	Ins. Thickness	Lagging*	Finish	Comments
Condensate Drainage	to 2"	FP	1"	Plastic	Black or White	

Note: \* All external lines insulated above ground shall be enclosed with Class CG and Aluminum Lagging.

### 4.02 DUCT INSULATION SCHEDULE

- A. Outside Air Ductwork Upstream of Equipment: Rigid glass fiber external.
- B. Supply Ductwork: Flexible glass fiber duct liner.
- C. Return Ductwork: Flexible glass fiber duct liner.
- D. Exhaust Ductwork: External glass fiber.

### 4.03 PAINTING

- A. All pipe, equipment, and tank insulation shall be painted as required by Section 09900.

END OF SECTION





**SECTION 15506  
DUCTWORK**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing all materials, equipment, labor, and supervision related to the heating, ventilation, air conditioning, and foul air ductwork systems necessary for the completion of the Work in accordance with the Contract Drawings.
- B. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.
- C. Additional product requirements are specified in Section 01350.

**1.02 DESCRIPTION OF SYSTEMS**

- A. Systems shall be as shown on the Drawings.

**1.03 DESIGN OF SYSTEM**

- A. The Contractor shall design the duct to meet the required operating pressure by means of duct material thickness, spacing of joints, and reinforcing and joint construction.

**1.04 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Descriptive literature, bulletins, or other data describing each item of equipment.
    - c. Complete list of accessories and appurtenances included with each item complete with manufacturer's name and model number.
    - d. General arrangement and dimension drawings.
    - e. Sectional Assembly Drawings.
    - f. Materials of construction.
    - g. Submit sample of duct material, made up into an elbow with turning vanes.

- h. Certified leak test as required by SMACNA HVAC Duct Leakage Test Manual.
- 2. Information for the Record:
  - a. Certified design capacity data for each section of duct.
- 3. Operation and maintenance manual.

## **PART 2 PRODUCTS**

### **2.01 SHEET METAL - RECTANGULAR**

- A. Ductwork, unless otherwise noted, shall be galvanized sheet metal and shall be built as required by HVAC Duct Construction Standards, Metal and Flexible, latest edition as published by SMACNA and diagrammatically shown on the Drawings.
- B. Ductwork 18-inch width and over shall be cross-broken, or ribbed and stiffened, so that it will not "breathe," rattle, vibrate, or sag.
- C. Curved elbows shall have a throat radius equal to the duct width. Provide splitter or turning vane(s) in all elbows.
- D. Square elbows shall have double-thickness turning vanes, unless single-thickness vanes are clearly identified on the Drawings.
- E. Transitions in ductwork shall be made with a slope not exceeding 1 to 5, preferably 1 to 7.
- F. Supply duct splits shall be provided with splitter damper and adjustable locking quadrant. Splitter blade shall be 1.5 times the smaller split width.
- G. Supply duct takeoffs shall include an adjustable air-turning device equal to Carnes No. 1250 Variturn Model 2, 3, or 4, or approved equal.

### **2.02 SHEET METAL - ROUND**

- A. Round sheet metal duct shall be constructed as required in HVAC Duct Construction Standards as published by SMACNA and referred to above. Low pressure duct may be shop fabricated, using good practice. Medium and high-pressure duct shall be manufactured product by a firm regularly engaged in such work and with a catalog listing construction, weight, Specifications, and pressure losses. Flat oval shall be same as medium pressure duct above.
- B. Round duct insulated internally shall be a product of a manufacturer engaged in such production and shall have an internal perforated liner equal to United Acoustic K-27.
- C. Flat oval duct insulated internally shall be same as B. above. Flat oval duct may be used in place of round or rectangular duct, provided the insulation thickness specified, and diffuser neck shall be rectangular to match duct.

### 2.03 GALVANIZED STEEL DUCTWORK

- A. Duct Material: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 zinc coating in conformance with ASTM A90.

### 2.04 AUXILIARY EQUIPMENT

- A. Duct reinforcing and hangers shall be of the same material as the duct system.
- B. At air handling units, provide flexible collars on all duct connections. Flexible materials to be "Ventglas" 30-ounce material, "Durolon" 26-ounce material, or approved equal, and be rated for pressure service required.
- C. Duct splitter dampers - Young Regulator Co., Barber Coleman, Carnes, Hart and Cooley, or approved equal.
- D. Spiral duct - Young Regulator Co., United Sheet Metal Division, or approved equal.
- E. Turning devices - Carnes, Barber Coleman, Hart and Cooley, or approved equal.
- F. Turning devices and splitter damper hardware for fibrous glass duct - Duro Dyne, or approved equal.
- G. Mastics and Sealers - Foster Products, HB Fuller Co., Vadnais Heights, MN, United McGill, or approved equal.
- H. Fasteners: Rivets, bolts, or sheet metal screws.

### 2.05 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers: Ductmate Industries, Inc., Proflex, Duro Dyne, Metal Fab, or approved equal.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated.
- C. Connector: Fabric crimped into metal edging strip.
  - 1. Fabric: UL listed, fire-retardant, neoprene-coated, woven glass fiber fabric to NFPA 90A, minimum density 30 ounces per square yard.
  - 2. Net Fabric Width: Approximately 3 inches wide.
  - 3. Metal: 3 inches wide, 24 gage galvanized steel, 0.032-inch-thick aluminum, 24 gage Type 316 stainless steel.

### 2.06 DUCTWORK FABRICATON

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Use 45-degree entries for taps or tees. Construct tees, bends, and radius elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and

where rectangular elbows are used, provide single thickness turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two gages heavier than the duct gages as indicated in SMACNA Standard. Joints shall be minimum 4 inches cemented slip joint, brazed or electric-welded. Prime coat welded joints.
- E. Provide standard 45-degree lateral wye take-offs unless otherwise indicated where 90-degree conical tee connections may be used.
- F. Duct Inlet/Outlet Screens: Provide duct inlets or outlets with wire screen, constructed of the same material as the ductwork it is serving, 0.063-inch diameter (16 gage), 1/4 inch by 1/4-inch mesh (2 mesh).

## **2.07 MANUFACTURED DUCTWORK AND FITTINGS**

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION OF DUCT SYSTEMS**

- A. Manufacture, install, seal, and insulate all ductwork as shown on the Drawings and as required by SMACNA manuals.
- B. Install ducts to preserve for fire resistance rating of partitions and other elements.
- C. Duct sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Low pressure ductwork and fittings shall be made tight for minimum air leakage. Large or noisy leaks will not be accepted. Duct tape shall not be used to seal joints, to make transitions, or for any other reason except on the outside of wrapped insulation. Duct tape shall not be used on sheet metal.
- E. All ductwork shall have all joints, seams, and laps sealed to Class “C” duct sealing requirements with mastic equal to Hardcast DT-5300 to ensure a completely airtight duct system.
- F. All duct systems shall be at least 95% efficient in volumetric transfer. The Contractor shall demonstrate efficiency by testing.
- G. Hangers for ductwork shall be in accordance with the SMACNA Standards, Plate Nos. 18 and 19, hanger for ducts and upper attachments. Hanger strap material and angles shall be galvanized. With bar joist and roof construction, use welded studs or C-clamp with retaining clip attached to the bar joist. In all cases, the maximum hanger spacing shall not be exceeded and the hangers shall be readily removable as required by SMACNA.

- H. Ducts may be hung from the building construction by strap hangers fastened to the duct in not less than two places and rigidly braced against swaying. Do not fasten any hanger to metal roof decking. Strap material shall be aluminum, stainless steel, or galvanized to be compatible with the service requirements.
- I. Where ducts pass through walls or floors, sheet metal closures shall be provided to close openings around ducts except where noted by specific detail. All passages shall be airtight to restrict air, moisture, and dust migration.
- J. All ductwork exposed to weather shall have all joints, laps, edges, etc., sealed and coated with duct sealer equal to Hardcast DT-5300 and applied with FTO-20 adhesive or approved equivalent.
- K. All ductwork exposed to weather and not insulated shall have all joints, laps, edges, etc., sealed and coated with duct sealer equal to Hardcast DT-5300 and applied with FTO-20 adhesive or approved equivalent.
- L. At rough-cut openings for fans, louvers, and where exposed ducts pass through walls, floors, or ceilings, provide sheet metal escutcheons to close openings around ducts and wall openings.
- M. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

### **3.02 INSPECTION**

- A. Subject completed duct system to pressure and leakage test as required in Section 15500 of the Specifications.

## **PART 4 SPECIAL PROVISION**

### **4.01 DESIGN PRESSURE**

- A. Design pressure required is 2-inch WC for all ducts.

### **4.02 FIRE STOPPING**

- A. Provide for and install fire dampers where noted.

### **4.03 DUCTWORK MATERIAL SCHEDULE**

- A. Control Room: Galvanized steel.
- B. Restroom: Galvanized steel.

END OF SECTION



**SECTION 16010**  
**GENERAL ELECTRICAL PROVISIONS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes general administrative and procedural requirements in accordance with the Drawings and as specified herein.
- B. The Contractor shall furnish and install all wire, conduit, disconnects, and related items, for HVAC equipment 120 volts or greater under Division 16. Controls, control wiring, and control conduit for HVAC equipment less than 120 volts shall be furnished and installed under Division 15.
- C. Telephone system wires, cable, equipment, and instruments shall be furnished and installed under Division 16 unless specified otherwise in Part 4.
- D. The responsibility for the following equipment items and Work shall be as listed below:
  - 1. Motors, unless indicated otherwise, shall be furnished and installed under other sections, but shall be wired as indicated on the Drawings under Division 16.
  - 2. Controls for motors on mechanical equipment unless indicated otherwise, will be furnished under other sections, but shall be installed and wired under Division 16.
  - 3. Unless otherwise indicated, all electrical and control equipment not furnished under Division 16 shall be installed and wired under Division 16.
  - 4. Electrical and control equipment furnished under Division 16 but which is to be installed under other sections, shall be wired under Division 16 as indicated on the Drawings and Specifications.

**1.02 SUBMITTALS**

- A. Specific submittals will be identified in individual sections of Division 16.

**1.03 QUALITY ASSURANCE**

- A. Work shall comply with the latest edition of NEC as prepared by NFPA, NESC.
- B. Contractor shall comply with applicable local electrical code requirements, where provisions of local codes are modified or supplemented with NEC, the more stringent interpretation shall prevail.
- C. Equipment and materials shall be new and, if of the same type as other performing parts of the same system, shall be the products of the same manufacturer.
- D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum of five years.

- E. Equipment, materials and installation shall comply with applicable requirements of NEMA, IEEE, and ANSI.
- F. All electrical equipment shall be listed and labeled by UL.
- G. Electrical enclosure requirements shall conform with area classifications, whether designated on the Drawings or not.
- H. Contractor shall provide Owner with all certificates of final inspection from the agency of proper authority prior to receiving final payment.

#### **1.04 ELECTRICAL CONTROL AND COORDINATION**

- A. Installation of electrical equipment shall be scheduled, sequenced, and positioned to efficiently coordinate the best flow of Work for electrical systems and all other non-electrical construction activities.

#### **1.05 PRODUCT HANDLING**

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. A copy of these instructions shall be included with the equipment at the time of shipping.
- B. Equipment damaged in shipment or storage shall not be installed and shall be replaced by the Contractor.

#### **1.06 GUARANTEE**

- A. Provide complete warranty information for each item. Include the following information:
  - 1. Date of beginning warranty period.
  - 2. Duration of warranty.
  - 3. Warranty options.
  - 4. Name, address, phone numbers, and procedures for filing warranty claims.
- B. The Contractor shall warrant the completed system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one year from the date of substantial completion.

### **PART 2 PRODUCTS**

#### **2.01 NEMA RATINGS**

- A. Equipment and panels shall be NEMA 4X stainless steel unless designated otherwise on the Drawings, or in the electrical or equipment specifications.



### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Coordinate electrical system, equipment, and materials installations with other building components and building trades.
- B. If the current requirement of any motor or piece of equipment is increased to such an extent that the wiring, conduit, or starter for that motor or equipment must be increased from that shown on the Electrical Drawings, the Contractor shall furnish and install the larger items under the section the equipment is specified. The increased wiring, conduit, and starter cost shall be included in the motor or equipment cost under the section the equipment is specified and no additional compensation will be allowed.
- C. Certain equipment furnished under the equipment sections shall be connected to the plant control system as shown on the P&ID drawings. Mechanical and electrical components for these connections shall be furnished, under the equipment sections, as required to provide control functions compatible with the plant control system. These connections and any remote-control connections shall be furnished and wired to clearly labeled terminal strips within the equipment control panel.
- D. If the electrical control requirements change from that specified or shown on the Electrical or P&ID drawings due to the requirements of the actual equipment furnished, the Contractor shall perform all necessary modifications under the equipment section and no additional compensation will be allowed. The final installation shall meet the operational intent of that specified and shown on the drawings.

#### **3.02 INSTALLATION**

- A. Verify dimensions by field measurements.
- B. Coordinate building and wall penetrations with other construction activities.
- C. Coordinate structural support devices and sleeves to be set in cast-in-place concrete and with other structural components as they are constructed.
- D. Coordinate connection of electrical systems with existing overhead and underground systems or utility services. Comply with government regulations, utility company requirements and local codes.
- E. Install electrical equipment to facilitate servicing, maintenance, ease of disconnection, and minimal interference with other installations.
- F. Electrical penetrations, shown on the Drawings or not, through an exterior surface shall be sealed and made water-tight. For metal panels, use a sealant around the penetration on both sides of the wall.
- G. Electrical penetrations, shown on the Drawings or not, through the fire resistance rated walls or floors shall be fire stopped as required by NEC using the approved method as recommended by the manufacturer. Fire stops (e.g. caulk) shall have a 3-hour fire resistance rating, and shall be made by the 3M Company, or equal.

- H. Electrical penetrations, shown on the Drawings or not, to hazardous areas shall be gas-tight and fire-stopped using "Link-Seal" FD or FS seals as manufactured by Thunderline Corporation, or equal.
- I. Multiwire (shared neutral) branch circuits operating at 120 VAC are not acceptable.

### **3.03 CUTTING AND PATCHING**

- A. Perform cutting and patching of electrical equipment and materials required to:
  - 1. Uncover Work for the installation of ill-timed Work.
  - 2. Remove or replace defective or damaged Work.
  - 3. Remove or replace Work not conforming to the contract or requiring specified testing.

### **3.04 DEMOLITION AND CLEANING**

- A. Electrical equipment, conduit, wire and appurtenances that are removed shall remain the property of the Owner and shall be stored at a site selected by the Owner. The Owner reserves the right to require the Contractor to dispose of certain unwanted portions of removed equipment and materials. The Owner shall have the right to reject any or all materials removed during construction, and the Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner.
- B. Abandoned conduit and wiring, unless specified or marked as "spare", shall be removed. Before any removal, consult with the Owner if materials are to be disposed of or reused. In situations where a portion of the conduit run back to its source remains in service, the abandoned conduit shall be removed back to the point where the conduit will remain in services. Resulting conduit stubs shall be plugged.
- C. When all Work is completed, tested, and accepted by the Engineer/Owner, the Contractor shall clean all light fixtures, equipment, and exposed surfaces affected by the Work.
- D. Contractor shall at all times keep the Work area in an orderly and clean condition by periodic removal of excess and unused materials.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 16020**  
**GROUNDING AND BONDING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Wiring schematics with wire termination points identified.
      - 1) Manufacturer's technical product sheets on each component to be furnished.
    - b. Field testing certificates, signed by the Contractor, certifying that the field tests comply with the requirements specified in Quality Assurance - Part 1.03.
    - c. Furnish manufacturer's name(s) and catalog numbers.
    - d. Manufacturer's recommended method of installation for the products to be furnished.
  - 2. Information for the Record:
    - a. Manufacturer's qualifications, including a list of similar installations.

**1.03 ELECTRICAL AND CONTROL COORDINATION**

- A. Layout and installation of grounding system and accessories shall be coordinated with other installations.

**1.04 PRODUCT HANDLING**

- A. Deliver ground wire properly packaged in factory fabricated type containers, or wound on NEMA specified type wire reels.
- B. Store grounding materials and ground wire in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.
- C. Handle grounding wire carefully to avoid abrading, puncturing and tearing wire insulation. Ensure that dielectric resistance of the cable is maintained.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Grounding materials shall be corrosion-resistant and chemically compatible with the materials with which they come in contact.
  - 1. Conduit shall be as specified in Section 16130.
  - 2. Conductors for equipment grounding shall be stranded THHN/THWN or XHHW-2, color-coded green. Equipment grounding conductor size shall not be less than that provided in the latest edition of the NEC, or as shown on Drawings, whichever is larger.
- B. Use of conduit system for the ground conductor shall not be permitted.
- C. Ground rods shall be copper clad and not less than 3/4 inch in diameter and 10 feet long.
- D. Connections:
  - 1. In readily accessible locations, compression or bolted connectors of Burndy Engineering Company or equal shall be used.
  - 2. In locations not readily accessible after installation, splices and connections of grounding cable shall be made by exothermic welding process equal to Cadweld.
- E. Where an underground ground ring encircling a building or structure is used, it shall be bare, stranded, copper conductor not smaller than No. 4/0 AWG, unless specified or shown otherwise.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Metallic water service pipe, metal frame of a building, concrete encased electrodes, and ground rings surrounding a structure shall be bonded together to form an effective grounding system.

### **3.02 INSTALLATION**

- A. System neutrals; secondaries of control power, instrument, metering and relaying transformers; noncurrent-carrying metallic equipment enclosures; exposed metal structures; and supports shall be effectively bonded to ground grids and busses provided under this Contract.
- B. Noncurrent-carrying metallic parts, electrical equipment and systems including, but not limited to, transformers, motors, lighting, equipment, raceways, control panels, consoles, panelboards, and cable shields, as well as metallic structures, shall be effectively grounded.

- C. Low-voltage electrical equipment, except as otherwise specified, shall be grounded by means of a separate conductor which shall be included in any multi-conductor cable.
- D. Electrical continuity of equipment grounding circuits such as metallic raceways shall be assured by bonding where necessary; equipment grounding conductors passing through metallic raceways shall be bonded to the raceways where they enter and leave.
- E. Particular care shall be taken to ensure good equipment ground continuity between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.
- F. Conduits stubbed-up below a floor mounted electrical apparatus shall be fitted with insulated grounding bushings and connected to the electrical apparatus ground bus or structure. Boxes mounted below floor mounted electrical apparatus shall be bonded to the apparatus ground bus.
- G. Insulated grounding bushings shall be used on the grounding of all conduits, 480 volts and higher, with copper grounding conductors.
- H. Conduits and raceways, regardless of type and material, shall include a separate insulated equipment ground conductor, whether shown on the Drawings or not, sized no less than required by the latest edition of the NEC or by the Drawings, whichever is larger, and connected to the grounding grid. Each circuit grounding conductor shall be dedicated for that circuit.
- I. Connections:
  - 1. Exposed connections shall be made by means of approved grounding clamps. In readily accessible locations, compression or bolted connectors shall be used. Exposed connections between different metals shall be sealed with a synthetic base substance in which zinc particles are suspended such as Burndy Penetrox A-13, Thomas & Betts, (Blackburn) Contax or equal.
  - 2. All buried connections shall be made by an exothermic welding process, "Cadweld", or equal. The tops of all ground rods shall be at least 12 inches below grade.
  - 3. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.
  - 4. Connections at Test Wells: Use compression type connectors on conductors and make bolted and clamped type connections between conductors and ground rods.
  - 5. Compression Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die

code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

6. Insulated grounding conductors connected to ground rods or ground buses shall be insulated over the entire area of the connection and sealed against moisture penetration of the insulation and cable.
  7. Ground rings shall be in direct contact with earth, buried at a depth of no less than 30 inches, and 20 feet long minimum, unless noted otherwise.
- J. Underground Distribution System Grounding:
1. Manholes, Handholes, and Underground Pullboxes: Install a driven ground rod close to the wall and set the rod depth such that 4 inches will extend above the finished floor. Where necessary, install ground rod before the manhole is placed and provide a No. 1 AWG bare tinned copper conductor from the ground rod into the manhole through a waterproof sleeve in the manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure sensitive tape or heat shrunk insulating sleeve from 2 inches above to 6 inches below the concrete. Seal floor opening with waterproof, nonshrink grout.
  2. Connections at Manholes, Handholes, and Underground Pullboxes: Connect exposed metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole to the ground rod or ground conductor. Connect circuit ground wire to ground rod. Make connections with minimum No. 4 AWG stranded hard drawn copper wire. Train conductors plumb or level around corners and fasten to manhole or handhole walls. Connect to cable armor and cable shields by means of tinned terminals soldered to the armor or shield, or as recommended by manufacturer of splicing and termination kits.
  3. Grounding System: Ground noncurrent carrying metallic items associated with manholes, substations, and pad mounted equipment by connecting them to bare underground cable and grounding electrodes arranged as indicated.
  4. Manholes, handholes and underground pullboxes shall have their metal parts bonded to the equipment grounding conductor of circuit(s) passing through them in accordance with NEC Article 250.
- K. Isolated Signal Ground:
1. Where shown on the Drawings, provide a minimum No. 2 AWG stranded, tinned, insulated ground conductor from each control panel or remote I/O panel to a designated system ground point. Ground conductor shall be routed in 3/4-inch Schedule 80 PVC conduit from panel location to system ground connection point. Terminate ground conductor at an insulated, isolated ground bus and at system ground point. Connection at ground rods shall be via exothermic welds.
- L. The metal parts of the following nonelectrical equipment shall be grounded: frames and tracks of electrically driven cranes; frames of nonelectrically driven elevator cars to which electric conductors are attached; hand operated metal shifting ropes or cables of

electric elevators, and metal partitions, grill work, and similar metal enclosures around equipment of over 750 volts between conductors.

- M. All non-current-carrying metal parts of portable equipment and fixed equipment including their associated fences, housings, enclosures, and supporting structures shall be grounded.

### 3.03 GROUNDING APPLICATIONS

- A. Underground grounding conductors shall be bare, tinned, stranded copper except as otherwise indicated.
- B. For telephone, alarm, and communication systems, provide a No. 4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location. All grounds in the telephone system shall be bonded together.
- C. Separately derived systems required by the NEC to be grounded shall be grounded in accordance with the latest edition of the NEC.
- D. Ground metal poles supporting outdoor lighting fixtures to a grounding electrode as indicated in addition to a separate equipment grounding conductor run with supply branch circuit.
- E. For all other equipment grounding conductor applications, comply with NEC for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated. Use of conduit system for ground conductor shall not be allowed.
- F. Bond the telecommunications grounding electrode to the power grounding electrode using No. 6 AWG copper wire minimum.

### 3.04 TESTING

- A. Comply with Section 16050.
- B. Testing shall be by independent electrical testing organization to perform tests described below and in Section 16050.
- C. Perform a megger test on the completed grounding system at each location where a maximum ground resistance level is specified, at service disconnect enclosure ground terminals, and at ground test wells.
  - 1. Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - 2. Perform tests by the two-point method in accordance with IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." Simple moisture addition is not acceptable.

796-7552.002  
2021

Northwestern Water & Sewer District  
Ford Road Pump Station Improvements

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 16030**  
**ELECTRICAL IDENTIFICATION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the provision of identification of electrical equipment and materials in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Product data for each type of identification product specified.
    - b. Manufacturer's name(s) and catalog numbers.
    - c. Nameplate schedule.

**1.03 QUALITY ASSURANCE**

- A. Applicable Standards:
  - 1. Comply with requirements of ANSI Standard, "Scheme for the Identification of Piping Systems" and "Wiring and Equipment Identification" with regard to type and size of lettering for raceway and cable labels.

**PART 2 PRODUCTS**

**2.01 NAMEPLATES AND LEGENDS**

- A. New equipment shall be identified by means of a laminated phenolic nameplate. Modified equipment shall be identified in the same manner as was the original equipment. Equipment whose designation has been changed shall be relabeled as specified or directed.
- B. Nameplates shall have white background with black engraved lettering identifying function or equipment designation.
- C. Main nameplate on distribution panels, control panel, and other panels shall be 2-inches high by 6-inches wide with 1-inch high letters. Individual nameplates shall be 1-inch high by 3-inches wide with 1/4-inch high letters.
- D. Legends shall be completely worded without abbreviations except as approved by the Engineer.
- E. Blank nameplates shall be included on all unused components.

- F. Nameplates on electrical panels which are fed from a remote source shall include, in addition to their function, where the power originates from (e.g., scum pump panel - fed from MCC-1, MCC-1 fed from main SWG).

## 2.02 CONDUCTOR IDENTIFICATION

- A. Wires and cables, except at lighting and 120 volts convenience outlets, shall be identified by means of tags describing circuit.
- B. Tags shall be on all connections, splices, and terminations, and shall also be applied where entering and leaving common wireways.
- C. Wire tags shall be equal to Thomas & Betts white, self-adhesive wrap or Panduit heat shrink type labels. Tags shall be vinyl, polyester or Polyolefin, resistant to excessive heat, water, cold, dirt, and grease.
- D. The tag type-on-area shall be sufficiently sized to contain five numerals on each line. Wire numbers shall be typed on with Thomas & Betts E-Z Coder Printer, Panduit Dura-Mark Printer or equal.
- E. Insulated conductors No. 8 AWG and larger shall be color coded at each end with a 2-inch wrap of suitable color tape as follows, if integral color is not utilized:

System	Phase Conductors A, B, and C	Neutral Conductors
120 volts, single-phase, 2-wire	Black	White
120/240 volts, single-phase, 3-wire	Black and Red	White
208 volts, 3-phase, 3-wire	Black, Red, Blue	--
208Y/120 volts, 3-phase, 4-wire	Black, Red, Blue	White
480 volts, 3-phase, 3-wire	Brown, Orange, Yellow	--
480Y/277 volts, 3-phase, 4-wire	Brown, Orange, Yellow	White
2400 volts, 3-phase, 3-wire	Black, Red, Blue**	--
2400 volts, 3-phase, 4-wire	Black, Red, blue **	White**
4160 volts, 3-phase, 3-wire	Black, Red, Blue**	--
4160 volts, 3-phase, 4-wire	Black, Red, Blue**	White**
4800 volts, 3-phase, 3-wire	Black, Red, Blue**	--
4800 volts, 3-phase, 4-wire	Black, Red, Blue**	White**
Grounding	Green	

\*\* Apply tape near termination on cable.

Tape shall be Scotch #35 in color required above as manufactured by 3M or equal.

- F. Direct current conductors shall be identified by the following methods:
1. Provide self-sticking markers on each direct current conductor.
  2. Marker colors shall be black letters on "alert orange" background.
  3. Each marker shall designate circuit conductor polarity and voltage (e.g. 28 VDC).
  4. Direct current control conductors shall be color-coded dark blue.
- G. On a 4-wire delta-connected system where the midpoint of one phase winding is grounded to supply lighting and similar loads, the conductor or busbar having the higher phase voltage to ground shall be durably and permanently marked by an outer finish

that is orange in color or by other effective means. Such identification shall be placed at each point on the system where a connection is made if the grounded conductor is also present.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Submit nameplate schedule for review and approval by the Engineer prior to fabrication of nameplates.

#### **3.02 INSTALLATION**

- A. Contractor shall furnish and install equipment nameplates, typed panel rosters, wire and cable tags, stenciling, and other identification with text, lettering type, etc., as specified in this Section.
- B. Nameplates shall be fastened by means of 3/16-inch diameter roundhead, stainless steel, self-tapping screws. UL 508 4X enclosure nameplates shall be secured with silicon adhesive.
- C. Pull, terminal, and junction boxes shall be identified by stenciling the names of the feeders and system wires and cables passing through them.
- D. MCCs and power panels of NEMA 3R double-door construction shall have stenciled panel designation at the top and branch designations appropriately spaced in the outer doors. NEMA 4X lighting and power panels shall have designations appropriately placed on them.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 16050  
ELECTRICAL TESTING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Contractor shall furnish all labor, tools, equipment, and materials necessary to perform electrical testing in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and Section 16010 and shall include:
  - 1. Information for the Record:
    - a. Certified reports of field tests and observations.

**1.03 QUALITY ASSURANCE**

- A. Testing shall be performed or supervised by the Contractor. Contractor shall be responsible for test records.
- B. Contractor shall visually check equipment, wire, phase matching and rotation in preparation for testing.
- C. Manufacturer's recommended instructions for testing shall be used when applicable.
- D. Testing shall be in compliance with accepted engineering practices, NEC and IEEE Standards.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Before conducting field tests, the Contractor shall submit to the Engineer a written outline of the methods of testing and equipment to be used.

**3.02 FIELD TESTING**

- A. Required testing shall be completed and written report submitted to the Engineer for acceptance before the Contractor proceeds with subsequent Work.
- B. Written reports shall be required on tests. Careful records shall be kept of each test and results shall be submitted to the Engineer.
- C. Final payment will not be released until all required written test reports are submitted and distributed for information.

- D. Contractor shall be responsible for the procurement and installation of compatible components and equipment, and shall perform all Work necessary for the proper operation and guarantee of the equipment.
- E. Contractor shall make such tests as may be necessary to demonstrate that the Work and equipment, as installed, comply with the Contract Documents. When required by the Engineer, such tests shall be performed in the Engineer's presence.
- F. Any system or equipment failing to meet the Contract requirements, or to function properly, shall be rectified at the Contractor's expense by readjusting or by removing and replacing the faulty Work or equipment, and the tests rerun until the requirements are met.
- G. Engineer reserves the right to require the Contractor's equipment be checked by an independent instrument tester.

### 3.03 CONDUIT TESTING

- A. After conduit and accessories have been installed and all concreting operations completed, all conduit runs shall be satisfactorily cleared of all obstructions and foreign matter. Any defects that might damage cable upon installation shall be corrected.
- B. Conduits shall be tested, in the presence of the Engineer if requested, by pulling through each conduit a flexible cylindrical mandrel having an outside diameter 1/4 inch less than the inside diameter of the conduit, followed by a stiff wire brush of the same diameter as the conduit. Where conduits installed under this Contract are connected to conduits installed by others, the entire runs between boxes, manholes, or other termination points shall be tested.
- C. Contractor shall keep a record, by number, of all conduits tested clear, and shall submit written copies of such record to the Engineer.
- D. Defects or stoppages in conduit runs installed by the Contractor shall be corrected. Defects or stoppages in conduit runs installed by others shall be reported to the Engineer, who shall determine the corrective measure to be taken.

### 3.04 GROUNDS

- A. Contractor shall test the ground resistance of the systems.
- B. Dry season resistance of each system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, provide additional grounding as directed by the Engineer.
- C. Where multiple ground rods are required, they shall be 20 feet apart. The Contractor, in the presence of the Engineer if requested, shall test all made grounds for continuity and resistance. Ground resistance of more than 5 ohms shall be reduced to 5 ohms or less by the use of additional, and properly separated, ground rods, or deep driving of ground rods.

**3.05 LOW-VOLTAGE CIRCUIT BREAKERS**

- A. Each low-voltage circuit breaker shall be manually opened and closed five times before being energized.
- B. Acceptance of each ground fault device will be only on an in-person trip and reset cycle demonstration for the Engineer or his representative - if the Engineer requests to be present. The Engineer shall be notified at least one week before scheduling this test.

**3.06 LOW VOLTAGE SYSTEM (INSULATION RATED AT 600 VOLTS)**

- A. Contractor shall perform insulation resistance testing of 480-volt power feeder circuits with a 500-volt megger.
- B. Written test reports of the results shall be submitted to the Engineer prior to final inspection. Equipment which may be damaged during this test shall be disconnected before the test and reconnected upon completion.
- C. Upon the completion of each electrical system rated 600 volts or less, but before wiring connections are made to equipment, the Contractor shall test each circuit and each piece of equipment for:
  - 1. Continuity.
  - 2. Grounds.
  - 3. Insulation resistance, phase-to-phase and phase-to-ground, of 480 volts conductors and equipment with a 500-volt megohmmeter.
- D. Discontinuities or grounds discovered in low voltage systems shall be corrected before the insulation resistance is measured.
- E. Insulation resistance readings, lower than required by good practices or Code, shall be promptly repaired or replaced. Retesting shall be completed until acceptable readings are acquired.
- F. Installed control cables and conductor terminations for instrumentation and controls shall be tested for properly grounded cable shields. Control cable shields shall be isolated from ground except at the grounding point. The Contractor shall remove all improper grounds at no additional cost to the Owner. This test shall be witnessed by the Engineer if requested.
- G. Following satisfactory completion of circuit and equipment insulation resistance tests, connection of the wiring to equipment, but before it is energized; the tests specified above shall again be carried out.
- H. Defective or improperly installed electrical equipment or wiring provided or installed and connected by the Contractor shall be repaired, replaced, or properly installed by the Contractor until it satisfactorily passes the field tests.
- I. Irregularities or faulty equipment shall be immediately reported to the Engineer.

**3.07 RESERVED**

**3.08 FIBER OPTIC CABLE TEST PROCEDURES**

A. Visual and Mechanical Inspection

1. Cables shall be inspected for physical damage and proper connection.
2. Splices and connectors shall be inspected for physical damage and proper connection.

B. Field Tests

1. Contractor shall perform cable length measurement and detect fiber fractures, sharp bends, or other defects through analysis of the backscattering signal with an Optical Time Domain Reflectometer (OTDR).
2. Contractor shall perform a continuity test to detect splice fractures of other defects through analysis of the backscattering signal with an Optical Time Domain Reflectometer (OTDR).
3. Contractor shall perform attenuation measurement of the cable loss at a wavelength of 850 or 1300 nanometers.
4. Contractor shall perform attenuation measurement of losses at each splice and connector at a wavelength of 850 or 1300 nanometers.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 16060  
HANGERS AND SUPPORTS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Contractor shall furnish all labor, tools, equipment, and materials necessary to provide supporting devices in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include.
  - 1. Shop Drawings for Review:
    - a. Manufacturer's technical product sheets on each component to be furnished.
    - b. Submit a list of materials needed for construction, giving manufacturers' names and catalog numbers.
  - 2. Information for the Record:
    - a. Manufacturer's qualifications.
    - b. Certified copies of factory test procedures and results.
    - c. Manufacturer's recommended method of installation for the products to be furnished.

**1.03 QUALITY ASSURANCE**

- A. Applicable Standards:
  - 1. Manufacturer's Standardization Society (MSS):
    - a. Comply with applicable MSS standard requirements pertaining to fabrication and installation practices for pipe hangers and supports.
  - 2. National Electrical Code (NEC):
    - a. Comply with related sections of NEC requirements for equipment, conduit, and raceways.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Mounting brackets, bolts, nuts, and washers for items of electrical equipment shall be provided with either an approved zinc plating process, be galvanized, be nonferrous, or be of a non-corrosive metal.
- B. Carbon steel hangers, supports, fastenings, and other devices shall have an approved plating process. Manufactured channel sections shall be P-1000 Unistrut with hot dip galvanizing after fabrication, or equal.
- C. "Shot-in-place" anchors and fastenings shall not be used. Perforated metal strap or wire is not acceptable for hangers or supports.
- D. Unless shown or specified otherwise, fasteners and anchors shall be as follows:

Base Metal	Fastener Metal and Coating
Stainless Steel	Stainless Steel
Aluminum	Stainless Steel
Galvanized Steel	Galvanized or zinc plated carbon steel
Field painted or uncoated carbon steel	Unfinished or zinc plated carbon steel

- E. Where a connection involves dissimilar base metals, fastener shall be as required for most corrosion resistant base metal in connection, or dielectric material shall be installed.
- F. Anchor bolts and fasteners in submerged applications shall be stainless steel.
- G. Non-metallic strut shall be made of pultruded fiberglass with an isophthalic polyester fire-retardant (FR-P) resin.
  - 1. The composite material shall have an ultraviolet light inhibiting chemical additive and meet ASTM E84 for flame spread. It shall have a complete Nexus Veil Coverage (outer surfacing fabric) to provide maximum chemical and UV protection.
  - 2. Non-metallic strut shall be as manufactured by Enduro Composite Systems, or equal.
- H. Hanger rod (all-thread) shall be 3/8-inch minimum diameter round steel rod.

## PART 3 EXECUTION

### 3.01 COORDINATION

- A. Sequence and coordinate location of hangers and supports to facilitate equipment installation and future access for maintenance.

### **3.02 INSTALLATION**

- A. Contractor shall provide all devices and materials such as expansion bolts, foundation bolts, screws, channels, angles, and other attaching means required to fasten lighting stands, panelboards, transformers, conduits, and other electrical equipment and materials to be installed on, or in, concrete bases or structures which are existing, or provided under other sections of the Contract. Foundation bolts shall be set by using manufacturer's templates.
- B. Surface mounted equipment shall be installed in such a manner as to permit free circulation of air on all sides. A minimum space of 1/4 inch shall be maintained between the back of equipment and the mounting surface.
- C. Wherever wall, columns, or like structural members are not available for mounting motor starters, push-button stations, and like equipment, hot dip galvanized structural steel sections shall be provided for such mounting, or as shown on the Drawings, shop prime coated, and epoxy finished per Section 09900.
- D. Where galvanized or cadmium plated surfaces or materials are cut, drilled, reamed, or damaged during the course of installation, the exposed metal shall be brush-on coated with 95%- zinc-enriched paint.
- E. Cut ends of non-metallic strut, such as manufactured by Enduro or equal, shall be brush-on coated with the manufacturer's recommended coating to prevent fibers from fraying.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 SUPPORT MATERIAL SCHEDULE**

- A. Exterior – All exterior supports shall be 304 stainless steel.
- B. In Chamber or Exposed to Wastewater – All supports shall be 304 stainless steel.

END OF SECTION



**SECTION 16120**  
**CONDUCTORS AND CABLES (600 VOLTS AND LESS)**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes 600-volt, single or multi-conductor power or control cable.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Manufacturer's technical product sheets on each component to be furnished.
    - b. A list of materials needed for construction giving manufacturer's names and catalog numbers.
  2. Information for the Record:
    - a. Manufacturer's recommended method of installation for the products to be furnished.

**1.03 QUALITY ASSURANCE**

- A. Comply with ICEA and NEMA publications for "Non-shielded Power Cables rated 2000 Volts or Less."

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Wires shall be identified by surface markings indicating manufacturer's name, conductor size, conductor material, voltage rating, UL Symbol, type designations, and optional ratings.
- B. Conductors shall be oil and gasoline resistant.
- C. Single conductors for 600-volt power, lighting, and receptacle circuits shall be Type THHN/THWN dual-rated or XHHW-2 and as follows:
1. Conductors shall be stranded, soft-drawn, or annealed copper.
  2. Single conductors for general use for power, lighting, and receptacles shall be a minimum size of No. 12 AWG stranded, unless otherwise noted on the Drawings.
  3. Minimum wire size for controls shall be No. 14 AWG unless noted otherwise.

4. Single conductors, for power distribution, No. 4 AWG and larger, shall be Type XHHW-2.
  5. Single conductors, for power distribution, smaller than No. 4 AWG for use in conduits and ducts shall be Type THHN/THWN dual-rated.
  6. Single conductors, for power distribution where exposed to sunlight, shall be listed and marked as sunlight-resistant as manufactured by Okonite, "Okoguard-Okolon" Type RHH or RHW-2 or USE-2, VH-1, or equal.
- D. Underground feeder and branch circuit cable for direct burial in earth shall be Type UF, RHW-2, or USE-2 for use in wet or dry locations. Cable shall include a ground wire and be listed and approved for such application.
- E. Flexible power cords shall be 3 or 4 conductor including ground, No. 12 AWG minimum wire size, rubber insulated, hard service cord, meeting UL requirements for flexible cord. Flexible power cords shall be rated for 600 VAC and have oil resistant thermoset insulation for use in wet locations (Type SOOW). Ampacity shall be in accordance with NEC Table 400.5(A) and any pertinent derating factors.
- F. Flexible control cords shall be 2, 3 or 4 conductor, No. 18 AWG minimum wire size, rubber insulated, hard service cord, meeting UL requirements for flexible cord. Flexible control cords shall be rated for 600 VAC and have oil resistant thermoset insulation for use in wet locations (Type SOOW).
- G. All wire and cable insulation and all cable outer coverings shall be listed and approved for the conditions under which the wire or cable is to be used.

## 2.02 COMPONENTS AND ACCESSORIES

- A. Splicing materials shall be as follows:
1. Plastic tape shall be 3M Scotch Electrical Tape No. 33+ or 88, or equal.
  2. Neoprene tape shall be Okonite Company "Okoprene", or equal.
  3. Insulating putty shall be 3M "Scotchfill Electrical Putty", or equal.
  4. Tapes and other splicing materials shall be used only as recommended by the manufacturer, and only if their condition is such as to meet the manufacturer's standards.
  5. Heat-shrinkable tubing shall be Raychem or equal.
- B. Connectors:
1. Wire connectors for No. 6 AWG and smaller wires shall have sharp internal threading which prevents pulling off, but are removable. Connectors shall be Type Y, Type R, Type G, or Type B, as manufactured by 3M Company or equal.
  2. Indentor butt connectors shall be Burndy "Hylinks", or equal.
  3. Indentor pigtail connectors shall be Thomas & Betts "Sta-Kon" connectors, or equal, applied to the twisted conductors, and covered with a nylon cap of the same manufacturer.

4. Indentor or compression connectors shall be Thomas & Betts "Sta-Kon" connectors, or equal. The insulation of conductors No. 2 AWG and larger shall be penciled to the diameter of the conductor. Wires connected to screw terminal block points shall have fork tongue lug terminals.
  5. Splices to uncut main runs shall be made with Burndy "Crimpits", or equal, for cables No. 4/0 to No. 10 AWG, and Burndy "Hytaps", or equal, for cables larger than No. 4/0 AWG.
  6. Bus Bar Taps - Bus bars shall be tapped using one of the following connectors.
    - a. Two-hole, crimp-type lugs, 600V - 35 kV, sized as required to match bus bar width and conductor in use. Connector metal shall match bus metal. Connector shall be UL listed as manufactured by Thomas & Betts Catalog No. 542XX, or equal.
    - b. Heavy duty compression, 600V - 35 kV, sized as required to match conductor in use. Connector metal shall match bus metal. Connector shall be UL listed as manufactured by Thomas & Betts Catalog No. 251-31446-XX, or equal.
- C. Power Blocks:
1. All power blocks whether in terminal boxes, motor control, and other locations, shall be equal to Allen-Bradley Bulletin 1492 UL-listed, 600V AC/DC, 3-pole suitable for copper conductors, and rated for 75 degrees C, minimum.
  2. Power blocks shall have sufficient current carrying capacity as required, and shall not be adjacent to control wiring terminal blocks.
- D. Wire Pulling Lubricants - Pulling lubricants shall be American Polywater Corp. Type J, Ideal Yellow 77 Plus, Thomas & Betts Polymer Base, or equal. Follow manufacturer's recommendations for compatibility with wire insulation, cable jacket, and conduit materials.

## 2.03 IDENTIFICATION

- A. All wires and cables, except at lighting and 120 VAC convenience receptacles, shall be identified by means of tags with wire names. Tags shall be on all connections, splices, and terminations, and shall also be applied where entering and leaving common wireway and at a minimum of 30 foot centers within the wireway. Wire tags shall be as specified in Section 16030.

## 2.04 FACTORY TESTS

- A. Wire shall be tested in accordance with:
1. UL Standard for type THHN/THWN wire and the optional Gasoline and Oil Resistant II listings.
  2. UL Standard for Type XHHW-2.
  3. UL and ICEA requirements for Type MC Cable.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Inspect raceways for compliance with specifications and Drawings. Do not proceed with installation until defective conditions have been corrected.
- B. Conduit layouts shall provide for cable separation between various systems and between various signals within given systems. The combining of conductors of various systems within one conduit system shall not be permitted.

### **3.02 INSTALLATION**

- A. Wiring, above ground, 120 volts and higher, shall be in conduit, wireways, or cable trays.
- B. Extreme care shall be used to prevent any injury or damage to the wiring. The Contractor shall observe the installation instructions and precautions issued by the manufacturer of the wire and cable.
- C. Cables shall be pulled through conduits in such a manner as not to overstress, stretch, score, cut, twist, or damage the protective covering or insulation of the conductor. If mechanical means are employed for pulling the cables or wires, a dynamometer shall be used.
- D. The ends of low-voltage cables installed in damp or wet locations shall be carefully sealed until permanently connected or spliced. The Contractor shall be responsible for maintaining a dry condition while the cables are being pulled.
- E. Underground circuit cables for direct burial in earth shall be installed per NEC and IEEE Standards, and as recommended by the cable manufacturer.
- F. Keep rocks and rough materials away from direct buried cables.
- G. Direct buried cable shall be backfilled with 6 inches of sand over the top of cable to prevent stone bruises and cuts to cable.
- H. If single conductor cable is used, space cables evenly at least 6 inches between cable centers. Sand shall be used to fill around cables. Be certain there are no cable crossovers.
- I. Cables emerging from the ground shall be installed in conduit from at least 18-inch below grade up to the termination point.
- J. Spare conductors or cables shall be individually and uniquely numbered. They shall have sufficient length to reach the farthest termination point within the enclosure. They shall be coiled and stored in a neat and workmanlike manner. The coil shall be tagged to indicate the location of the other end of the spare conductors.
- K. All 120 volt "home runs" in excess of 100 feet shall be No. 10 AWG minimum. All 120-volt branch circuits supplying heating, air conditioning, or lighting loads of 1500 watts or more shall be No. 10 AWG minimum.



- L. Conductors in vertical runs shall be adequately supported with approved conductor supports, as outlined in the NEC.
- M. All underground feeder and branch circuit cables for direct burial in earth shall be installed per the NEC, National Electrical Safety Code Section 35, IEEE Standard 590, and as noted on the drawings and as recommended by the cable manufacturer. Cable shall be installed in an "S-Loop" to allow for ground movement. Backfill trench to provide 18 to 24 inches of cover above the top of the highest wire or cable. Place a 6-inch wide, foil-backed, yellow tape with black lettering reading "ELECTRIC LINE" in the trench, and then complete backfilling operations. Tape shall be Thomas & Betts "E-Z-CODE" NAF-0708, or equal.
- N. Conductors No. 12 AWG and smaller shall not be in the same conduit with wires No. 6 AWG and larger.
- O. Conductor Combination and Separation:
  - 1. The combining of conductors of various systems within one raceway system shall not be permitted. Raceway layouts shall provide for the cable separation requirements between parallel raceways of various systems, and between various signals within given systems throughout Division 16 as required. Each of the following shall be maintained in a separate raceway system apart from the others.
    - a. Lighting and 120 VAC utility.
    - b. Power Distribution, 600 VAC or less.
    - c. Power Distribution, greater than 600 VAC.
    - d. Communications Systems (Telephone, Intercom, Ethernet).
    - e. Fire Alarm Systems.
    - f. Security Systems
    - g. Analog cables for Instrumentation and Control.
    - h. PLC Communications Systems (Data Highway, Modbus, etc.).
    - i. Motor Branch Circuits.
    - j. Class 3 Motor and Equipment Controls.
  - 2. Where Motor Branch Circuit conductors are less than No. 4 AWG, they may be combined with related Class 3 motor and equipment control conductors.
  - 3. Fiber Optic Cables may share raceways of other systems except where prohibited by the NEC.

### 3.03 SPLICES AND TERMINATIONS

- A. Wire and cable lengths shall be continuous and without splices between the points of connection, except as otherwise specified or indicated on the Drawings.

- B. Splices and terminations where specified or indicated on the Drawings shall be made in strict accordance with the conductor manufacturer's recommendations.
- C. Splices and connections shall have a conductivity and insulation resistance at least equal to that of the cable.
- D. Terminated conductors shall be bundled and identified to match approved Contractor submitted drawings.
- E. Owner and Engineer may inspect any and all joints before they are taped. If they are taped without being inspected, the tape may be ordered removed from any joint or joints, and the Contractor shall correct any defect found. After inspection and correction of any fault found, the Contractor shall properly re-tape the joints with new tape.
- F. Splices:
  - 1. Dry Locations - No. 6 AWG and Smaller, Single Conductor:
    - a. Using either an insulated spring or an indentor butt connector shall be followed by wrapping with two half-lapped layers of approved plastic tape extending a minimum distance of 1 inch from the connector.
  - 2. Dry Locations - No. 4 AWG and Larger, Single Conductor:
    - a. No. 4 AWG conductor and larger shall be spliced using indentor or compression connectors, penciled to the diameter of the connector, and wrapped with two half-lapped layers of approved plastic tape extending a distance from the connector of twice the outside diameter of the larger conductor, or 1 inch, whichever is greater.
    - b. Splices to uncut main runs shall be made with "Crimpits", or equal, for Cable Nos. 4/0 AWG to 10 AWG, and "Hytaps", or equal, for cables larger than No. 4/0 AWG, and wrapped with two half-lapped layers of approved plastic tape.
    - c. Electrical insulating putty shall be used as filler before applying tape, where necessary, to provide a smooth taping surface.
  - 3. Wet Locations:
    - a. Single-conductor, with nonmetallic covering, shall be spliced using either indentor (compression) or insulated butt connectors followed by wrapping with four half-lapped layers of approved plastic tape extending a distance from the connector of twice the outside diameter of the larger conductor or 1 inch, whichever is greater.
    - b. The insulation of Conductors No. 2 AWG and larger shall be penciled to the diameter of the conductor and wrapped with four half-lapped layers of approved plastic tape extending a distance from the connector of twice the outside diameter of the larger conductor or 1 inch, whichever is greater.
    - c. Splices in manholes shall only be permitted where specifically shown on Drawings. Where permitted, in manholes, splices No. 4 AWG and

smaller shall be in submersible NEMA 6 terminal boxes within easy reach of ground level.

- d. Electrical insulating putty shall be used as filler before applying tape, where necessary, to provide a smooth taping surface.

G. Terminations - When connecting conductors at terminals, the following methods shall be used, unless otherwise specified:

1. Indentor or compression terminals shall be applied to the conductor. Terminals shall be held in place at terminal posts or studs with approved locknuts or lock washers.
2. The shields of shielded, multi-conductor control and metering cables, unless otherwise specified by equipment manufacturers, shall be terminated at one end of the cable only.
3. Shield shall be stripped back, intact, applying a compression grounding terminal to the twisted shield, and securely fastening the terminal to the appropriate point on the equipment or device.
4. Shield at the non-terminated end of shielded cables shall be stripped back at least 2 inches beyond the stripped inner conductor's cutoff, and the cable taped with two half-lapped layers of plastic tape where the shield emerges from the outer sheath.
5. Where dead-ending low-voltage wires and cables, the ends shall be insulated and sealed in a manner similar to a standard splice for the particular location and type of wire or cable.
6. All power system terminations shall be phased-out.

H. Where specified, bus bar tapping shall be in strict accordance with bus bar and connectors' manufacturer's recommendations.

#### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 16121**  
**CONTROL AND SIGNAL CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The Section includes the installation of all wire, cable, and terminators for a complete instrumentation and control package.
- B. Work shall include but not be limited to the following major items:
  - 1. Communications cable between programmable controller components, processors, graphic interface units, and printers.
  - 2. Communications cable between PLC I/O Panels and programmable controller processors.
  - 3. Programmable controller power supplies to processors and I/O chassis.
  - 4. Analog signal wiring between controls, instruments, equipment, field devices, PLC I/O panels, annunciators, or other instrumentation and control components required to complete the Work.
  - 5. Signal wiring, data highway, fiber optic, conduit materials, and installation not provided under Division 16.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and Section 16010 and shall include:
  - 1. Shop Drawings for Review:
    - a. A list of materials needed for construction giving manufacturer's names and catalog numbers.
    - b. Manufacturer's technical product sheets on each component to be furnished.
  - 2. Information for the Record:
    - a. Manufacturer's qualifications.
    - b. Certified copies of factory test procedures and results.
    - c. Manufacturer's recommended method of installation for the products to be furnished.
    - d. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.

### 1.03 QUALITY ASSURANCE

- A. The installation of equipment and materials shall conform to the recommendations and instructions of the respective manufacturers of equipment and materials.
- B. Fiber-optic cable terminations shall be by certified cable installers. The Contractor shall provide a documented listing of fiber optic cable installation experience.

## PART 2 PRODUCTS

### 2.01 CONTROL CONDUCTORS

- A. Control conductors shall, unless noted otherwise on the Drawings, be supplied as single conductor, No. 14 AWG, 19 stranded, 600 volts, 90-degree C of Type THHN/THWN dual rated.
- B. Wire shall be supplied in three different integral color codes as follows: brown, orange, and red.
- C. Intrinsically safe wiring shall be color coded light blue.
- D. Direct current control conductors shall be color coded dark blue.
- E. Control wire circuits from external sources shall be color-coded yellow.

### 2.02 TRANSMITTER CABLE

- A. Indoor Use:
  - 1. Cable shall be 2-conductor, No. 16 AWG stranded tinned copper with minimum No. 18 AWG stranded tinned copper drain wire.
  - 2. Cable shall have a 100% aluminum foil shield with PVC jacket, rated for 60 degrees C and 600 volts.
  - 3. Cable shall have maximum capacitance of 23 pF (picofarads) per foot between conductors.
  - 4. Cable shall have nominal outside diameter of 0.313 inches.
  - 5. Cable shall be Belden 8719, or equal.
- B. Indoor, Outdoor, Transition between Indoor/Outdoor and where subject to damp or wet conditions:
  - 1. Cable shall be 2-conductor, No. 16 AWG stranded, tinned copper with a drain wire. Insulation shall be PVC with a nylon overcoat.
  - 2. Cable shall have a 100% aluminum foil shield with PVC jacket, rated for 90 degrees C and 600 volts. Jacket shall be sunlight resistant.
  - 3. Cable shall be suitable for direct burial and outdoor applications.
  - 4. Nominal outside diameter shall be 0.294 inches.
  - 5. Cable shall be Belden 1118A, or equal.

- C. Inside Control Panels and Connected to Analog I/O Modules:
  - 1. Cable shall be 2-conductor, No. 22 AWG stranded tinned copper with polyethylene insulation, and No. 22 AWG stranded tinned copper drain wire. Color code: Black, Clear.
  - 2. Cable shall have a 100% aluminum-polyester foil shield with PVC jacket, rated for 60 degree-C and 300 volts.
  - 3. Cable shall have maximum capacitance of 24 pF per foot between conductors.
  - 4. Cable shall have nominal outside diameter of 0.175 inches.
  - 5. Cable shall be Belden 8761.
- D. Transmitter cable shall be identified by the initials "PR".

## **2.03 COMMUNICATION CABLE (DATA HIGHWAY AND REMOTE I/O CABLE)**

- A. Indoor Use:
  - 1. Cable shall be 78 ohms, 2 conductor No. 20 stranded tinned copper, twin axial transmission line cable, with 55% tinned copper braid, and 100% shield coverage with PVC jacket.
  - 2. Cable shall be Belden 9463, or equal.
- B. Direct burial applications, in below-grade conduits or when exposed in wet locations:
  - 1. Cable shall be 78 ohms, 2 conductor No. 20 stranded tinned per, twin axial transmission line cable, with gel-filled 55% tinned copper braid, and 100% shield coverage with LDPE jacket.
  - 2. Cable shall be suitable for the specified programmable control system.
  - 3. Cable shall be Belden 9463DB, or equal.
- C. This cable shall be identified by the initials "DH+".
- D. Nominal OD shall be 0.240 inches.

## **2.04 FIBER-OPTIC CABLES**

- A. Cable shall be suitable for harsh industrial areas both indoor and outdoor.
- B. Cable shall be UL listed for use as non-conductive optical fiber riser cable (OFN/OFNR).
- C. Cable shall be suitable for operating temperature between minus 40 degrees C to 75 degrees C, 0% to 100% relative humidity.
- D. Cable shall have PE jacket, 4-fibers 62.5/125/250 micron (core/clad/ buffer).
- E. Connectors shall be provided as required and installed as recommended by cable and connector manufacturers. Connectors shall be compatible with equipment to which they will be connected. Connectors shall be as manufactured by 3M, AMP, Corning Cable Systems, Fiber Instrument Sales, Molex, Seiko, or equal.

- F. Cable shall have the following characteristics:
  - 1. Crush resistance of 500 pounds per square inch minimum.
  - 2. Impact resistance of 3.3 foot-pounds, 25 impacts minimum.
  - 3. Withstand 25 flexing cycles of 12 pounds and radius of 20 times the cable outside diameter, minimum.
  - 4. Withstand 25 twists per bend cycles of 12 pounds and radius of 20 times the cable outside diameter.
- G. Cable shall be Belden I100466, or equal.

## **2.05 CATEGORY 5 AND 6 ETHERNET CABLE**

- A. The Ethernet cable shall be No. 23 AWG solid bare copper with polyolefin insulation, PVC jacketed, unshielded, four twisted pair.
- B. DC resistance shall be 28.6 ohms per 1000 feet.
- C. Capacitance shall be 15 pF per foot maximum.
- D. Nominal velocity of propagation shall be 70%.
- E. Cable shall be EIA/TIA 568-B.2-1 Category 6 verified.
- F. Suitable applications: Industrial Ethernet Cable, harsh environments, 350 MHz Enhanced Category 6, Gigabit Ethernet, 100BaseTX, 100BaseVG ANYLAN, 155 ATM, 622 ATM, NTSC/PAL Component or Composite Video, AES/EBU Digital Video, RS-422, RJ-45 Compatible.
- G. Nominal OD shall be 0.475 by 0.265 inches.
- H. Cable shall be Belden 11872A, or equal.

## **2.06 THREE-CONDUCTOR SHIELDED CABLE**

- A. Indoor Use:
  - 1. Cable shall be 3-conductor, No. 16 stranded, tinned copper with a minimum No. 18 stranded, tinned copper drain wire. Conductor insulation shall be polyethylene.
  - 2. Cable shall have a 100% aluminum-polyester foil shield, PVC jacket, and be rated for 60 degrees C, 600 volts.
  - 3. Nominal outside diameter shall be 0.327 inches.
  - 4. Cable shall be Belden 8618, or equal.
- B. Indoor, outdoor, transition between indoor/outdoor, and where subject to damp or wet conditions:
  - 1. Cable shall be 3-conductor, No. 16 stranded, tinned copper with a minimum No. 18 stranded, tinned copper drain wire. Conductor shall be PVC insulated with a nylon overcoat.



2. Cable shall have a 100%, aluminum-polyester, foil shield with PVC jacket and be rated for 600 volts, 75 degrees C - wet and 90 degrees C - dry. Jacket shall be sunlight resistant.
  3. Cable shall be suitable for direct burial and outdoor applications.
  4. Nominal OD shall be 0.317 inches.
  5. Cable shall be Belden 1119A, or equal.
- C. Three conductor shielded cable shall be identified as "Triad" or "Triplex."

## **2.07 RESERVED**

## **2.08 MODBUS CABLE**

- A. The Modbus cable shall be No. 22 AWG stranded copper, three twisted pairs with an overall shield and No. 22 AWG stranded tinned copper drain wire.
- B. Modbus Cable shall have an oil and UV resistant, black, PVC jacket.
- C. Modbus Cable shall be rated for use at 300 volts.
- D. Nominal DC conductor resistance shall be 14.7 ohms per 1000 feet.
- E. Nominal DC shield resistance shall be 1.5 ohms per 1000 feet.
- F. Nominal capacitance between conductors shall be 11.0 pF per foot maximum.
- G. Nominal capacitance between one conductor and other conductors connected to shield shall be 20.9 pF per foot maximum.
- H. Nominal velocity of propagation shall be 78%.
- I. Nominal impedance shall be 120 ohms.
- J. Modbus Cable shall be EIA Industrial RS-485 PLTC/CM.
- K. Nominal OD shall be 0.42 inches.
- L. Modbus Cable shall be Belden 3108A, or equal.

## **2.09 ACCESSORIES**

- A. Control Wiring Terminal Blocks:
  1. Terminal blocks, whether in terminal boxes, motor control components, instrumentation, plant communication system, and other locations, shall be Allen-Bradley Bulletin 1492-W4, or equal, suitable for DIN Rail mounting.
  2. Separate terminal strips shall be provided for analog and discrete signal wires, with the discrete terminal strip located on the left side of the enclosure.
  3. Terminals shall be provided for cable shields.
  4. Terminal blocks shall be identified in accordance with Section 16030.

## **2.10 SOURCE QUALITY CONTROL**

- A. Wire/cable shall meet IEEE flame test; UL 1581, "Vertical Tray Flame Test"; and ANSI/NFPA Standard 262-1985 (UL-910) "Horizontal Flame and Smoke Test" requirements.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Examine raceways and other elements receiving cables for compliance with requirements for installation tolerances and other conditions affecting performance of transmission media.

### **3.02 INSTALLATION**

- A. Control wiring shall be identified and tagged per Section 16030.
- B. Each wire number shall be "solid", preprinted, and not pieced from single or double digit tags.
- C. Wire shall be installed with different color conductor in common conduit, for maximum convenience, with individual conductor identification, which shall be in addition to fiber tag identification as specified herein.
- D. The Contractor shall observe the installation instructions and precautions issued by the manufacturer of the wire/cable.
- E. Communication cable shall be installed in 1-inch rigid galvanized steel or PVC coated RGS conduit with one cable per conduit.
- F. Analog signal cable shall be installed in galvanized rigid steel or PVC coated RGS conduit.
- G. No mixing of signal conductors and AC voltage conductors shall be permitted within a single conduit.
- H. Instrument cable, communication, and analog signal conduits shall be separated a minimum of 12 inches from any AC voltage source or conductor.
- I. Instrument cable shields shall be grounded to a common ground terminal in the control panel unless device manufacturer recommends otherwise. Shields shall not be grounded at the field device or at any intermediate point.
- J. Each programmable controller component shall be grounded to earth ground as well as the cable shield between them. Grounding field wiring shall be in accordance with the manufacturer's recommendations. In no case, shall the cable shield be grounded at both ends.
- K. Each instrument cable wire shall be identified and terminated at marked terminal strips.
- L. Analog instrument cables inside panels shall be justified right as described in Section 16903 and shall terminate at separate terminal strips.
- M. Each instrument cable shall be installed in continuous lengths between terminations. No splicing shall be permitted.

- N. 20% spare twisted pairs shall be provided in each conduit run between panels where cables serve more than one device.
- O. Conductors carrying high voltage and/or high current shall be installed in separate ducts from low power conductors and PLC component cables.
- P. All cable (power, instrument, communication) in panels shall have the same physical properties as in the field, to minimize the possibilities of transients.

### **3.03 SPLICES AND TERMINATIONS**

- A. Spacing between adjacent terminal strips shall not be less than five inches as measured from the individual terminal block edges.
- B. Wire and cable lengths shall be continuous and without splices between the points of connection, except as otherwise specified or indicated on the Drawings.
- C. Splices and terminations where specified or indicated on the Drawings shall be made in strict accordance with the conductor manufacturer's recommendations.
- D. Splices and connections shall have a conductivity and insulation resistance at least equal to that of the cable.
- E. Terminated conductors shall be bundled and identified to match approved Contractor submitted drawings.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 SPARE PARTS**

- A. Extra terminal block points shall be provided in the quantity of 30% over the quantity used.

END OF SECTION



**SECTION 16122**  
**WIRING DEVICES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes providing wiring devices in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. A list of materials needed for construction giving manufacturer's names and catalog numbers.
    - b. Manufacturer's technical product sheets on each component to be furnished.
  - 2. Information for the Record:
    - a. Manufacturer's qualifications.
    - b. Certified copies of factory test procedures and results.
    - c. Manufacturer's recommended method of installation for the products to be furnished.
    - d. Manufacturer's recommended spare parts list for components and accessories.
    - e. Operation and maintenance manuals for equipment provided, including accessories, and maintenance instructions.
    - f. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.

**1.03 PRODUCT HANDLING**

- A. Handle wiring devices and components carefully to avoid breakage, impacts, denting, and scouring finishes. Do not install damaged equipment.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Switches shall be specification grade, totally enclosed, quiet tumbler, ac type, meeting NEMA Performance Standards and FS and capable of control of 100% tungsten filament lamp loads.
- B. Switches shall be rated at 20 amps, 120/277 volts. Operating handles shall be phenolic colored brown. Switches shall have screw terminals.
- C. Receptacles shall be specification grade, meeting NEMA Performance Standards, and FS, and having a contact arrangement such that contact is made on two sides of each inserted blade without detent.
- D. Receptacles shall be two-pole, three-wire grounding type with rating of 20 amps, 125 volts, NEMA configuration 5-20R, and have screw-type wire terminals suitable for No. 12 thru No. 10 AWG designated CO/ALR. Bases shall be phenolic composition colored brown.
- E. Receptacles for outdoor installation and where shown on the drawings shall be provided with ground-fault protection with push-to-test capabilities.
- F. Switches shall be rated 20 amp, 120/277 volts. Switches shall be as manufactured by Appleton Electric Company, Catalog Number EDS175, or equal.
  - 1. Switches shall be factory-sealed, designed to UL Standards. Switches shall be enclosed in separate sealing chambers.
  - 2. Screws and handle shall be stainless steel.
  - 3. Switch shall be clearly marked to indicate ON-OFF position, and shall be lockable in either position.
    - a. Constructed with continuously adjustable trim potentiometer for adjustment of low end dimming, anodized heat sinks, 5-inch wire connecting leads and quiet on-off switch.
- G. For flush-mount devices, the Contractor shall provide specification grade, one-piece, 0.040-inch nominal thickness, No. 430 satin finish stainless steel device plates with oval-head, matching mounting screws.
- H. For surface-mount or weatherproof devices, the Contractor shall provide cast metal device plates of malleable ferrous metal, with gaskets and oval-head, stainless-steel screws.
- I. Wall plates for receptacles located outside of building, and inside of buildings in wet or damp locations, shall be the weatherproof type. Weatherproof receptacles, where exposed to weather or in other wet locations, shall be in a weatherproof enclosure, the integrity of which is not affected when the receptacle is in use (attachment plug cap inserted), per NEC 406.8. Enclosures shall be as manufactured by TAYMAC Corporation, Tempe, Arizona, RACO, or equal.

- J. Where weatherproof switches are designated or required, provide the switch specified mounted in the specified box with a gasketed, weatherproof, cast-metal cover plate incorporating an external operator for the internal switch and with stainless steel mounting screws. Cover plate shall be Crouse-Hinds Cat. No. DS181, or equal.

## **2.02 PERFORMANCE REQUIREMENTS**

- A. GFCI receptacles which cannot pass their internal test function shall render themselves incapable of delivering power or indicate by visual or audible means that the receptacle must be replaced. GFCI receptacles shall not provide power if the source wires are connected to the load terminals per UL943.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Switch and outlet boxes shall be cleaned from foreign materials before devices are installed. Wall plates and covers shall be installed after all wall treatments have been completed.

### **3.02 INSTALLATION**

- A. Outlet, fixture, and device boxes in unfinished areas shall be surface mounted. Outlet, fixture, and device boxes shall conform to the requirements specified in the paragraphs herein.
- B. Concealed galvanized steel outlet and switch boxes for electric lights, wall switches, and receptacles, etc., shall have plaster rings installed where required. In every instance, boxes shall be of such form and dimension as to be adapted to the number, size, and arrangement of conduits connected thereto.
  - 1. Outlet boxes shall be firmly anchored in place, and shall be provided with approved 3/8-inch fixture studs where required.
  - 2. Junction boxes shall be provided with blank covers to match other covers in the same area.
- C. Ceiling outlet boxes shall be 4 inch octagonal or 4-11/16 inches square, when required, and not less than 1-1/2 inches deep. Switch and receptacle outlet boxes shall be 4 inches with provisions for standard switch and receptacle covers.
- D. Outlets boxes in exterior locations and interior exposed locations shall be "FS" or "FD", and PVC where used with PVC conduit.
- E. Wall mounted convenience receptacles shall be mounted 18 inches from the finished floor to the bottom of the box unless shown otherwise on the Drawings, required by the NEC, or where required to clear radiators, grilles, louvers, or other mechanical equipment.

- F. Wall mounted switches shall be mounted 44-48-inches above finished floor to the center of the box unless directed otherwise. Space between door openings and switches shall be as uniform as possible throughout the buildings.
- G. Special purpose outlets shall be located as shown on the Drawings, or in accordance with project or manufacturer's requirements.
- H. Splices made with wire nuts, crimp connectors, terminal blocks, split-bolts, or similar connectors shall be in boxes that are readily accessible. Terminal boxes shall be located a maximum of 8 feet above finished floor, and shall have a vertical-facing orientation.
- I. Unless otherwise required, all receptacles shall be installed vertically with their ground pins up. Where horizontal receptacles are used, they shall be installed with the neutral conductor uppermost.
- J. Conventional 120 VAC receptacles shall not be wired to the load side of GFCI receptacles unless both devices are contained in the same box.
- K. Isolated ground (IG) receptacles in nonmetallic boxes shall have nonmetallic wall plates.
- L. Cables connected to Category 5 and 6 computer jacks shall not have more than 1 inch of the conductors exposed outside of the cable's outer jacket. No more than 0.5 inch of the individual conductors shall be untwisted.

### 3.03 TESTING

- A. Prior to energizing circuits, test wiring for electrical continuity and for short circuits in accordance with Section 16050. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.
- B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer's recommendations.

### PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION



**SECTION 16130**  
**CONDUIT, SURFACE METAL RACEWAYS, AND ACCESSORIES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all labor, tools, equipment, and materials necessary to provide conduits and surface metal raceways in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and Section 16010 and shall include:
  - 1. Shop Drawings for Review:
    - a. Wiring schematics with wire termination points identified.
    - b. A list of materials needed for construction, manufacturer's name and catalog numbers.
    - c. Provide conduit layout drawings. All conduit layouts shall show conduits and conduit types with anticipated number, size, and type of power, control or instrumentation conductors/cables, spares and grounds for each and every section of Division 16 requiring separate conduits. Location of floor and wall penetrations and separation between parallel conduits shall be dimensioned.
  - 2. Information for the Record:
    - a. Manufacturer's qualifications.
    - b. Manufacturer's technical product sheets on each component to be furnished.
    - c. Certified copies of field test procedures and results.
    - d. Manufacturer's recommended method of installation for the products to be furnished.
    - e. Operation and maintenance manuals for equipment provided, including accessories, and maintenance instructions.
    - f. Manufacturer's recommended spare parts list for the system components and accessories.
    - g. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.
    - h. Conduit layouts shall consist of "as-installed" drawings showing the exact location and routing of all conduits and conduit duct banks that

**SECTION 16131**  
**CABLE TRAYS AND WIREWAYS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes labor, tools, equipment, and materials necessary to provide cable trays and wireways in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Dimensional drawings of cable tray and wireway systems showing layout of cable trays and wireways with all fittings, hangers, spatial relationships to associated equipment, structures, and adjacent cable trays, wireways, piping, and duct systems.
    - b. Manufacturer's technical product sheets on each component to be furnished.
    - c. Show connections to electrical panels and enclosures.
  - 2. Information for the Record:
    - a. A list of materials for construction giving sizes, manufacturer's name, and catalog numbers.
    - b. Certified copies of factory and field test procedures and results.
    - c. Manufacturer's recommended method of installation for the products to be furnished.
    - d. Operation and maintenance manuals for equipment provided, including accessories, and maintenance instructions.
    - e. Manufacturer's recommended spare parts list for the system components and accessories.
    - f. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.

**1.03 QUALITY ASSURANCE**

- A. All items of the cable tray and wireway systems shall be listed as a product of a single manufacturer.

#### 1.04 ELECTRICAL CONTROL AND COORDINATION

- A. Contractor shall review cable tray and wireway routing to other installations and structures.
- B. Final location of cable trays and wireways shall be approved by the Engineer.

#### 1.05 PRODUCT STORAGE AND HANDLING

- A. Store cable trays and wireway components in original packaging and protect from weather and construction traffic. Store indoors when possible.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Wireway systems shall be lay-in or feed-through type and sized as indicated on the Drawings. Wireway system shall be as manufactured by Hoffman, or equal, and shall be steel or stainless steel as indicated on the Drawings or as specified herein.
- B. Cable tray systems shall be ladder type as called for on the Drawings. The system shall be manufactured by Cooper B-Line, or equal, and shall be galvanized steel, stainless steel, or aluminum as indicated in the Drawings and Part 4 of these Specifications.
- C. Materials and Finish:
  - 1. Wireways:
    - a. Steel:
      - 1) Straight sections and fittings shall be 14-gauge steel minimum with painted and corrosion resistant finish inside and out along with oil resistant gaskets for a NEMA 12 rating minimum.
    - b. Stainless Steel:
      - 1) Straight sections and fittings shall be minimum 16-gauge type 304 stainless steel with No. 2B finish with oil resistant gaskets for a NEMA 4X rating.
  - 2. Cable Trays:
    - a. Aluminum:
      - 1) Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063.
      - 2) Fabricated parts shall be made from Aluminum Association Alloy 5052.
    - b. Hot-Dipped Galvanized Steel:
      - 1) Straight section and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter, and shall be

hot-dipped galvanized after fabrication in accordance with ASTM A123.

- 2) Covers and splice plates shall be hot-dip galvanized after fabrication. Mill galvanized covers shall not be acceptable for hot-dipped galvanized cable tray.
- 3) All hot-dipped galvanized steel cable trays, after fabrication, shall be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc.

c. Stainless Steel:

- 1) Straight section and fitting side rails and rungs shall be made of AISI Type 304 or Type 316 stainless steel.
- 2) Transverse members (rungs) or corrugated bottoms shall be welded to the side rails with Type 316 stainless steel welding wire.

D. General:

1. Except as otherwise indicated, provide metal cable trays and wireways of types, classes and sizes indicated; with splice plates, hangers, bolts, nuts and washers for connecting units.
2. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards.

## 1.02 PERFORMANCE REQUIREMENTS

A. Wireways:

1. Wireways shall be installed per manufacturer's recommendations and shall maintain the area NEMA rating as indicated.

B. Cable Trays:

1. Cable trays shall have strength and rigidity to provide support for all contained wiring, fittings, and terminations as indicated on the Drawings and as specified.
2. Cable trays for outdoor installation shall be sized for an additional 20 pounds per square foot for snow and ice loading.
3. Cable trays and fittings shall be per NEMA Standards Publication VE-1. Inside depth and width shall be as indicated on the Drawings. Fittings shall have a maximum rung spacing of twelve inches, measured in a direction parallel to the cable tray.

## 1.03 COMPONENTS AND ACCESSORIES

A. Wireways:

1. Wireway supports shall be installed per the manufacturer's recommendations and as specified in NEC.

2. Wireways shall be labeled every 10 feet as to the type of wiring contained within the wireway system.
- B. Cable Trays:
1. Covers and accessories supplied by the manufacturer shall be installed where indicated on the Drawings and be of the same material and finish as the cable tray.
  2. Supports shall be in conformance with NEMA standards and recommendations, and shall be capable of carrying the required cable loads, fittings, junction boxes, splices, conduit terminations, tray weight, plus 25% excess capacity for potential future loads. On vertical runs, the cable shall be held by supports against thrust external to the tray.
  3. Support kits shall be supplied only by the manufacturer of the cable tray system and shall be of the same material and finish as the cable tray. Kits shall be installed per the manufacturer's recommendations.
  4. Provide only the manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends barrier strips, connectors, and grounding straps as required.
  5. Provide firestopping barriers per Section 07270 where tray passes through a wall into a classified area, outdoor area, or elsewhere as required.
  6. Provide warning signs that shall have black letters 1-1/2 inches high on yellow background and labeled with "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Field revised locations of cable trays and wireways shall be approved by the Engineer before installation.

### **3.02 INSTALLATION**

- A. Wireways:
1. Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that wireway equipment complies with requirements of NEC.
  2. Wireway covers shall be able to open at least 90 degrees after complete installation to allow for access.
  3. The entire wireway system shall be grounded in compliance with the NEC and shall not be used as a grounding conductor or as an equipment grounding conductor.

4. Debris shall not be allowed to accumulate within wireways at any time. At the conclusion of construction, the contractor shall be responsible for removing any debris that is within the wireways.

B. Cable Trays:

1. Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that cable tray equipment complies with requirements of NEC and applicable portions of NFPA 70B, Electrical Equipment Maintenance
2. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.
3. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600; 5000; 15000 volts.
4. Support kits shall be installed per the manufacturer's recommendations.
5. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections.
6. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.
7. Cable trays installed adjacent to walls shall be supported on wall-mounted brackets as provided by the system manufacturer.
8. Metallic cable trays shall be grounded in accordance with NEC.
9. The entire system shall be grounded in compliance with the NEC, and shall not be used as a grounded circuit conductor or as an equipment grounding conductor.
10. Warning labels shall be installed in visible locations upon completion of cable tray installation.
11. Debris shall not be allowed to accumulate on the cables and trays at any time. At the conclusion of construction, the contractor shall be responsible for removing all debris that is on the cables and trays.

**3.03 INSPECTION, START-UP, AND TRAINING**

- A. Test cable trays and wireways to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance.
- B. Testing shall be conducted in accordance with NFPA 70B, Chapter 18.

**PART 4 SPECIAL PROVISIONS**

Not used

END OF SECTION

**SECTION 16132  
ACCESSORIES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all labor, tools, equipment, and materials necessary to provide electrical boxes and fittings in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and Section 16010 and shall include:
  - 1. Shop Drawings for Review:
    - a. A list of materials needed for construction, giving quantities, manufacturer's name and catalog numbers.
    - b. Manufacturer's technical product sheets on each component to be furnished.
  - 2. Information for the Record:
    - a. Manufacturer's qualifications.
    - b. Certified copies of factory test procedures and results.
    - c. Manufacturer's recommended method of installation for the products to be furnished.
    - d. Operation and maintenance manuals for equipment provided, including accessories, and maintenance instructions.
    - e. Manufacturer's recommended spare parts list for the system components and accessories.
    - f. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.

**1.03 QUALITY ASSURANCE**

- A. Applicable Standards:
  - 1. UL.
  - 2. NEMA.
  - 3. FS.
  - 4. NEC.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Except as otherwise specified in non-corrosive areas, metallic outlet, device, terminal, junction, pullboxes and conduit fittings shall be appropriate to the related conduit specification.
  - 1. Cast ferrous metal boxes shall be used with rigid galvanized conduit. Threaded openings shall have a minimum of 5 threads and neoprene-gasketed, cast covers held in place with stainless steel screws.
  - 2. Boxes whose weight in cast ferrous metal would exceed 75 pounds shall be made of sheet steel with 5-thread bosses and neoprene-gasketed covers held in place with stainless steel screws. Similarly, sheet aluminum boxes shall be provided in the larger sizes.
  - 3. Boxes larger than 6-inch shall be equipped with cap screws and hinged covers.
- B. In areas designated as NEMA 4X, outlet, device, terminal, junction and pullboxes shall be NEMA 4X of stainless steel or FRP. Sheet metal boxes where permitted above, shall be NEMA 4X watertight boxes made of 12-gauge stainless steel.
- C. Terminal and junction boxes used for control, signal, or communication wiring shall be NEMA 4X stainless or FRP, except where located in a dry area or electric room, where they shall be NEMA 12. Terminal boxes shall have white-painted backplates, barriered terminal blocks of sufficient quantity for all field taps and for all spare deadends.
- D. Cast boxes used indoors in non-corrosive locations not subject to flooding or hosing shall:
  - 1. Be dust-tight equal to O-Z/Gedney Electrical Manufacturing Company Type YU flush boxes and Type YS surface boxes.
  - 2. Include mounting lugs, with threaded openings having a minimum of 3 threads and neoprene-gasketed covers held in place with stainless steel screws.
- E. Sheet-metal boxes where permitted, including junction boxes and pullboxes at motor control centers, shall be hot-dip galvanized NEMA 12 with neoprene-gasketed covers held in place with stainless steel screws.
- F. In hazardous areas, NEMA 7 pull boxes and junction boxes shall meet all requirements of Class I, Division 1, Group D unless noted otherwise.
  - 1. Enclosures shall have hinged covers and captive cover screws, multiple threaded for fast removal, and an O-ring added to make the enclosure watertight.
  - 2. Enclosures shall be as manufactured by Killark Electric Manufacturing Company, or equal.
- G. Checkered covers shall be provided for boxes in floors or sidewalks.



- H. Concealed outlet and switchboxes for electric lights, wall switches, and receptacles, etc., shall consist of standard galvanized steel boxes and plaster rings where required. Boxes shall be National Steel City or equal.
- I. Outlets in exterior locations or in exposed conduit shall be "FS" or "FD", and PVC where used with PVC conduit.
- J. Interior junction boxes and gutters shall conform to NEC thickness and dimensional requirements, minimum.
- K. Cut edges or knockouts on all FRP boxes shall be sealed with a catalyzed resin compatible with the original resin and as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.

## **2.02 MANHOLES AND CONCRETE PULLBOXES FOR UNDERGROUND INSTALLATION**

- A. The Contractor shall provide all manholes and concrete boxes for underground electrical utilities as shown or required, including excavation, concrete, steel reinforcing, backfill, metal frames and covers, cable racks, pulling irons, and the restoration of adjacent areas to their original condition.
  - 1. Steel reinforcing and concrete for manholes and concrete pullboxes shall be Class A, as specified in Section 03200 and Section 03300, respectively.
  - 2. Manholes shall be constructed for H-20 loading. The cable racks shall be connected to the grounding system and to a ground rod in the manhole.
  - 3. Manhole maybe constructed of precast concrete in accordance with Section 02551 and Section 02552.
- B. Signal manholes shall be 48 inches wide, 48 inches long and 72 inches high inside dimensions, unless specified otherwise on the Drawings. Electric manholes shall be a minimum of 60 inches wide, 84 inches long, and 72 inches deep, or as shown on the Drawings.
  - 1. Manhole frames and covers shall be heavy-duty Neenah R-1792 Series, with R-1792 GL solid lids marked "Electric" for electric manholes, and with R-1792 FL solid lids marked "Signal" for signal manholes.
  - 2. Electric and signal manholes shall have access openings of 26-1/2 inches, and pulling-in-irons shall be provided as directed at the Site.
  - 3. Concrete pullboxes, signal, and electric manholes shall not have any conductor splices in the enclosure, unless approved by the Engineer.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Layout and installation of electrical cabinets, boxes, and fittings shall be coordinated with other installations.

### 3.02 INSTALLATION

- A. Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Install items where indicated and where required to suit code requirements and installation conditions.
  - 1. Cap unused knockout hole where blanks have been removed and plug unused conduit hubs so as to maintain the NEMA rating of the box.
  - 2. Install boxes in locations which ensure ready accessibility to enclosed electrical wiring and avoid installing boxes back to back in walls where there would be less than 6 inches (150 mm) separation. Fasten boxes firmly and rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
  - 3. Do not install aluminum products in concrete.
- C. Outlet and device boxes for flush mounted installation shall be a minimum of 4 inch square or octagonal and positioned accurately to allow for surface finish thickness.
- D. Junction boxes, pullboxes, and enclosures with hinged doors which are surface mounted shall utilize spacers to maintain 1/4-inch clearance from the wall.
- E. Floor boxes shall be installed level and flush with finished flooring material.
- F. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and secure connections when fastened with locknut or bushing on rounded surfaces.
- G. Provide electrical connections for installed boxes.

### 3.03 GROUNDING

- A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

### 3.04 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components, remove burrs, dirt, and construction debris, and repair damaged finish including chips, scratches, abrasions, and weld marks.

## PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

**SECTION 16220**  
**DIESEL GENERATOR SYSTEMS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing a stationary, engine powered, standby power rated, diesel fueled, generating system(s), complete and in place, ready for service.
- B. System shall include, but not be limited to, the engine-generator set, battery system, exhaust system, fuel system, enclosure, ducting, and all other appurtenances needed to make a complete operating system.
- C. Engine-generator system shall be delivered to the Site completely equipped, tested, and ready for installation.
- D. Engine-generator system(s) shall be comprised of all new materials. The design kW rating is based on the loads and load steps and the model listed in Part 4 of this Section.
- E. Power and control wiring to the generator(s), transfer switch(s), and accessories, except wiring described herein, shall be furnished and installed under other sections of Division 16.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Submit a list of materials giving manufacturer's name, and catalog numbers.
    - b. Submit manufacturer's technical product sheets on each component to be furnished.
    - c. Submit drawings which show dimensional layouts of the engine-generator system(s) and its spatial relationship to associated equipment.
    - d. Submit wiring diagrams for the engine-generator system(s) showing connections to feeders, load, and accessory equipment. Clearly differentiate between portions of the wiring that are manufacturer installed and the portions to be field wired.
    - e. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.
  - 2. Information for the Record:

- a. Manufacturer's recommended method of installation for the products to be furnished.
- b. Certified copies of the factory and field test procedures and results.
- c. Operation and maintenance manuals.
- d. Manufacturer's qualifications, including a list of similar installations.

### **1.03 QUALITY ASSURANCE**

- A. Engine-generator system(s) and accessories described herein shall be furnished by a single supplier who shall be responsible for the performance of the equipment in its entirety. The responsibility shall not be split among suppliers of individual components.
- B. The supplier of the engine-generator shall maintain a rental fleet of portable engine generators within 100 highway miles of the project location, maintain 24-hour parts and service capability, and provide qualified, factory trained, service personnel that can respond to an emergency call within 4 hours of notification.

### **1.04 ELECTRICAL AND CONTROL COORDINATION**

- A. All electrical, instrumentation, control equipment, and panels furnished under this Contract shall conform to appropriate Sections of Division 16 of these Specifications. Equipment and panels shall be NEMA rated as shown on the Drawings or specified in Part 4.
- B. Certain equipment items shall be connected to the plant control system as shown on the Control (P&ID) Drawings. Those connections and any remote-control connections shall be wired to clearly labeled terminal strips within the equipment control panel.

### **1.05 GUARANTEE**

- A. The manufacturer's standard warranty shall be for a period of five years from the date of substantial completion and shall not be limited by hours of operation. Warranty shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables including, but not limited to lubricating oil, filters, antifreeze, and other service items used during the course of repair.
- B. Optional warranties, supplier/manufacturer maintenance packages, and associated cost shall be available for the Owner's consideration.
- C. Engine starting batteries shall have a twelve-month full replacement warranty. The warranty shall be prorated from twelve to sixty months.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT**

- A. Engine:

1. Provide a liquid cooled, four cycle, full compression, ultra-low sulfur diesel fueled engine for each engine-generator system.
2. Each engine shall have the number of cylinders and displacement needed to develop the brake horsepower and torque necessary to drive the alternator at 1800 revolutions per minute to meet the specified performance requirements listed in Part 4.
3. Provide a fully enclosed electronic speed sensing isochronous governor, capable of providing accurate speed control. Frequency regulation shall be plus 0.5% of rated frequency during steady state conditions.
4. Engine shall be provided with an electric starting motor with starter pinion and solenoid to turn the engine at firing speed under the temperature range of 110 degrees F maximum and 0 degrees F minimum. Each starting motor shall be rated to operate on the voltage as determined by the engine manufacturer.
5. An engine mounted, replaceable element, dry type air cleaner of sufficient capacity and filtration rating to protect working parts of the engine from dust and grit.

B. Cooling System:

1. Each engine shall be furnished with a radiator, mounted on vibration isolators, and fan with fan guard.
2. Radiator shall keep the engine within normal operating temperature when running at full load.
3. Radiator for an engine-generator system installed indoors shall be provided with a duct adapter flange to allow the attachment of an air discharge duct to direct air discharge through the radiator and the wall.
4. Each engine coolant system shall be filled with the engine manufacturer's recommended antifreeze/antiboil solution. The Contractor shall provide the engine manufacturer's recommended antifreeze/antiboil solution.
5. Engine shall be furnished with a coolant heating system. The heating element(s) shall be single-phase and rated for operation at 60 Hz and the AC voltage listed in Part 4 of this Section.
6. Engine coolant heater system shall maintain the manufacturer's specified coolant temperature. A thermostat shall control the temperature of the coolant to the manufacturer's recommended temperature for start-up.
7. WARNING: Do not energize block heater until engine block is filled with coolant and the generator set is run to remove trapped air. Otherwise, block heater failure will result.

C. Alternator:

1. Alternator shall be 4-pole, engine driven, drip proof, self-aligning, continuous duty, synchronous unit with full amortisseur windings. The insulation shall be NEMA Class H.

2. Alternator shall be rated for the voltage listed in Part 4 of this Section and for 60 Hz operation at rated 1800 rpm.
  3. The alternator neutral wire shall not be connected to ground at the alternator. Each alternator shall be directly connected to the engine through a flexible coupling.
  4. Operating temperature of the rotor and stator shall not exceed 105 degrees C at rated load.
  5. Alternator shall have a brushless, rotating, solid-state, full wave, rectifier or a permanent magnet exciter. Surge suppressors shall be included on the brushless, solid-state exciter to protect the diodes from voltage spikes.
  6. Alternator shall have a voltage regulator to provide no load to full load regulation of plus or minus 0.5% at rated voltage during steady state conditions. Regulator shall be a totally solid state design, and shall include electronic voltage buildup, volts per Hz regulation, three phase sensing, over-excitation protection, loss of sensing protection, temperature compensation, and shall limit voltage overshoot on startup, and be environmentally sealed.
- D. Engine Fuel System:
1. The engine shall have fuel filters with replaceable elements and an engine driven or electric fuel pump.
  2. Fuel shall be injected into each cylinder by individual, adjustment- free injectors.
  3. A radiator mounted fuel cooler shall be provided.
  4. Fuel filter and serviceable fuel system components shall be located to prevent fuel from spilling onto engine-generator set batteries.
- E. Lubrication System:
1. Lubricating oil shall be supplied by a lube oil system.
  2. Full flow, replaceable element, oil filters, with a liquid cooled oil cooler, dip stick oil level indicator, and oil pan drain valve shall also be provided.
  3. The filter system shall be equipped with a bypass valve to prevent stoppage of lubricating oil in the event the filters become clogged
  4. The contractor shall provide the engine manufacturer's recommended lubricant and fill the crankcase to the proper level.
- F. Strip Heater:
1. Engine-generator system(s) located outdoors or in an unheated area shall have a UL listed, 120 VAC, 60 Hz, single-phase strip heater(s) mounted in the alternator housing to prevent condensation and shall be provided with an automatic control to turn off the heater(s) when the alternator is running.
- G. Batteries/Charger/Tray:
1. Provide sealed storage batteries.

2. Batteries shall be sized to crank and start the engine in the ambient temperatures of 0 degrees F for outdoor installations and 40 degrees F for indoor installations.
  3. Battery system shall have the capacity to start the engine a minimum of three times between charges.
  4. Provide battery cables sized to prevent voltage drop problems during cranking cycle.
  5. Provide a UL listed, fully automatic, solid-state, battery charger with both float and equalize charge rates, automatic AC line voltage compensation, DC voltage regulation, and automatic equalizing timer.
  6. The input voltage to the charger shall be 120 VAC, single phase, 60 Hz.
  7. Charger shall be capable of fully recharging batteries within 24 hours.
  8. Charger shall have the following protective features: fused AC input, fused DC output, automatic surge suppression, and current limit overload protection.
  9. Charger shall have a DC ammeter, DC voltmeter, AC pilot light, and an equalize charge light.
  10. Provide the following alarm contacts for connection to the alternator local annunciator: low DC voltage, high DC voltage, current/charger failure, and AC power failure. Provide high DC voltage shutdown. Charger shall be mounted for easy visual and maintenance access.
  11. Provide a battery tray or rack for each battery set.
  12. Battery tray or rack shall conform to NEC. It shall be treated to be resistant to deterioration by battery electrolyte.
  13. Battery tray or rack shall contain any spillage or boil-over of electrolyte.
- H. Exhaust System:
1. Engine-generator system located indoors shall have an engine exhaust system installed to discharge combustion gases quickly and silently with minimum restriction. System back pressure shall not exceed manufacturer's recommendations.
  2. Piping shall be as recommended by the manufacturer - insulated and shielded, supported and braced to prevent weight or thermal growth being transferred to the engine.
  3. Exhaust shall have flexible expansion fittings to accommodate thermal growth. Support dampers and springs shall be included where necessary to isolate vibration.
  4. Long runs of exhaust pipe shall be pitched away from the engine and water traps installed at the lowest point. Exhaust stacks shall be extended to avoid nuisance fumes and odors, and outlets cut at 45 degrees to minimize noise.

5. Exhaust pipes shall have stainless steel screening at the outlet to prevent entry of small animals.
6. The exhaust system inside a building, including piping and silencer, shall be insulated with fiber glass. Insulation shall be temperature rated to 1000 degrees F. Conductivity shall be 0.50 BTU-inch/hour-SF-degrees F at 300 degrees F. Insulation shall conform to ASTM C795, Standard Specification for Thermal Insulation in Contact with Austenitic Stainless Steel. Insulation shall be Johns-Manville type HTB 26, or equal.
7. Accessory materials installed as part of insulation work shall include but not be limited to:
  - a. Field-applied jacketing materials - Sheet metal, plastic, canvas, fiber glass cloth, insulating cement, PVC fitting covers.
  - b. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives, pressure-sensitive tapes.
  - c. Support Materials - Hanger straps, hanger rods, saddles, support rings.
- I. Load Center
  1. Generator shall be provided with a load center to which all ancillaries (battery charger, heaters etc.) are wired to by manufacturer. Contractor shall be required to furnish and install one (1) power feed to load center.

## **2.02 ENGINE-GENERATOR CONTROL PANEL**

- A. Engine-generator control panel shall be mounted on the alternator end of the assembly.
- B. Control panel shall be housed in a rigid metal, NEMA 4 rated enclosure, and shall include a section for cable terminations. Enclosure doors shall be lockable.
- C. Control panel shall be furnished with the necessary fuses, transformers, and other accessories required to perform the following functions:
  1. Alternator output power thermal magnetic circuit breaker, as listed in Part 4 of this Section. Breaker shall be sized and rated to carry 100% of the output current of the alternator, be UL listed, and have an adjustable shunt trip unit.
  2. Automatic start/stop operation.
  3. Adjustable cycle cranking.
  4. Output voltage adjustment potentiometer.
  5. Digital AC metering with manual phase selection and 0.5% true RMS accuracy.
  6. Digital engine monitoring.
  7. Shutdown sensors and alarms with horn and reset.
  8. Adjustable cool-down timer, and a maintained-action, red mushroom head, emergency stop push-button.
  9. Self-diagnostics and fault logging.



10. Contact to operate a spring-action to open, motorized to close, louver on indoor installations. The contact shall be rated at 10 amps, 120 VAC, and open when the engine(s) begins to crank and close when the engine(s) shuts down.
- D. Control panel components shall be environmentally sealed to protect against moisture and dirt. Engraved nameplates (black letters on white background) shall be provided to identify each device or function located on each control panel.
- E. Control panel located in unheated locations shall be provided with a strip heater, with thermostat, to eliminate condensation. Voltage shall be as specified in Part 4 of this Section.
- F. Provide visual display of the following variables, either with gauges or digital displays:
  1. Engine oil pressure.
  2. Engine oil temperature.
  3. Coolant temperature.
  4. Engine RPM.
  5. System DC Volts.
  6. Engine accumulated running hours.
  7. Alternator AC volts, selectable line-to-line and line-to-neutral.
  8. Alternator AC amps, selectable each phase.
  9. Alternator frequency.
  10. Alternator output kW.
  11. Alternator output kWHR.
  12. Alternator output kVA.
  13. Alternator output kVAR.
  14. Percentage of rated power.
  15. Alternator power factor.
- G. Control panel shall include a local annunciator with the following alarms:
  1. Low engine oil pressure alarm light.
  2. Low engine oil pressure shutdown light.
  3. High coolant temperature alarm light.
  4. High coolant temperature shutdown light.
  5. Low coolant temperature alarm light.
  6. Overcrank lockout light.
  7. Audible alarm and reset button.
  8. System not in Auto indicator light.

9. Overspeed shutdown alarm light.
10. Diagnostic shutdown light.
11. Low coolant level.
12. Low battery/DC voltage.
13. Battery charger ac failure.
14. High battery voltage.
15. Emergency stop depressed.
16. Spare.

Note: All alarm lights to be flashing LED type.

H. Remote Alarms and Monitoring:

1. Provide a remote annunciator (Drawing Designation GRA) to meet the requirements of NFPA 110, Level 1. The annunciator shall provide remote annunciation of the following alarms:
  - a. Low engine oil pressure alarm light.
  - b. Low engine oil pressure shutdown light.
  - c. High coolant temperature alarm light.
  - d. High coolant temperature shutdown light.
  - e. Low coolant temperature alarm light.
  - f. Overcrank lockout light.
  - g. Audible alarm and reset button.
  - h. System not in Auto indicator light.
  - i. Overspeed shutdown alarm light.
  - j. Diagnostic shutdown light.
  - k. Low coolant level.
  - l. Low battery/DC voltage.
  - m. Battery charger AC failure.
  - n. High battery voltage.
  - o. Emergency stop depressed.
  - p. Spare.
  - q. Generator running.
2. Remote annunciator shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.

3. Provide alarm indication for “generator ground fault” on solidly grounded wye systems of more than 150 volts to ground and circuit breakers rated 1000 amp or more, to meet NEC. Also provide alarm conditions for ‘generator running’ and ‘generator fault’ for the SCADA/Telemetry unit.

## **2.03 PERFORMANCE REQUIREMENTS**

- A. The engine-generator system shall be capable of producing the amount of electrical power listed in Part 4 of this Section at 0.8 power factor for continuous operation.
- B. The engine-generator system shall be ready to have loads applied within 10 seconds after start-up.
- C. The engine-generator system shall have a minimum motor starting capability of the kilovolt amperes (kVA) listed in Part 4 of this Section. The engine-generator system shall meet NFPA 110 single step load pickup. These ratings shall be met after all applicable demand factors for operation at 1,000 feet above sea level and in an ambient temperature of 110 degrees F maximum and 0 degrees F minimum.

## **2.04 ACCESSORIES**

- A. Silencer:
  1. Engine-generator system shall provide a critical grade silencer to provide noise attenuation.
- B. Enclosure:
  1. Provide a weather-protected, sound attenuated, enclosure for each engine-generator system located outdoors. Maximum sound level shall be 70 decibels at 50 feet, while the engine-generator system is operating at full load.
  2. Enclosure shall be constructed from galvanized steel and shall be designed and constructed so that the engine-generator system and accessories are totally enclosed.
  3. Enclosure shall be zinc phosphate treated prior to painting, then painted with the manufacturer’s standard color polyester powder baked paint.
  4. Enclosure door(s) shall be hinged and key lockable with stainless locks and hinges. Other enclosure hardware shall be stainless steel. A control panel viewing window with safety glass and lockable access door to the control panel and circuit breaker shall be provided. Each enclosure shall be provided with an externally mounted, shielded emergency stop button; drain lines to the outside for lube oil, coolant, and crankcase fumes disposal.
- C. Engine Generator Fuel Storage System - Subbase Fuel Tanks:
  1. Furnish and install engine generator fuel storage system, sized as shown on the schedule, in accordance with Federal, State and Local authorities.

2. The sub-base fuel storage tank shall be a UL 142 approved, double wall design for above ground use, consisting of a Fuel Holding Cell (Inner Tank) and The Secondary Containment Tank (outer tank).
  3. Tanks shall provide at least one 24-hour day fuel supply for engine-generators operating at full capacity.
  4. The subbase fuel storage tank shall include but not be limited to: lockable fill cap, overfill protection, spill containment, normal vent with riser and cap, emergency pressure relief vent, outer tank emergency pressure relief vent, mechanical fuel gauge, low fuel level alarm, 2-inch opening for fuel gauge/switch assembly, and leak alarm.
  5. The Fuel Holding Cell (inner tank) and Secondary Containment Tank (outer tank) shall be mated together into one assembly.
  6. Subbase fuel tanks shall be suitable for applications requiring sound enclosures.
  7. The sub-base fuel tank and related equipment including vents and fill pipes shall not block access to serviceable items on the engine or generator.
  8. Access ports, such as vents, fill opening and instrumentation, on the sub-base fuel tank shall not be located inside the area defined by the plan view of the radiator shroud.
  9. Means shall be provided to prevent adding additional fuel to the tank if oil is detected in the interstitial space between the inner and outer tanks.
- D. Emergency Stop Pushbutton:
1. All generators shall have a remote manual stop station similar to a "Break-Glass" station located outside the room housing the prime mover. If the generator is located outdoors the stop station shall be located elsewhere on the premises.
  2. The pushbutton station shall have a red pushbutton labeled "Stop" covered by a thin glass disc. A small hammer shall be attached to the enclosure with a chain. The switch shall have one Normally Closed set of contacts for each generator. The enclosure shall be rated for the area in which it is installed.
  3. A permanent nameplate shall be provided to indicate that the purpose of the switch is to stop the generator in an emergency. The nameplate shall be mounted on or in close proximity to the pushbutton station.
  4. The contractor shall provide at least five spare glass discs to the owner.
  5. The pushbutton station shall be Allen-Bradley Catalog Number 800T-NX114 with Glass Disc Kit 800T-N28, or equal.

## 2.05 FABRICATION

- A. Base:

1. Engine-generator system shall be mounted on a structural steel base capable of maintaining proper alignment between components during shipment, installation, and operation.
2. The engine-generator system shall be free from torsional stress when running at 10% of rated speed.
3. Provide spring type vibration isolators with rubber backing between the structural steel base and its foundation.

## **2.06 FACTORY TESTS AND FIELD TESTS**

- A. Prior to shipment, the unit shall be factory performance tested under load with all accessories. The tests shall be performed in accordance with the manufacturer's standards.
- B. Full block load test shall demonstrate no more than a 15% RMS voltage dip and 15% frequency deviation measured during the fourth complete cycle following application of the load.
- C. Both voltage and frequency shall return to within 3% of rated voltage and frequency in less than 5 seconds following the application of the block load. The following block load tests shall be performed:
  1. Stepped load test at 1/2, 3/4, and full load for 5 minutes each step.
  2. Three-quarter block load.
  3. Full single step block load.
- D. The Contractor shall furnish a qualified representative of the manufacturer to perform inspection, start-up, testing, and training services. The manufacturer's representative shall be experienced in the installation, start-up, operation, and maintenance of the equipment, and fuel shelf life.
- E. The representative shall check the installation and supervise final adjustments and initial start-up of the equipment. The representative shall certify that each installation is correct and that the equipment is operating satisfactorily. This service shall be for a minimum period of one trip and three days.
- F. The complete installation including each automatic transfer switch, if applicable, shall be field-tested for compliance with the plans and specifications following completion of all site work. Testing shall be conducted by representatives of the transfer switch supplier, if applicable, and the engine-generator supplier, and the switchgear supplier, if applicable. The Contractor shall supply the load bank and other equipment required for each test. The Owner and inspector shall be notified in advance and shall have the option to witness the tests. The tests shall be repeated until each system performs as specified. The tests to be conducted on site shall be as follows:
  1. Perform a cold start test on each engine-generator using the generator's actual load as a test load. A power failure shall be simulated by opening the normal power source disconnect and the following information shall be recorded for each engine-generator set.

- a. Time delay on start.
  - b. Cranking on time.
  - c. Time required coming up to speed.
  - d. Voltage and frequency overshoot.
  - e. Time to achieve steady state.
  - f. Voltage, frequency, and amps at standby state.
  - g. Oil pressure, water temperature, and battery charge rate at 5 minute intervals for the first 15 minutes and at 15 minute intervals thereafter for 2 hours.
  - h. Time delay on retransfer after return of normal power.
  - i. Cool down time delay.
2. Immediately after cooling time from cold start test, perform a one-step, four-hour, full load test using a load bank. Record the same data as in the cold start test except for time delays on transfer and retransfer.
  3. Disable each engine-generator from starting by a method approved by the manufacturer and test the crank cycle by switching the engine-generator controls to "Run".
  4. Test each engine-generator safety shutdown mechanism.
- G. After the field-testing, has been successfully completed, the manufacturer's representative shall train the Owner's personnel for one eight-hour day in the proper operation and maintenance of the equipment. The Owner may make a video record of the training.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Examine area for compliance to written installation requirements.

#### **3.02 INSTALLATION**

- A. Engine-Generator:
1. Provide a concrete housekeeping pad in accordance with Section 03300.
  2. Each engine-generator set shall be installed with galvanized steel anchor bolts as recommended by the manufacturer. Bolts shall be embedded in the concrete pad. Expansion-type anchors are not acceptable.
  3. Each engine-generator shall be installed with vibration isolators provided with the set.
  4. Provide equipment grounding connection(s) for each engine-generator unit as indicated by the manufacturer. Tighten each connection to comply with the

tightening torques specified in UL standards to assure permanent and effective grounding.

5. All connections to the engine, generator and mounting base such as conduits, fuel lines, exhaust piping, etc., must have flexible sections to prevent breakage and isolate vibration to the generator set.

B. Ducting:

1. For each engine-generator set located in a building, sheet metal duct shall be installed between the engine radiator and the exhaust wall louver.
2. Seal each joint with neoprene or similar gasket material adequate to eliminate air leaks.
3. Attach the insulation with appropriate adhesive and sheet metal fasteners on 12-inch centers.
4. Coordinate louver anchoring with louver manufacturer.
5. Louvers shall be gravity type. Motor operated louvers are too slow to open and therefore are not acceptable.

C. Fuel Piping System:

1. The piping system shall be installed per the manufacturer's instructions and all federal, state, and local codes and regulations. In addition, the fuel piping system shall comply with Section 15211.
2. The installed system shall have the capability of pressure testing the primary and secondary piping at regular time intervals.
3. The primary and secondary system shall be installed with the correct pipe slope for fluid leakage monitoring.
4. Primary and secondary piping shall be continuous between containment chambers.
5. Primary and secondary piping shall be installed per NFPA 30, Flammable and Combustible Liquids Code, and manufacturer's instructions.
6. Underground piping that slopes at least 1/8 inch per foot toward one of the containment chambers shall have a leak detection device installed in that containment chamber. Piping that is level or slopes less than 1/8 inch per foot shall have a leak detection wire or ribbon installed in the bottom of the secondary pipe throughout its length.
7. Underground piping shall be constructed in a manner to allow pressure testing of both the primary and secondary pipe during construction and at periodic intervals in the future.
8. All pipe joints shall be secondarily contained and accessible by maintenance personnel.

D. Exhaust System:

1. Install the exhaust silencer and all exhaust piping furnished with the engine-generator as recommended by the manufacturer.
2. Install wall flashing and stainless steel animal screen where the system passes through the wall.
3. Pitch the exhaust system to a petcock location that is convenient for draining.
4. All surfaces to be insulated shall be clean and dry.
5. Wet, dirty, or damaged insulation shall not be used.
6. Insulation shall be a minimum of 6 inches thick. Install in multiple layers if necessary to achieve desired thickness. Joints of multiple layers shall be staggered and overlapped.
7. Insulation shall be covered to protect it from dust, water, oil, antifreeze, etc.
8. Insulation materials and accessories shall be installed in a neat and workmanlike manner by skilled and experienced workers who are regularly engaged in industrial insulation work.
9. Aluminum lagging shall be 0.016-inch thick with banding straps on minimum 18-inch centers and at each joint.

#### PART 4 SPECIAL PROVISIONS

##### 4.01 ENGINE GENERATOR LOADING SCHEDULE

Step Number	Load Type (1)	Load Rating (2)	Full Load Amps	Motor Controller (3)	Equipment ID Tag
1	Mtr	455HP	510	VFD	Pump-1
2	Mtr	455HP	510	VFD	Pump-2
3	Misc	30KVA	36	-	

- (1) Load Type:
- Mtr = Motor
  - Trf = Transformer
  - Res = Resistance Heating
  - HVAC = Heating, Ventilating, Air Conditioning
  - Misc = Miscellaneous
- (2) Load Rating:
- hp = Horsepower
  - kW = kilowatts
  - kVA = kilovolt-amperes
- (3) Motor Controller:
- FV = Full-Voltage, across-the-line
  - RVSS = Reduced-Voltage Solid-state
  - VFD = Variable Frequency Drive
  - 2S = Two-Step, single or double winding
  - RVA = Reduced Voltage Auto-transformer
  - 2Spd = Two Speed



#### 4.02 POWER GENERATING SYSTEM SCHEDULE

- A. The following schedule is intended to aid the Contractor in identifying generator location and size. It is intended to supplement the Drawings and Specifications and is not guaranteed to be complete. All generators shown on the drawings shall be furnished and installed by the Contractor whether or not listed in the schedule.

Location	Size kW/kVA	Model Number	Alternator Voltage(s)	Engine Coolant Heater Voltage	Control Panel Strip Heater Voltage	Minimum Starting Capability (kVA)	Circuit Breaker Rating (amps)	Tank Capacity	Day Tank Capacity	Manufacturer
Outdoor	1,000kW 1,250kVA	KD1000	KH04070T			22.5		24 hr	N/A	Kohler – No equals acceptable

#### 4.03 FUEL

- A. The Contractor shall provide a full tank of fuel for testing the system. The fuel tank shall be topped off at the Contractor's expense after testing is complete and before the system is turned over to the Owner.

#### 4.04 SPARE PARTS

- A. Provide one spare 120 VAC, single phase, 60 Hz, 1/2 hp over full fuel return pump for each engine generator system.
- B. Provide one spare positive displacement transfer pump as specified above.

END OF SECTION



**SECTION 16410  
PANELBOARDS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all labor, tools, equipment, and materials necessary to furnish and install panelboards in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's technical product sheets on each component to be furnished. Submit shop drawings for each panelboard including dimensioned plans and elevations, component and device lists, a single line diagram showing main and branch bus current ratings, and short circuit ratings of panelboard.
    - b. Furnish manufacturer's name(s) and catalog numbers.
  - 2. Information for the Record:
    - a. Operation and maintenance manuals.
    - b. Upon completion of the installation and acceptance by the Owner and Engineer, all electrical (schematic) diagrams, interconnection diagrams, panel layouts, and related support materials shall be corrected and amended to reflect the installed system.

**1.03 QUALITY ASSURANCE**

- A. Work shall be in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these drawings and specifications.
- B. Equipment and materials shall be new and, if of the same type as other performing parts of the same system, shall be the products of the same manufacturer.
- C. Equipment and material shall be furnished by manufacturer of panelboards whose products have been in satisfactory use in similar service for not less than five years.
- D. Applicable Standards:
  - 1. NEC – Comply with NEC Article 408 as applicable to installation and construction of electrical panelboards and enclosures.
  - 2. UL – Comply with applicable requirements of UL 67, "Standard for Panelboards," and UL Numbers 50, 869A, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures.

- a. Provide panelboard units that are UL listed and labeled.
- 3. NEMA – Comply with NEMA Standards Pub/No. 250, “Enclosures for Electrical Equipment (1,000 volts Maximum),” Pub/No. PB 1, “Panelboards,” and Pub/No. PB 1.1, “Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.”

#### **1.04 ELECTRICAL AND CONTROL COORDINATION**

- A. Layout and installation of panelboards shall be coordinated with other installations including loads that the panelboard feeds, clearances in front of and above panelboards, and ratings of the panelboard(s).

#### **1.05 PRODUCT HANDLING**

- A. Deliver panelboards properly packaged in factory fabricated type containers or wrappings, which properly protect devices from damage.
- B. Store panelboards in original packaging and protect from weather and construction traffic. Wherever possible, store indoors. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle panelboards carefully to prevent physical damage. Do not install damaged switches or breakers, remove from Site and replace damaged devices with new.

### **PART 2 PRODUCTS**

#### **2.01 EQUIPMENT**

- A. Except as otherwise specified, low-voltage panelboards shall be factory-finished, dead-front assemblies of individually removable, bolted circuit breakers and NEMA standard copper mains and busses, enclosed in code-gauge, surface-mounting steel cabinets. The backboxes shall be continuously welded and galvanized after fabrication. Panelboards shall not exceed 78-inches in height, and shall be so mounted that height of the top operating handle will not exceed 6-feet, 7-inches from the floor. Shorter panelboards shall be mounted proportionately lower.
- B. Panelboards shall be UL listed and conform to FS W-P115, Type I, Class 1, and all applicable ANSI, IEEE, and NEMA standards.
- C. Panelboards shall be shop tested in accordance with NEMA standards.
- D. All panelboards shall include, whether shown on the Drawings or not, a Surge Protection Device (SPD) as specified in Section 16251.
- E. Panelboards shall be equipped with hinged doors. Doors taller than 30-inches shall have three hinges and doors taller than 42 inches shall have 3-point catches. A directory frame with glass or approved plastic cover shall be provided on the inside of each door and shall contain a typewritten directory listing all active and inactive circuits. Each door shall be equipped with a stainless-steel cylinder lock and hinges. The Contractor shall

furnish two panelboard keys with tag identifications per panel to the Owner. Panel fronts shall not be removable with the door locked. Panelboards shall have a solid copper neutral and a separate copper ground bar.

- F. Metal nameplates shall be secured to dead-front with rivets or screws. Nameplates shall contain system information, catalog number, and factory order number. Sticker or foil nameplates are not permitted. Interior wiring diagram, neutral wiring diagram, UL listed label and short circuit current rating shall be displayed on the interior.

## **2.02 INTERIORS (208Y/120 VOLTS)**

- A. Continuous main current ratings as indicated on associated Drawings, not to exceed 600 amps maximum. Minimum Short Circuit Current Rating shall be 10,000 RMS symmetrical interrupting capacity. Panelboards rated for 208Y/120 volts or 120/240 volts shall be Type NQOD as manufactured by Square D, or equal.
- B. Provide one copper continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboards shall be suitable for use as Service Equipment.
- C. All current carrying parts shall be insulated from ground and phase-to-phase.
- D. Interior trim shall be of dead-front construction to shield user from energized parts.
- E. Interiors shall be field convertible for top or bottom incoming feed. Main and sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amps shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

## **2.03 INTERIORS (480Y/277 AND 480 VOLTS)**

- A. Panelboards shall be rated for 480Y/277 volt or 480 VAC minimum. Continuous main current ratings as indicated on associated schedules shall be rated 600 VAC or 250 volts DC maximum. Continuous main current ratings as indicated on drawings, not to exceed 1,200 amps maximum. Main lug and main breaker panelboards shall be suitable for use as Service Equipment.
- B. Short Circuit Current Ratings (SCCR) shall not exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amps.
- C. The panelboard interior shall have three flat copper bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus. There shall be one (1) continuous bus bar per phase; each bus bar having a pair of exposed longitudinal edge portions providing non-specific mounting means for main and branch circuit breakers specified herein.
- D. The bussing shall be fully rated with sequentially phased branch distribution. Panelboard bussing shall be plated copper. The entire interleaved assembly shall be contained

between two (2) U-shaped steel channels, permanently secured to a galvanized steel mounting pan by tamper-resistant fasteners.

- E. Interior trim shall be dead-front construction to shield user from all energized parts. Main breakers up to 800 amps shall be vertically mounted. Main breaker and main lug interiors shall be field convertible for top or bottom incoming feed.
- F. Ground bar shall be copper. Solid neutral shall be equipped with a full capacity ground strap for service entrance applications. Gutter mounted neutral shall be acceptable.
- G. Circuit breaker panelboards shall be Square D type "I-Line" or equal.

#### **2.04 MAIN CIRCUIT BREAKER IN PANELBOARDS**

- A. Molded case circuit breakers shall have overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole.
- B. Two and three pole circuit breakers shall have an internal common trip crossbar to provide simultaneous tripping. Circuit breakers frame sizes above 100 amps shall have a single magnetic trip adjustment located on the front of the breaker which allows the user to simultaneously select the desired trip level of all poles.
- C. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL listed for reverse connection without restrictive line or load markings.

#### **2.05 BRANCH CIRCUIT BREAKERS IN PANELBOARDS**

- A. Breakers shall be UL listed with amperage ratings and number of poles as indicated on the Drawings.
- B. Molded case branch circuit breakers shall have bolt-on type bus connectors.
- C. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two and three pole circuit breakers shall have an internal common trip crossbar to provide simultaneous tripping.
- D. There shall be two forms of visible trip indication. The breaker handle shall be trip free and reside in a TRIPPED position between ON and OFF. In addition, there shall be a VIS-TRIP indicator appearing in the clear window of the circuit breaker housing.
- E. In addition to standard ON/OFF markings, circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position by rivet or bolt. Clip on means will not be permitted.
- F. The exposed faceplates of all branch circuit breakers shall be flush with one another.
- G. All circuit breakers for 120 volts, 277 volts, and fluorescent, LED and HID lighting circuit shall be approved for switching duty, and shall be marked SWD.

- H. Branch circuit breakers for 120/208/240/277-volt circuits shall be Type Q with 10,000-amp minimum interrupting capacity. Breakers shall be operable in any position, shall be bolted to mains, and shall be removable from the front of the panelboard without disturbing adjacent units.
- I. Ground Fault Circuit Interrupters (GFCI) shall be provided where listed in the panel schedules. GFCI shall be Class A, 4-6 mA.
- J. Equipment protection circuit breakers (EPD) with UL Listed 30 mA equipment protection shall be provided where listed in the panel schedules.
- K. GFCI and GFEPD branch circuit breakers shall have "push-to-trip" and "reset" devices for maintenance and testing purposes.

## **2.06 CIRCUIT BREAKERS FOR 480V OR 480/277 VOLT PANELBOARDS**

- A. In addition to the above specifications, 480 volt circuit breakers shall meet the following specifications.
- B. Circuit breakers shall be factory sealed and shall have a date code on the face of the circuit breaker. Poles shall be labeled with respective phase designations.
- C. Circuit breakers shall not require any additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Each individual circuit breaker shall be capable of being mounted independently. Circuit breakers of different frame sizes shall be capable of being mounted across from each other.
- D. Manufacturer shall provide time/current characteristic trip curves (I<sub>p</sub> and I<sub>2t</sub> let-through curves for true current limiting circuit breakers only) for each type of circuit breaker.
- E. Circuit breakers shall have 42,000-amp minimum interrupting capacity. Amp ratings shall be as shown on the Drawings.

## **2.07 FUSIBLE DISTRIBUTION PANELBOARD WITH FRONT ACCESS**

- A. Interior
  - 1. Interior shall be rated for 600 VAC.
  - 2. Continuous main current rating shall be as indicated on the Drawings.
  - 3. The panelboard bus material shall be plated copper running the entire length of the bus bar. The bus bars shall be fully rated to allow high ampacity switches to be mounted in any position from top to bottom.
  - 4. Main lugs and solid neutral shall be mounted in the main compartment.
  - 5. Main compartment shall be isolated by a bolted cover to shield user from energized parts.
  - 6. Main lugs or main switch interiors shall be field convertible for top or bottom incoming feed.

7. A solidly bonded copper equipment ground bar shall be provided.
  8. For service entrance applications, a solid neutral with full capacity bonding strap shall be provided.
- B. Enclosures
1. Boxes shall be of galvanized steel constructed in accordance with UL 50.
  2. Paint shall be manufacturer's standard type and color.
  3. Wiring connections shall be front accessible.
  4. Enclosures located outdoors or indoor wet areas shall be rated NEMA 3R.
  5. Enclosures located in electrical control rooms or process areas shall be rated NEMA 12.
- C. Manufacturer
1. Power distribution panelboards shall be Square D Class 4620 Type QMB, or equal.

## **2.08 RESERVED**

## **2.09 LABELS**

- A. Provide products that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the NEC, Article 100.
- B. Install label inside enclosure identifying the type of circuit breaker installed, its overcurrent rating, its interrupt rating and the UL class. Where applicable, trip settings and time delays should be provided on permanent labels.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Locate independently mounted circuit breakers and install in accordance with manufacturer's written installation instructions.
- B. Circuit breakers in distribution equipment shall be factory installed.
- C. Install wiring between circuit breakers and load devices as specified in Section 16120.
- D. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and UL 486B.
- E. Provide equipment grounding connections for individually mounted units as indicated and as required by the NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.



- F. Upon completion of installation, inspect devices, and remove paint splatters, other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
- G. Dead-front trim shall have pre-formed twistouts or plastic inserts designed for the purpose covering unused mounting spaces.
- H. Directory cards shall be typewritten and list all active circuits. Inactive circuits shall be labeled: SPARE.

### **3.02 IDENTIFICATION**

- A. Identify components in accordance with Section 16030.

### **3.03 TESTING AND INSPECTION**

- A. Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make the final system adjustments.
- B. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.
- C. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
- D. Check tightness of electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**SECTION 16411  
SWITCHBOARDS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all labor, tools, equipment, and materials necessary to furnish and install switchboards in accordance with the Drawings and as specified herein.
- B. **This switchboard (MDP-1) is provided by pump vendor and installed by Contractor.**

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Submit shop drawings for each switchboard including dimensioned plans and elevations, component and device lists, and a single line diagram showing main and branch bus current ratings and short time and short circuit ratings of switchboard.
    - b. Submit shop drawings of spare fuse cabinet showing material, dimensions, and features including storage provisions for fuse cartons.
    - c. Submit schedule of features, characteristics, ratings, and factory settings of individual protective devices.
    - d. Furnish manufacturer's name(s) and catalog numbers.
    - e. Furnish manufacturer's technical product sheets on each component to be furnished.
  - 2. Information for the Record:
    - a. Operation and maintenance manuals.
    - b. Panel Schedules
- B. Upon completion of the installation and acceptance by the Owner and Engineer, all electrical (schematic) diagrams, interconnection diagrams, panel layouts, and related support materials shall be corrected and amended to reflect the installed system.

**1.03 QUALITY ASSURANCE**

- A. Work shall be in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and specifications.
- B. Equipment and materials shall be new and, if of the same type as other performing parts of the same system, shall be the products of the same manufacturer.

- C. Equipment and material shall be furnished by an established, reputable manufacturer, shall be of top-quality construction, design, and shall be guaranteed to perform the service required.
- D. Applicable standards:
  - 1. NEC.
  - 2. NEMA.
  - 3. UL.
- E. Field Testing Organization Qualifications: To qualify for acceptance, the testing organization must demonstrate, based on evaluation of organization submitted criteria conforming to ASTM E699 that it has the experience and capability to conduct satisfactorily the testing indicated.
- F. Product Selection for Restricted Space: The drawings indicate maximum dimensions for switchboard equipment including clearances between switchboard and adjacent surfaces and items. Switchboards having equal performance characteristics and complying with indicated maximum dimensions may be considered.

#### **1.04 PRODUCT HANDLING**

- A. Deliver in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.
- B. Store so condensation will not occur on or in switchboards. Provide temporary heaters as required to assure avoiding condensation.
- C. Handle switchboards in accordance with NEMA Standard PB2.1, "General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards." Use factory installed lifting provisions.

#### **1.05 GUARANTEE**

- A. The Contractor shall warrant the completed system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one year from the date of the completed and certified test or from the date of first beneficial use.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS:**

- A. 480-volt Switchboard: Furnish and install, as shown on the Drawings, a service and distribution switchboard as specified herein, for 480 volts, 3 phase, 4 wire system, unless noted otherwise.
- B. The switchboard enclosure shall be NEMA 12 indoor construction. Switchboard shall be of the modular type construction with the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top, and rear shall be covered with removable screw-on code-gauge steel plates.

1. Switchboard shall include all protective devices and equipment, as listed on drawings, with necessary interconnections, instrumentation, and control wiring.
  2. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips.
  3. Switchboard shall be constructed in accordance with the latest NEMA PB-2 and UL 891 standards.
- C. The bus shall be silver plated copper of sufficient size to limit the temperature rise to 65 degrees C, based on UL tests. The bus shall be braced for 50,000 amps symmetrical, and supported to withstand mechanical forces exerted during short-circuit conditions when directly connected to a power source having the indicated available short-circuit current.
1. The through bus on the end section shall be extended and pre-drilled to allow the addition of future sections with standard splice plates. Grade 5 bolts will be used at bus joints. Ground bus and lugs shall be furnished.
  2. Ground bus shall extend the entire length of the switchboard, and shall be firmly secured to each vertical section.
- D. Individual sections shall be front accessible and the rear of all sections shall align. Incoming line termination, main device connection, and all bolts used to join current-carrying parts, shall be installed so as to permit servicing from the front only so that no rear access is required. The branch devices shall be front-removable and panel-mounted, with line and load side connections front accessible.
- E. The main protective device, to be installed in the main device section, shall be a quick-make, quick-break, trip-free, heavy-duty type molded-case circuit breaker. It shall be a 3-pole 600-volt breaker with a trip current rating as indicated on the drawings and an interrupting capacity of not less than 50,000 amps RMS symmetrical, at the system voltage.
- F. All branch circuit molded-case circuit breakers, shall be of quick-make, quick-break, trip-free thermal-magnetic type, with frame, trip, and voltage ratings, 3-pole, as indicated on the plans. All breakers shall have an interrupting capacity of not less than 50,000 amps RMS symmetrical at the system voltage. All breakers shall be removable from the front of the switchboard without disturbing adjacent units.
1. Comply with additional requirements of Section 16431.
- G. A ground-fault protection system shall be included when indicated on the Drawings. It shall consist of:
1. An adjustable current sensor enclosing all phase and neutral conductors of the circuit to be monitored (zero sequence method).
  2. Appropriate relaying equipment to provide the desired ground-fault current sensitivity and time-current response characteristics.
  3. A fusible, bolted pressure-contact switch equipped to function in conjunction with the other elements of the ground-fault protection system.

- 4. Installation of the equipment shall, in all respects, be in accordance to the manufacturer's recommendations.
- H. A microprocessor based power meter (PM) shall be UL listed, suitable for 3-phase measurements including phase current, phase voltage, kW, kW demand, kW-hours, kVA, kVAR, kVAR-hours, and power factor. Unit shall be Siemens Model 4300, or equal.
- I. Switchboard, circuit breakers, and power meter shall be as manufactured by Siemens Energy & Automation, Inc., or equal.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install switchboards and accessory items in accordance with manufacturers' written installation instructions.
- B. Anchor each switchboard assembly to two 4-inch minimum channel iron sills arranged in accordance with manufacturer's recommendations. Attach by tack welding or bolting. Level and grout sills flush with switchboard mounting surface.
- C. Provide and install housekeeping pads for all switchboards.
- D. Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- E. Frame and mount printed, basic operating instructions for switchboards, including control and key interlocking sequences, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on the front of the switchboards.
- F. Tighten grounding connections to comply with tightening torques specified in UL Standards 486A and 486B.
- G. Ground equipment to main electrical ground bus indicated. Provide maximum 5-ohm ground resistance at switchboard location.
- H. Tighten switchboard bus join bolts and electrical connector and terminal bolts in accordance with manufacturer's published torque tightening values. Where manufacturer's torque values are not stated, use those specified in UL Standards 486A and 486B.

#### **3.02 IDENTIFICATION**

- A. Comply with Section 16030.
- B. Identify field-installed wiring and components and provide warning signs.
- C. Identify units, devices, controls, and wiring with factory applied labels and signs.
- D. Compartment nameplates shall be engraved laminated plastic for each compartment, mounted with corrosion resistant screws.

### 3.03 INSPECTION, START-UP, AND TRAINING

- A. Comply with applicable standards of the INETA including Standard ATS, "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems."
- B. Pretesting: Upon completing installation of the system, perform the following preparation for tests:
  - 1. Make insulation resistance tests of switchboard buses, components, and connecting supply, feeder, and control circuits.
  - 2. Make continuity tests for circuits.
  - 3. Provide set of Contract Documents to test organization. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
  - 4. Provide manufacturer's instructions for installation and testing of switchboard to test organization.
- C. Quality Control Testing Program: Conform to the following:
  - 1. Program objective: to assure switchboard installation meets specified requirements, is operational within specified tolerances, provides appropriate protection for systems and equipment, and is suitable for energizing.
  - 2. Make field tests and inspections and prepare switchboard for satisfactory operation in accordance with manufacturer's recommendations and these specifications.
  - 3. Schedule tests and notify the Engineer or Owner at least one week in advance of test commencement.
  - 4. Prepare written reports of test results and observations. Report defective materials and workmanship. Include complete records of adjustments and remedial efforts.
  - 5. Upon satisfactory completion of tests and related effort, apply a label to tested components indicating test results, person responsible, and date.
- D. Visual and Mechanical Inspections: Include the following inspections and related work:
  - 1. Inspect for defects and physical damage, testing laboratory, labels, and nameplate compliance with up-to-date circuit connections.
  - 2. Verify that potential transformers, including their overcurrent protection and current transformers, meet specified requirements.
  - 3. Perform operational test and exercise of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
  - 4. Check switchboard anchorage, area clearances, and alignment and fit of components.

5. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
  6. Clean switchboard interior and exterior using manufacturer's approved methods and materials.
  7. Perform visual and mechanical inspection and related work for circuit breakers and fuses as specified in Sections 16431 and 16432.
- E. Upon completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

### 3.04 PROTECTION

- A. Apply temporary heat in accordance with manufacturer's recommendation within each section of switchboards throughout periods during which the switchboard is not in a space that is continuously under normal control of temperature and humidity.

## PART 4 SPECIAL PROVISIONS

### 4.01 EXTRA MATERIALS

- A. Spare Fuses: Provide six spares of each type and rating of fuse and fusible devices used. Include spares for:
1. Potential transformer fuses.
  2. Control power fuses.

### 4.02 SWITCHBOARD SCHEDULE

Switchboard Name	Location	NEMA Rating	Approx. Size (H X W X D)	Notes
MDP-1	Control Building	12	91.5" x 72" x 24"	*By Pump Supplier

END OF SECTION



**SECTION 16430  
DISCONNECT SWITCHES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section defines the requirements necessary to furnish and install circuit and motor disconnect switches in accordance with the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's technical product sheets on each component to be furnished.
    - b. Furnish manufacturer's name(s) and catalog numbers.
  - 2. Information for the Record:
    - a. Manufacturer's recommended method of installation for the products to be furnished.
    - b. Operation and maintenance manuals.
    - c. Manufacturer's recommended spare parts list for the components and accessories.
    - d. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.

**1.03 ELECTRICAL AND CONTROL COORDINATION**

- A. Layout and installation of disconnect switches and accessories shall be coordinated with other trades and with motor horsepower ratings.

**1.04 PRODUCT HANDLING**

- A. Deliver disconnect switches properly packaged in factory fabricated type containers or wrappings, which properly protect devices from damage.
- B. Store disconnect switches in original packaging and protect from weather and construction traffic. Wherever possible, store indoors. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle disconnect switches carefully to prevent physical damage. Do not install damaged disconnect switches, remove from Site and replace damaged devices with new.

## **PART 2 PRODUCTS**

### **2.01 RESERVED**

### **2.02 NONFUSED SAFETY SWITCHES**

- A. Provide non-fused switches with the same provisions as for fused switches but without fuse clips.
- B. Disconnect switches for motors driving process equipment shall have two normally open auxiliary contacts. One shall be wired to disable the motor controller when the switch is open. The other shall be wired to signal the Plant Control System (PCS) that the equipment is "In Service." Disconnect switches for motors driving utility equipment shall have one normally open auxiliary contact. It shall be wired to disable the motor controller when the switch is open.
- C. For applications in which all of the conditions listed in the following (1 thru 4) are met, the safety disconnect switch shall be a Crouse-Hinds NSSC manual motor starting switch, or equal, with a high-impact, fiberglass-reinforced polyester, corrosion-resistant, dust-tight, watertight, weatherproof enclosure rated NEMA 3, 4X, and 12 containing a two or three pole switch, as required by the application. Each switch shall have provisions to be pad locked in the off position. Each switch shall be UL listed and horsepower rated for 250 VDC or VAC, or 600 VAC as required. Lugs shall be UL listed for copper cable. Each switch shall include an equipment grounding plate for 3/4-inch and 1-inch conduit.
  - 1. Auxiliary contacts are not required for interlocking or remote monitoring.
  - 2. The driven equipment is not process related; e.g., overhead door operator, electric hoist, HVAC equipment, etc.
  - 3. The motor is three-phase rated 10 hp or less at 460 VAC, 7-1/2 hp or less at 230 VAC, or single-phase rated at 2 hp or less at 230 VAC, or 1 hp or less at 115 VAC.
  - 4. Motor overload protection is not required, or is provided separately by a separate device in the motor circuit.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install disconnect switches for use with motor driven equipment, motors, and controllers, within sight of the motor position where indicated.
- B. Provide suitable means for mounting disconnect switches.

### **3.02 TESTING**

- A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Where

possible, correct malfunctioning units at Site, then retest to demonstrate compliance;  
otherwise, remove and replace with new units and retest.

**PART 4 SPECIAL PROVISIONS**

**4.01 FUSES**

- A. Provide and install fuses for all fused disconnect switches along with a minimum of 3 spare fuses of each size supplied.

END OF SECTION



**SECTION 16440**  
**AUTOMATIC TRANSFER SWITCHES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all labor, tools, equipment, and materials to install a complete and functional automatic electrical load transfer system.
- B. System shall connect partial or the entire facility electrical load to either the normal electrical utility source or to a standby electrical power source, which may be an alternate feed from the electric utility company or an engine-generator set.
- C. Transfer switch shall be delivered to the Site completely equipped, tested, and ready for installation.
- D. Transfer switch and components shall be comprised of all new materials. The design rating shall be based on the loads listed in Part 4 of this Section.
- E. Power and control wiring to the generator(s), transfer switch(es), and accessories, except wiring described herein, shall be furnished and installed under other sections of Division 16.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Submit a list of materials giving quantities, manufacturer's name, and catalog numbers.
    - b. Submit manufacturer's technical product sheets on each component to be furnished.
    - c. Submit drawings which show dimensional layouts of the transfer switch from various elevations and its spatial relationship to associated power and control conduits and other associated equipment.
    - d. Submit wiring diagrams showing connections to feeders, load, and accessory equipment. Clearly differentiate between portions of the wiring that are manufacturer installed and the portions to be field wired.
  - 2. Information for the Record:
    - a. Manufacturer's recommended method of installation for the products to be furnished.
    - b. Certified copies of factory and field test procedures and results.
    - c. Operation and maintenance manuals.

- d. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.
- e. Manufacturer's qualifications, including a list of similar installations.

### **1.03 QUALITY ASSURANCE**

- A. All Work and materials shall be in compliance with applicable requirements of governing agencies having jurisdiction and the NEC.
- B. Automatic transfer switch(es) and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards of UL, NEMA, and NFPA as follows:
  - 1. UL 50 - Cabinets and Boxes.
  - 2. UL 489 - Molded Case Circuit Breakers, Molded Case Switches.
  - 3. UL 508 - Industrial Control Systems.
  - 4. UL 1008 - Transfer Switches.
  - 5. NEMA ICS - Industrial Control and Systems.
  - 6. NFPA 101 - Life Safety Code.
  - 7. NFPA 110 - Emergency and Standby Power Systems.
- C. Transfer switch(es) and accessories described herein shall be furnished by a single supplier who shall be responsible for the performance of the equipment in its entirety. The responsibility shall not be split among suppliers of individual components.

### **1.04 ELECTRICAL AND CONTROL COORDINATION**

- A. Size of automatic transfer switch shall be coordinated with the normal feed source, standby feed source and the voltage and current of the load being transferred.

### **1.05 GUARANTEE**

- A. The manufacturer's standard warranty shall be for a minimum period of one year and shall include repair parts, labor, and reasonable travel expense necessary for repairs at the job site.
- B. Optional warranties and associated cost shall be available for the Owner's consideration.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT**

- A. Automatic transfer switches shall be installed within a NEMA 4X rated enclosure, unless otherwise noted in Part 4. All transfer switches 1000 amps or larger shall be in a free-standing enclosure.

- B. Switches rated 1000 amps and less shall include quick-break, quick-make contact mechanism for manual transfer under load.
- C. Switch shall be sized and rated for continuous duty operation at the current and voltage listed in Part 4 of this Section.
- D. Main contacts shall be rated for 600 VAC minimum.
- E. Transfer switch shall be designed to carry 100% of rated current continuously in the enclosure and have 4 poles for 3 phases and a neutral, unless otherwise noted.
- F. Transfer switch shall be double-throw, with a center neutral (OFF) position, electronically and mechanically interlocked, and mechanically held in both normal and standby positions.
- G. Each transfer switch shall be equipped with quick-break, quick-make, over-center contact, operating mechanisms suitable for safe manual operation under load with door(s) closed.
- H. One set of Form "C" contacts rated at 10 amps, 250 VAC shall be provided for remote monitoring of each of the following parameters:
  - 1. Switch in Normal, Standby, and Neutral positions.
  - 2. Remote monitoring of each transfer switch fault condition.
  - 3. Failure to transfer.
  - 4. Failure to re-transfer.
  - 5. Microprocessor fault.
  - 6. Loss of utility power.
- I. Switches located outdoors or in non-climate controlled environments shall contain thermostatically controlled space heaters.
- J. Automatic transfer switch shall be similar to ASCO Series 7000, Russ Electric RMTD, Lake Shore Electric, or equal.

## 2.02 PERFORMANCE REQUIREMENTS

- A. The automatic transfer switch shall comply with Standard UL-1008 with 3-cycle short-circuit closing and withstand as follows:

RMS symmetrical amps at 480 VAC:

Switch Rating Amps	Closing and Withstand
100 - 400	353,000
600 - 800	65,000
1,000 - 1,200	85,000
1,000 - 4,000	100,000

- B. When coordinated with current limiting fuses, each automatic transfer switch shall have closing and withstand ratings of 200,000 amps, RMS symmetrical.

C. Operation - Engine-Generator System:

1. Sequence for operation of the transfer switch from the normal source to the standby source shall be as follows:
  - a. The standby engine-generator shall start after a time delay of at least 1-minute but not to exceed 5-minute to allow for the normal source momentary voltage or frequency transients.
  - b. Conditions requiring operation of the engine-generator:
    - 1) Voltage of any phase drops below 80% or rises to 120% of nominal.
    - 2) Frequency drops below 80% or increases to 120% of 60 Hz.
    - 3) A voltage differential between any two phases of 20% or greater is detected.
  - c. The time delay shall be keyboard programmable.
2. The transfer switch shall transfer load to the standby power source when that source has reached and maintained specified voltage and frequency on all phases for 1-minute minimum and 5-minute maximum.
3. Sequence for operation of the transfer switch from the standby source to the normal source shall be as follows:
  - a. The automatic transfer switch shall retransfer the load to the normal source, after 1-minute minimum and 5-minutes maximum delay, when all of the following conditions are met:
    - 1) The normal source phase voltages have been restored to a preset value of at least 90% to no more than 110% of nominal.
    - 2) Frequency of the normal source has been restored to no less than 95% and no more than 105% of 60 Hz nominal.
    - 3) The voltage differential between all phases of the normal source is below 20%.
  - b. The time delay shall be keypad programmable.
4. After retransfer of the load to the normal power source, the engine-generator set shall operate at no load for 30 minutes to allow the set to cool down, and to prevent restarting the engine-generator if the restoration of normal power is temporary.
  - a. The preset time period shall be keypad programmable.

D. Operation - Two Utility Sources:

1. Sequence for operation of the transfer switch from the normal source to the standby source shall be as follows:

(Required unless otherwise specified: 1 minute minimum, 5 minutes maximum.)



- a. Voltage of any phase drops below 80% or rises to 120% of nominal.
  - b. Frequency drops below 80% or increases to 120% of 60 Hz.
  - c. A voltage differential between any two phases of 20% or greater is detected.
  - d. The time delay shall be keyboard programmable.
2. The transfer switch shall transfer load to the standby power source if that source has maintained specified voltage and frequency on all phases. (Required unless otherwise specified: 1 minute minimum, 5 minutes maximum.)
  3. Sequence for operation of the transfer switch from the standby source to the normal source shall be as follows:
    - a. The automatic transfer switch shall retransfer the load to the normal source, after a time delay, when all of the following conditions are met: (Required unless otherwise specified: 1 minute minimum, 5 minutes maximum.)
      - 1) The normal source phase voltages have been restored to a preset value of at least 90% to no more than 110% of nominal.
      - 2) Frequency of the normal source has been restored to no less than 95% and no more than 105% of 60 Hz nominal.
      - 3) The voltage differential between all phases of the normal source is below 20%.
  4. The time delay shall be keypad programmable.

## 2.03 FABRICATION

- A. Main switch contacts shall be made of high-pressure silver alloy. Contact assembly shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
- B. Normal power source connection lugs shall be at top. Standby power source lugs shall be at bottom. Load connection lugs shall be at top.

## 2.04 COMPONENTS AND ACCESSORIES

- A. Control system shall be microprocessor based, solid-state, and shall be field programmable for transfer, re-transfer, and "pause-in-neutral position" time delays.
  1. Override momentary normal source power failure to delay engine starting.
  2. Transfer of load to standby power source.
  3. Retransfer of load to normal power source.
  4. Contact transition time on transfer to either power source.
  5. Allow engine-generator set to run unloaded after retransfer to the normal power source.

- B. Control system shall be field programmable for automatic or manual exercising of the switch and the engine-generator set, with or without load.
  - 1. Any operator initiated functions including, but not limited to selecting load or no-load exercising, shall be provided on the enclosure door and shall not require the enclosure to be opened to access this feature thus minimizing exposure to arc flash conditions.
- C. A contact closure shall be provided to start and stop the engine-generator set.
- D. Non-volatile memory capable of storing historical data including date and time of transfer and re-transfer for a minimum of 16 operating cycles shall be provided.
- E. Control system shall have three-phase under and over voltage, under and over frequency, and phase voltage differential sensing of both the normal and standby power sources.
- F. Control system shall provide each operational function of the automatic transfer switch. Controller shall have two asynchronous serial communications ports, a real-time clock, and a battery control power backup.
- G. Microprocessor shall have on-board self-diagnostics to perform periodic tests of the memory, I/O, and communications circuits, and have watchdog/power fail circuit.
- H. Controller shall have a back-lighted Liquid Crystal Display (LCD) with a keypad for access to view operational parameters and to make programming changes. The display shall show a minimum of four (4) lines of 20 characters, and the keypad shall have at least 6 tactile buttons.
- I. Transfer switch shall be equipped with electronic controls designed for surge voltage isolation, voltage sensors on all phases of power sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts.
- J. Transfer switches located outdoors shall have a thermostatically controlled, 480-volt electric heater to prevent internal condensation.

## 2.05 SOURCE QUALITY CONTROL

- A. Automatic transfer switch shall be subjected to the following factory tests:
  - 1. Units shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.
  - 2. Switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1.
  - 3. Manufacturer shall provide Owner with factory test reports.
  - 4. Manufacturer shall certify compliance with all specifications including compliance with codes, standards, and withstand current ratings.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Coordinate with other electrical work, including normal feeds, standby feeds and locations, as necessary to interface installation of transfer switch with other Work.

### **3.02 INSTALLATION**

- A. Automatic transfer switch and associated control devices shall be installed in accordance with the manufacturer's written instructions.
- B. Provide and install housekeeping pads for all floor mounted transfer switches.
- C. Power wiring shall be anchored to withstand short circuit current conditions.
- D. Provide equipment grounding connection(s) as indicated by the manufacturer.
- E. Tighten electrical connectors and terminals in accordance with manufacturer's published torque tightening values. Where such values are not published, comply with tightening values specified in UL Standards.

### **3.03 INSPECTION, STARTUP, AND TRAINING**

- A. The Contractor shall furnish a qualified representative of the manufacturer to perform inspection, testing, and training services. The manufacturer's representative shall be experienced in the installation, operation, and maintenance of the equipment.
- B. The representative shall check the installation and supervise final adjustments of the equipment. The representative shall certify that each installation is correct and that the equipment has been tested and is operating satisfactorily.
- C. If the automatic transfer switch is used with an engine-generator system, testing shall be conducted by representatives of the engine-generator supplier and the automatic transfer switch.
- D. The Owner and Engineer shall be notified in advance and shall have the option to witness the tests.
- E. After the field testing, has been completed, the manufacturer's representative shall train the Owner's personnel for one eight-hour day in the proper operation and maintenance of the equipment. The Owner may make a video record of the training.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 AUTOMATIC TRANSFER SWITCH SCHEDULE**

- A. The following schedule is intended to aid the Contractor in identifying automatic transfer switch location and size. It is intended to supplement the Drawings and Specifications and is not guaranteed to be complete. All automatic transfer switches shown on the Drawings shall be furnished and installed by the Contractor whether or not listed in the schedule.

Location	Switch ID Tag	Phase	Voltage L-L	Continuous Amps	Number of Poles	Switch Rating (1)	Enclosure Heater Control Voltage	Short-Circuit Closing and Withstand Amps RMS Symmetrical	NEMA Type Enclosure
Outdoor	ATS	3	480 V	1600	3	1600	120	42 kA	4X

(1) Switch Rating: SE = Entrance

END OF SECTION

**SECTION 16510  
LIGHTING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Under this Section, the Contractor shall provide all labor, material, services, and appurtenances necessary to make a complete operating lighting system.
- B. The Work specified in this Section includes but shall not be limited to, furnishing, installing, connecting, and testing lighting fixtures, lamps, hangers, structural supports, wiring, outlets, connections, and controls as shown on the Drawings or specifications.
- C. All Work, services, wiring, devices, equipment, and systems described herein shall conform to appropriate Sections of Division 16.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. A list of materials giving manufacturer's name and catalog numbers.
    - b. Manufacturer's Literature on lighting photometrics.
  - 2. Information for the Record:
    - a. Manufacturer's recommended method of installation for the products to be furnished.
    - b. Operation and maintenance manual.
    - c. Manufacturer's recommended spare parts list for components and accessories.
    - d. Provide warranty for review; executed copies shall be submitted when completed with copies included in the operation and maintenance manuals.

**PART 2 PRODUCTS**

**2.01 LIGHTING FIXTURES**

- A. All lighting fixtures, exit lighting fixtures and emergency lighting fixtures shall be of the size and type designated in the "Lighting Fixture Schedule" and as indicated on the Drawings.
- B. All lighting fixtures shall be equipped with accessories, special finishes, or modifications as required, and with hangers and end caps. Continuous rows of ceiling mounted or stem mounted fluorescent lighting fixtures shall have couplers. Flush mounted lighting

fixtures shall be furnished with all mounting accessories required for complete installation in the particular ceiling system involved.

- C. All vapor tight fixtures shall include an approved cast iron or malleable box.
- D. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 Electronic Drivers for LED Devices, Arrays, or Systems. LED drivers shall have a sound rating of A, have a minimum efficiency of 85%, and be rated for a THD of less than 20% at all input voltages.
- E. LED fixture shall comply with UL Standard 8750 Light Emitting Diode Equipment for use in Lighting Products, IES Standard LM-79 Electrical and Photometric Measurements of Solid-State Lighting Products, IES Standard LM-80 Measuring Lumen Maintenance of LED Light Sources.
  - 1. Provide LED fixtures with a DesignLights Consortium® (DLC) listing, a US Department of Energy (DOE) LED Lighting Facts label, or a US Environmental Protection Agency (EPA) ENERGY STAR label, which have demonstrated third-party testing verification.
  - 2. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers.

## **2.02 LAMPS**

- A. LED lamps shall have a minimum color temperature of 4000 degrees K, CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum.

## **2.03 LIGHTING CONTROL, GENERAL**

- A. In addition to the conduit and wiring, the lighting control systems for the exterior lighting systems, certain indoor lighting systems, entrance ways, vestibules and canopies shall consist of the following components:
  - 1. Integral 120 volt photoelectric cell units shall be provided.
  - 2. Photoelectric cell units shall:
    - a. Be weatherproof.
    - b. Have light level adjustment.
    - c. Have 1/2-inch stem mounting with swivel.
    - d. Have contacts rated to handle 15 amps of incandescent light at 120 VAC and 8.3 amps of ballast load at 120 VAC.
  - 3. Photoelectric cell units shall be Intermatic K4221, or equal.
  - 4. Exterior LED lighting shall have surge protective devices (SPD) for each luminaire. SPD shall be UL-1499 recognized for all phases.

## **2.04 ROADWAY AND YARD LIGHTING**

- A. All luminaires for the roadway and yard lighting systems shall be of the sizes and types designated on the Drawings.
- B. All luminaires shall be equipped with accessories as required for proper workmanlike installation.
- C. All pole mounting shall be complete with prefabricated anchor bolt assembly, leveling shims, pole base cover, grounding lug, and reinforced handhole.
- D. All exterior luminaries shall be dark bronze in color.

## **2.05 OCCUPANCY SENSOR SYSTEM**

- A. Occupancy sensors shall have both infrared and ultrasonic detection circuits.
- B. Occupancy sensors shall be wall or ceiling mounted as shown on the drawings.
- C. Wall-mounted occupancy sensors shall have a 110-degree minimum coverage band.
- D. Occupancy sensors and control units shall be UL Listed.
- E. Operating temperature range shall be 32 to 104 degrees F with rate of change not exceeding 20 degrees F per hour. Relative humidity range shall be 0% to 95% non-condensing.
- F. Once triggered, occupancy sensors shall maintain their ON state for at least 20 minutes. Time delay may be fixed or adjustable.
- G. Control units for occupancy sensors shall operate on 120 VAC and provide the required DC voltage and current to at least three sensors.
- H. Load capacity of occupancy sensor system shall be 1800 watts incandescent or 2400 watts on 120 VAC ballasts. For higher capacity or loads on multiple circuits, use an expansion relay or lighting contactor.
- I. Occupancy sensor system shall be Hubbell ATD1600 series sensors with CU series control unit, or equal.

## **PART 3 EXECUTION**

### **3.01 LIGHTING FIXTURES**

- A. All lighting fixtures shall be securely supported with hangers approved for the purpose and the particular ceiling involved. Fixture support methods shall meet the fixture manufacturer's recommendations.
- B. Box mounted fixtures shall be mounted directly to the mounting ears of the box.
- C. Fixtures shall be supported from structural ceilings or structural supports, not suspended ceiling supports. Fixtures shall not be hung from metal deck.
- D. Suspended fixtures shall be suspended by means of rigid conduit stems, not by chains or cords, unless noted otherwise.

- E. Fixtures shall be installed with due regard for structural systems, doors, piping, ductwork, and other mechanical equipment and related Work. Any fixture obscured with other Work shall be relocated at the Contractor's expense.
- F. Unless the mounting height of fixtures is shown on the Drawings or designated in the Project Specifications, fixtures shall not be mounted less than 9 feet above the floor unless the ceiling height will not permit such height.
- G. Job site Conditions: Surfaces and structures to, and on which products will be placed and installed shall be inspected before the Work of this Section begins, and shall be capable of supporting the products. Surfaces which will be concealed by products shall be finished before products are installed. Sources of permanent power shall be connected to products only after the products have been installed, inspected, tested, and approved.
- H. Emergency fixtures shall be wired to the same branch lighting circuit as normal fixtures in the same area, but to the line side of any switch or control device.

### **3.02 ROADWAY AND YARD LIGHTING**

- A. All poles and luminaires shall be assembled and erected in full compliance with manufacturer's recommendations.
- B. Trenching and backfilling for electrical work shall be performed as specified in Section 02200.
- C. All concrete bases for roadway and yard lighting as indicated on the Drawings shall be furnished and installed under this Contract in a manner as specified in Section 03300 of this Specification.

### **3.03 OCCUPANCY SENSOR SYSTEMS**

- A. Occupancy sensor control units shall be installed in NEMA rated enclosures appropriate for the area in which they are to be located.
- B. Occupancy sensors shall be mounted on the wall or ceiling in accordance with the drawings and manufacturer's instructions.

### **3.04 TESTS AND INSPECTIONS**

- A. General - This Section sets forth the electrical testing procedures required for the acceptance of electrical equipment as described in the sections that follow. The purpose of the specified tests and inspections is to determine that each piece of equipment is in satisfactory condition to successfully perform its intended function. It is the intent of these procedures to ensure that all workmanship, material, the manner and method of erection and installation conform to manufacturer's instructions, IEEE and ANSI standards and NEC, except as modified herein.
- B. Responsibility - The Contractor shall perform and supervise all tests unless specifically noted otherwise herein or on the Drawings. The Contractor shall furnish all equipment



required for the test performed by him and shall be responsible for providing such safety measures as are required for each test.

1. The Contractor shall schedule all testing with the Engineer and no testing of any kind shall be performed without the Engineer's approval.
  2. The Contractor shall notify all involved parties other than the Engineer prior to test, advising them of the test to be performed and the schedule date and time.
  3. The Contractor shall give manufacturers sufficient notice to allow the necessary arrangements to be made and to have their engineer or representative present at tests where their presence is required. Where the manufacturer's responsibility includes both electrical and mechanical performance, the Contractor shall coordinate the tests with the others involved.
- C. Circuits and Devices - The Contractor shall show by demonstration in service that all circuits and devices are in operating condition.
1. Tests shall be provided to determine that each item of control equipment will function not less than 5 times.
  2. The Contractor shall test all 600-volt wiring to verify that no short-circuits or accidental grounds exist. Tests shall be made using an instrument that applies 500 volts between conductor and ground.
  3. The conduit system shall be tested for continuity to ground.

### **3.05 CLEANING**

- A. Prior to requesting final payment, Contractor shall thoroughly clean lighting fixtures and lamps.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 FIXTURE SCHEDULE**

- A. See Drawings for fixture schedule.

END OF SECTION



**SECTION 16902**  
**METERING AND CONTROL EQUIPMENT**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Work under this Section includes furnishing and installing all metering and control equipment which is part of the Plant Control System except the programmable controller system and the graphic user interface system.
- B. All Work performed shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's literature including model number, type, size, materials, quantity, connections, equipment number, mounting hardware, and installation information.
  - 2. Information for the Record:
    - a. Equipment suppliers report that equipment is properly installed and satisfactory operation is obtained.
    - b. Software, cables, etc. for configuration, programming or operation of meters or equipment, minimum of two each is required.
    - c. Operation and maintenance manuals.
    - d. Schedule of Owner's training for all new equipment.

**PART 2 PRODUCTS**

**2.01 PRODUCT REQUIREMENTS**

- A. All metering and control equipment shall be as indicated on the Drawings and as specified, and shall include, but not be limited to those devices hereinafter defined. Should additional devices be required, but not specifically indicated elsewhere, in order to affect the intent of the Contract Documents, such devices shall be furnished.
- B. All metering and control equipment used for similar applications shall be the product of a single manufacturer.
- C. All features and requirements listed in the individual instrument specifications are required.
- D. All field instrument enclosures shall be NEMA 4X construction.

- E. All faces of panel mounted instruments shall be NEMA 4X construction except where the panel is located in a protected Control Room environment.
- F. Whenever an "or equal" equipment item is proposed in lieu of that specified it will not be considered equal if it is of non-potted construction and the specified item is potted construction.

## 2.02 PERFORMANCE REQUIREMENTS

- A. Analog signals for input to a programmable controller system shall be isolated 4-20 mA DC and where required, current to current transducers or other device shall be furnished to produce an isolated signal to the programmable controller analog input modules.
- B. Digital input signal sources shall provide an isolated contact rated at 5-amp minimum, 115 VAC, to the programmable controller system.
- C. Power supplies shall be furnished for two-wire transmitters and other devices requiring DC power. No more than four loops shall be powered from one power supply. Separate power supplies shall be provided for duplicate instruments to ensure failure of one power supply will not inhibit operation of secondary equipment.
- D. The Site is in an area subject to radio frequency activity. Any equipment sensitive to radio frequency interference (RFI) shall be provided with the proper RFI filters, be properly shielded and grounded, or otherwise protected to allow proper operation of the equipment.

## 2.03 FLOW

- A. Flow ~~Meter and Human Machine Interface Element and Transmitter (FMFE)/(FIT))~~

Function	Measure flow in process line and transmit signal proportional to flow
Type	Pulsed DC magnetic induction
Size	<del>16</del> 2-inches
Meter Location <del>/ Rating</del>	<del>Underground Vault Flow Meter Chamber</del>  <del>Rated for NEMA6/IP67 Continuous Submerged Service in a maximum of 15-feet of water.</del>  <del>NEMA 7 Junction Box</del>
<del>NEMA IP Rating</del>	<del>Rated for NEMA6P/IP68 Continuous Submerged Service.</del>  <del>A junction box adequate for the specified ratings shall be provided if required.</del>
<del>Input Signal</del>	<del>Analog Process Flow</del>
Output Signal	Isolated 4-20mA DC output into 800 ohms.  Flow direction, empty pipe detection. Two contact outputs and one contact for positive zero return.
Fluid Type	Municipal Wastewater

Metering Tube	304 SST, Epoxy Coated
Accuracy	0.5% of the flow rate 1-33 fps
Liner	Hard Rubber
Electrodes	Hastaloy C Bullet Nose
HMI / Display	<del>Remote Mounted, capable of simultaneously displaying flow rate and totalization</del>
<del>Transmitter / HMI / Display Transmitter Enclosure:</del>	NEMA 4X remote electronic display <u>(mounted in Pump Control Building)</u> , with flow rate and totalization indicator.  Backlit LCD Display
Process Pipe Connections	Class D 150 lb. AWWA Flanges
Grounding	All meters must be supplied with orifice type 316 stainless steel grounding rings. Grounding electrodes are not acceptable.
Converter:	Microprocessor based remote converter.  Refer to drawings for cable length.
Power Requirements	110/120 VAC 50/60 Hz. for Remote display
Electrical Rating	Meter shall be FM approved for Class 1 Division 1 and 2 Groups B, C and D.
Manufacturer	Sparling
Model	TigermagEP FM656
<u>Drawing Designation</u>	<u>FM-1 (Flow Meter)</u> <u>FMH-1 (Remote Transmitter / HMI)</u>

## 2.04 ACCESSORIES

- A. All piping and tubing for connections to instruments shall be stainless steel. Threaded pipe shall be ASTM A312, Grade TP304, Schedule 40S, and fittings shall be AISI Type 304. Tubing shall be ASTM Grade TP304, 0.028-inch minimum wall thickness for flareless "bite" type with threaded nut and ferrule fittings.
- B. All mechanical fasteners such as bolts, nuts, screws, cinch anchors, clamps, etc., shall be stainless steel.
- C. All special mounting brackets shall be stainless steel, galvanized, or nonferrous non-corrosive metal.
- D. All equipment mounted outdoors that includes any type of visual indicator, LCD, etc., shall be furnished with a sun visor.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. The features and installation of the instrumentation shall be coordinated for optimal performance with the characteristics of the process material to be metered.
- B. Care must be exercised to identify locations that meet the requirements of the manufacturer including upstream and downstream distances, pressures, temperatures, and accessibility for maintenance.

- C. Verify equipment requirements and dimensions with provisions specified under this Section. Check actual field conditions, report necessary changes, and submit equipment reflecting changes.
- D. Coordinate Work with other trades to avoid conflict and to provide correct rough-in and electrical connection requirements. Inform Contractors of other trades of the required access to and clearances around equipment to maintain serviceability and code compliance.
- E. Where the installation of any device is dependent on, or affected by, Work performed under other sections of these specifications, the Contractor shall coordinate the Work. Installation coordination includes the correct location and placement of devices, piping to the equipment, pipe taps, control power circuits, connections to the control system, etc.
- F. Installation of instrumentation in an existing system being modified, replaced, or abandoned, shall be coordinated with the Owner and shall be performed to minimize operational disruptions and minimize time that equipment may be out of service.

### 3.02 INSTALLATION

- A. Installation shall include the provision of materials, and the coordination of all details, necessary to properly install the instruments including location, arrangement in piping, power source, signal wiring and conduit, special brackets, and all mounting hardware.
- B. All instrumentation devices shall be installed in accordance with the manufacturer's installation requirements.
- C. Wiring practices for intrinsically safe systems shall be in accordance with ISA RP12.06.01.
- D. Instruments shall be installed so that the various components are accessible for maintenance. Care shall be taken in the installation to ensure sufficient space is provided between instruments and other equipment, including piping, for ease of removal and servicing. All instruments shall be readily accessible from grade, permanent platforms, or fixed ladders.

### 3.03 STARTUP AND TRAINING

- A. The Contractor shall provide the services of component manufacturer's factory trained personnel for the supervision of installation, initialization, and calibration of equipment.

## PART 4 SPECIAL PROVISIONS

None Used

END OF SECTION

**SECTION 16903  
CONTROL PANELS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Work under this Section includes the fabrication and installation of all control panels and other enclosures required to provide a complete instrumentation and control package. Panel wiring is also included herein.
- B. All control panels furnished or installed under this contract shall meet the requirements of this Section. Panels include, but are not limited to, those designated control panels, interim panels, enclosures, remote I/O panels, or other required enclosures necessary to complete the Work.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Submittals shall show door arrangement and device layout, wireways, subpanel layout, padlock and vault type locking handle, dimensions, legends, terminal blocks and terminations, etc.
    - b. Panel schematic wiring diagrams shall be provided to show all panel wiring systematically numbered. All devices shall be identified by device symbol designation; all lines and points shall be numbered. Each line shall be identified by function.
    - c. Furnish manufacturer's name, catalog numbers, and product specifications for each component and panel to be furnished.
  - 2. Information for the Record:
    - a. Operation and maintenance manuals.
    - b. Upon completion of the installation and acceptance by the Owner and Engineer, all electrical (schematic) diagrams, interconnection diagrams, panel layouts, and related support materials shall be corrected and amended to reflect the installed system.

**1.03 QUALITY ASSURANCE**

- A. All control panel enclosures shall be UL listed and designed in accordance with applicable NEMA, ANSI, and UL 508 Standards.
- B. All wiring and terminations shall be designed, manufactured, and tested in accordance with the latest applicable standards of the NEC as well as state and local codes.

- C. Control panels shall conform to third party safety certification. The assembled control panel shall bear a serialized UL label listed for "Industrial Control Panels" UL 508A. The enclosure, and all components mounted thereto shall conform to UL descriptions and procedures.

## **PART 2 PRODUCTS**

### **2.01 ENCLOSURES**

- A. All enclosures shall be Hoffman Enclosures, Inc., Bulletin A4, A12, A19, or A30 as specified or equal.
- B. All equipment and controls shall be mounted in metal enclosures designed and manufactured in accordance with the applicable standards of NEMA, ANSI, and UL 508A Standards. Panels shall be floor-mounted, free standing or wall mounted (as determined by manufacturer's mounting provisions for the size and type of panel).
- C. Enclosures in a Control Room shall be NEMA 12 rated. Enclosures not located in a Control Room shall be NEMA 4X rated, nonventilated stainless steel unless noted otherwise.
- D. Enclosures shall have a rolled lip around all sides of the opening so that a drip hood is not required.
- E. Single door enclosures shall be hinged left with removable hinge pins. All NEMA 12 rated panel doors shall incorporate a vault type handle with 3-point latching mechanism for securing the door in closed position and door locks shall be keyed alike. NEMA 4X rated panel doors shall be furnished with padlock hasp and padlocks, all keyed alike. NEMA 4X rated panel doors shall be held closed with hardware certified compatible with the epoxy resin coating or stainless steel. Only smooth rubber gasket material shall be used for providing the door seal.
- F. Double door enclosures shall have a removable center mullion and overlapping doors with three-point latching mechanisms with oil tight keyed locking handles, all keyed alike.
- G. Removable "eye" bolts shall be provided to facilitate slinging and handling of enclosures. "Eye" bolts shall be mounted directly to and be part of the enclosure structural members so as to distribute the stresses and weight while slinging.
- H. Panels shall have print pockets attached inside the door, as space permits.
- I. Cover boxes, enclosures; etc. regardless of size with front mounted devices shall have a hinged door unless noted otherwise.
- J. Panel layout and equipment spacing shall be sufficient to allow for device removal and maintenance without disassembly of adjacent devices. Additionally, ample panel gutter space (sides, top, and bottom) shall be provided for training wires and cables.
- K. The Contractor shall properly size each enclosure, allowing 20% back panel spare space. Each enclosure shall be sized as specified herein or shown on the Drawings, or to suit



the physical dimensions required for components and heat requirements of the components mounted within, whichever is the largest.

- L. Control panel doors shall not exceed 36 inches in width.
- M. Control panel depth shall not be less than 8 inches.
- N. Floor mounted type enclosures shall be provided with floor stands. The legs of floor-mounted enclosures shall be at least 12 inches high.

## 2.02 PLC AND REMOTE I/O ENCLOSURES

- A. Programmable controller system enclosures shall include, in addition to those general requirements previously listed:
  - 1. Power supply and distribution equipment.
  - 2. All I/O wiring from the modules, including spares, wired to terminal strips.
  - 3. The main processor chassis, I/O chassis as required, power supplies and power strips.
  - 4. A constant-voltage, filtered power supply shall be provided for all AC loads or an uninterruptible power supply.
  - 5. Circuitry and devices for a POWER ON indicating light.
  - 6. A 15 amp, specification grade, duplex receptacle, and interior fluorescent lighting switched by a door operated switch, both powered from a circuit separate from the control voltage circuit.
- B. All panel enclosures housing a PLC shall be of sufficient size to house any required analog output power supplies, properly sized wiring channel and wiring terminals sufficient in number to terminate all incoming and outgoing wiring of the enclosures, plus enough spares to wire all spare points in the I/O chassis assuming worst case conditions (all 120VAC inputs).

## 2.03 POWER, INSTRUMENTATION AND CONTROL WIRING

- A. Panel interior control wiring shall be a minimum of No. 16 AWG-MTW, 2/64 PVC insulation, and 90 degrees C rated for AC connections. Nylon jacketed and/or TFFN wire will not be accepted. Thermoplastic wire cover shall be colored:

RED	for AC wires
DARK BLUE	for DC wires
CANARY YELLOW	all foreign wiring inside the panel not being de-energized by the panel feed circuit breaker
GREEN	all ground wire connections
BLACK	for power source
WHITE	for power neutral
LIGHT BLUE	intrinsically safe system

- B. Signal conductors shall be as specified in Section 16121.
- C. Power wiring shall be 600 volts and as specified in Section 16120. Conductors shall be stranded copper. No wire smaller than No. 12 AWG shall be used for power wiring.
- D. All wire in control enclosures shall be identified at each terminal with wire identification tags as specified in Section 16030.

#### **2.04 ENCLOSURE ACCESSORIES**

- A. Terminal blocks shall be Allen Bradley 1492 - W4 or equal. The Contractor shall allow 20% extra terminal connections in addition to those terminals required for the termination of spare control conductors and instrument cables.
- B. Outdoor NEMA 4X rated enclosures shall have condensation protection and temperature control to maintain equipment manufacturer's specified operating temperatures. Condensation protection and temperature control shall be typical for all such enclosures and shall be sized accordingly and thermostatically controlled. Condensation protection and temperature control shall be Hoffman Enclosures Inc. - Bulletin D85, or equal.
- C. Plastic wireway shall be used to train wires in all control panels and enclosures. Wireway fill shall not exceed 20% and shall be run in continuous lengths with snap-on type covers.
- D. Each panel shall have a panel grounding bus bonded to the panel enclosure and a braided grounding strap connecting the panel door(s) to the panel enclosure frame.
- E. Nameplates and legends shall be per Section 16030.

#### **2.05 FABRICATION**

- A. Equipment, controls, and devices specified elsewhere and shown on the Drawings shall be mounted in enclosures manufactured in accordance with applicable NEMA, ANSI, and UL 508A Standards. All devices shall be mounted in accordance with the component manufacturer's recommendation. Devices shall be adequately supported and organized so that operation and maintenance access is unrestricted.
- B. All necessary inner panels and supporting members shall be provided by the Contractor.
- C. To minimize future maintenance problems, all panel enclosures shall be provided by one manufacturer to the extent that it is possible.
- D. All panel wiring shall terminate at terminal blocks unless noted otherwise. Wire numbers shall be marked on an integral marker strip in numerical sequence for each individual block.
- E. Instrumentation designs shall be such that analog signals that do not leave the enclosure shall be wired direct, without splices or terminals, from instrument to instrument unless accomplished in accordance with other provisions of these specifications.

- F. Signal wiring shall be segregated and shielded from control and power wiring, grouped functionally, and arranged neatly to facilitate tracing of circuits.
- G. No combination of analog, digital input, or control output wiring should be intermixed within the same bundle or duct. All analog wires shall be justified right while discrete 120 VAC wires shall be justified left.
- H. Plastic wiring wraps shall be used to bundle wires, except within wiring ducts. The bundles shall be securely fastened to the steel structure at suitable intervals, not exceeding 12 inches.
- I. Required device holes shall be provided by the panel manufacturer and punched prior to coating. No extra holes or field cut holes shall be permitted unless approved by Owner or Engineer.
- J. Door or cover mounted panel devices shall not be located less than 30 inches above the finished floor. Door and cover mounted devices (i.e., pushbuttons, pilot lights, selector switches, meters, etc.) mounted in NEMA 12 and 4X enclosures shall, in addition to standard gaskets, be sealed with silicone grease compound as manufactured by Dow-Corning (No. 732) or equal.
- K. Panels containing 480 volt power wiring contained within shall have a defeatable (disconnect switch) mounted on the panel front exterior to prevent opening the panel while the switch is in the ON position.
- L. Panels containing 120 volt power (except canary yellow foreign wiring powered elsewhere) shall have provided inside the enclosure a properly sized fused isolation switch or circuit breaker.
- M. Floor mounted and free standing enclosures shall be equipped with an interior, 15 amp, specification grade duplex receptacle and interior fluorescent lighting. A switch shall be provided to control the lighting unless noted otherwise in these specifications. The receptacle and light shall be powered from a circuit separate from the control voltage circuit.
- N. Panel shall have sufficient structural reinforcement to ensure a flat plane surface, to limit vibration, and to provide rigidity during shipment, installation, and operation, without distortion or damage to the panel or damage to any instrument mounted thereon. Minimum thickness of panels shall be:
  - 1. Single door wall mounted up to 48-inch high by 36-inch wide by 16-inch deep shall be a minimum of 14-gauge steel.
  - 2. Floor-mounted, wall-mounted and free standing panels larger than the above shall be a minimum of 12-gauge steel with angle reinforcement.
- O. Joined edges, corners, and seams shall be of a continuous bead weld (filler or dubbing shall not be permitted), and ground to a finish so as not to be detectable after painting. Spot welds shall be used only to connect flat metal surfaces to structural support bracing to provide rigidity. Panels with any warping due to welding procedures or any other cause shall be rejected.

- P. Panels shall be bonderized or cold phosphated before painting. NEMA 12 rated panel shall be primed and factory finished with two coats of ANSI color baked enamel. The color is to be selected by the Owner. NEMA 4X rated panels shall be primed and coated with a powdered resin, heat-cured, 100% solid thermosetting epoxy, unless the enclosure is stainless steel. Interior surfaces shall be high-gloss white, and the exterior surfaces shall be a high-gloss color to be selected by the Owner.
- Q. The inner-mounting panel shall be a minimum of 12 gauge for single door enclosures and 10 gauge for double door enclosures. The panel shall be mounted with stainless steel fasteners and coated the same as panel interior.
- R. Equipment mounted within free standing and floor-mounted control enclosures shall not be located such that it will be less than 18 inches above the mounting surface (floor, housekeeping pad, platform, etc.) after installation in the field.
- S. Outdoor enclosures shall have their operator controls, (such as, but not limited to: pushbuttons and selector switches), mounted on a steel inner swing-out panel unless noted otherwise on the drawings. The swing-out panel mounted controls shall be accessible only after opening the lockable outer door.
- T. Indicators and control operators mounted through the exterior of control enclosures shall be at least 30 inches above the walking surface (floor, housekeeping pad, platform, etc.) after installation in the field. The only exception to this rule will be alarm horns, speakers and similar audible devices.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Panel location and clearances shall be in compliance with the NEC.

#### **3.02 INSTALLATION**

- A. Each conduit penetration of the panel shall be made in accordance with the manufacturer's recommendations. Each panel penetration shall comply with requirements to maintain NEMA ratings specified. No remaining holes or knockouts will be permitted except for power wiring entrances, signal wiring entrances, and mounting hole for any future panel mounted device(s). Holes shall be covered with a plastic plate. Conduit entrances shall be from the bottom of the enclosure first; then if bottom is not practical, the sides of the enclosure will be used. All panel mounted equipment will be protected from metal shavings, moisture, and debris while working in enclosures.
- B. Install wiring between panel mounted devices and field devices as specified in Section 16120.
- C. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and UL 486B.

- D. Provide equipment grounding connections for individually mounted units as indicated and as required by the NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.
- E. Upon completion of installation, inspect devices, and remove paint splatters, other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
- F. The bottom of wall-mounted control enclosures shall be at least 18 inches above the floor or platform. Use galvanized or aluminum unistrut when attaching control enclosures to vertical surfaces. Consideration shall be given to compatibility of unistrut and control panel metal surfaces in contact with one another.
- G. The mounting of each panel shall allow for a minimum of 30-inch wide by 42-inch deep work area and door opening clearance of 90 degrees in front of panel to accommodate suitable room to open panel door and to provide the necessary work area.
- H. Each floor mounted or freestanding panel shall be installed on a 4-inch thick housekeeping pad, continuous under the panel and extending 1-inch out from all sides. Pads shall have a 1/2-inch chamfer on all sides, except against walls.

### 3.03 IDENTIFICATION

- A. Identify panel and components in accordance with Section 16030.
- B. Individual nameplates shall be labeled to match the single line and schematic drawings.

## PART 4 SPECIAL PROVISIONS

### 4.01 GENERAL ENCLOSURE SCHEDULE

- A. The following schedule is intended to aid the Contractor in identifying panels, location, and approximate size. It is intended to supplement the Drawings and Specifications and is not guaranteed to be complete. All enclosures shown on the drawings, specified or as necessary to complete the Work shall be furnished and installed by the Contractor whether or not listed in the schedule unless otherwise noted in the Allowance Section.

Panel Name	Location	NEMA Rating	Approx. Size (H x W x D)	Notes
SCADA / Remote Telemetry Unit (RTU)	Control Building	See 01021	See Section 01021	By Allowance See Section 01021*
Pump Control Panel	Control Building	See 11735	See Section 11734	*By Pump Supplier

- B. Panels marked with \* require installation and field wire terminations by the Contractor. Reference the design plans and specifications for wire terminations.

END OF SECTION



