

# ADDENDUM No. 1

ITB No. 4703

## Barton Pump Station Valve Improvement Project

**Due: January 20, 2022 at 10:00 A.M. (local time)**

The following changes, additions, and/or deletions shall be made to the Invitation to Bid for Barton Pump Station Valve Improvement Project, ITB No. 4703 on which proposals will be received on/or before the date and time listed above. The bid opening will be at Larcom City Hall (301 E Huron Street, Ann Arbor, MI 48104). Interested parties and/or bidders are welcome to congregate in the north vestibule of City Hall to hear the read bid amounts at bid opening.

The information contained herein shall take precedence over the original documents and all previous addenda (if any) and is appended thereto. **This Addendum consists of one hundred seventy-four (174) pages. Full addendum with updated Contract Drawings and as-built attachments will be provided to primary plan holders with a signed non-disclosure agreement filed with the City. A copy of the non-disclosure agreement is located in Appendix C of the Contract Documents.**

**Bidder is to acknowledge receipt of this Addendum No. 1, including all attachments (if any) in its Bid by so indicating on page ITB-1 of the Invitation to Bid Form. Bids submitted without acknowledgment of receipt of this addendum will be considered nonconforming.**

The following forms provided within the ITB document should be included in submitted bids:

- City of Ann Arbor Prevailing Wage Declaration of Compliance
- City of Ann Arbor Living Wage Ordinance Declaration of Compliance
- Vendor Conflict of Interest Disclosure Form
- City of Ann Arbor Non-Discrimination Ordinance Declaration of Compliance

**Bids that fail to provide these completed forms listed above upon bid opening may be rejected as non-responsive and may not be considered for award.**

### I. CORRECTIONS/ADDITIONS/DELETIONS

Changes to the Bid document which are outlined below are referenced to a page or Section in which they appear conspicuously. The Bidder is to take note in its review of the documents and include these changes as they may affect work or details in other areas not specifically referenced here.

#### **Contract Documents**

##### **SECTION 01 14 00 Work Restrictions**

*Revise paragraph 1.4.G.3 as follows:*

3. The demolition and replacement of the existing sluice gate system shall occur in the wet by divers or **in the dry with installation of stop logs**, and shall be scheduled within the period of October 1 to March 15. The demolition of the existing sluice gate and installation of the new sluice gate will require the shutdown of the 36" raw water supply line by closing and locking out Valve No. 17 and 18. CONTRACTOR shall provide fourteen (14) days' notice of when the work will occur. The shutdown of the 36" raw water supply line shall last no longer than seven (7) days. No other major work is permitted during the sluice gate replacement.

## SECTION 01 14 00 Work Restrictions

Revise paragraph 1.4.H.3.i as follows:

- i. CONTRACTOR shall close and lockout the valves, install line stops, and drain affected sections of the 24" and 42" raw water supply water mains as shown in the plan set. CONTRACTOR shall provide thirty (30) days' notice of when the work will occur. **This work will require the shutdown of the entire raw water supply to the City's water treatment plant facility and the 42" raw water main shall be returned to service no longer than six (6) hours after the section is fully isolated.** No other major work is permitted under this phase of the contract.

## SECTION 01 14 00 Work Restrictions

Revise paragraph 1.4.K as follows:

- K. Group No. 5 – Yard Valving and Piping Installation
  1. Removal and replacement of existing 24" raw water supply line, and section of 20" discharge header with future 42" raw water supply line tie-in and backflushing capabilities, and new Valves No. 30-34 to be installed associated with Group No. 5 located in the Barton Pump Station Yard shall be scheduled within the time period October 15 to March 15. The CONTRACTOR shall remove and replace the existing 24" raw water supply line with a 36"x36" tee with 36"x24" reducer to tie into the existing 24" raw water supply line and new 36" piping with a new 36" gate valve with a 36"x42" reducer that terminates with a 42"x20" tee **42" 45-degree bend** that is plugged for future connection to future 42" raw water supply line. CONTRACTOR shall follow the steps in the plans for the required piping work, new valve installations, and replacements and all associated work.
  2. Remove and replace existing 24" raw water supply line, and 20" discharge header piping with new 36", and 42" piping and 36" and 20" gate valves. CONTRACTOR shall close and lockout valves, install line stop, and drain affected piping as shown on the plan set. CONTRACTOR shall provide seven (7) days' notice of when the work will occur. This work will require the shutdown of the 24" raw water supply line, and shall last no longer than fourteen (14) days. No other major work is permitted during this phase of the contract with the exception of the Group No. 3 valving and piping replacements, ~~if both groups are simultaneously awarded.~~

## ADD DIVISION 26 Electrical

Includes the following Specifications attached in their entirety:

Electrical System General Requirements	26 05 00
Equipment Installation	26 05 03
Low Voltage Copper Wire and Cable	26 05 19
Grounding	26 05 26
Supports and Fasteners	26 05 29
Metallic Conduit and Fittings	26 05 33.13
Boxes	26 05 33.16
Identification	26 05 50
Cleaning Underground Conduit	26 05 93
Enclosed Contactors	26 09 19
Dry Type Transformers	26 22 00
Wiring Devices	26 27 26
Snap Switches	26 27 29
Fuses	26 28 13
Molded Case Circuit Breakers	26 28 16.13

*Disconnect Switches*  
*Motor Starters*

26 28 16.16  
26 29 13

## **ADD SECTION 35 22 29 Stainless Steel Sluice Gates**

*Specification is attached in its entirety.*

## **SECTION 40 05 00 Process Valves and Accessories**

**Add the entire paragraphs 2.4 and 2.5 as follows:**

### **2.4 CUSHIONED SWING CHECK VALVES**

- A. Valves 2-1/2 inches and larger shall have a cast or ductile iron body and bolted cap with a minimum non-shock W.O.G. working pressure rating as specified in the valve schedule. Seats shall be stainless and shall be screwed into the valve body. The disc shall be ductile iron with permanently rolled in stainless faces. The disc hinge pin shall be stainless steel riding in bronze bushings, one on each side of the valve. Valves shall have ANSI 125-pound standard drill flat faced flanges unless otherwise specified or shown on the Plans. Shockless chamber assembly shall be steel and mounted on the external side of the valve. The cushion chamber shall be attached to the side of the valve body externally and constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The cushion chamber shall be arranged so that the closing will be adjustable to meet the service requirements. Valves shall have outside weighted arm.
- B. Swing check valves shall be manufactured by APCO/DeZurik, GA, or J&S Valve.

### **2.5 STAINLESS STEEL BALL VALVES**

- A. Valves 2 inches and under shall have a 316 stainless steel body with a minimum non-shock W.O.G. working pressure rating as specified in the valve schedule. Ball shall be 316 stainless steel with PTFE double seal seats. Stem shall be 316 stainless steel with PTFE seals. Valves shall have screwed ends and lever operators unless otherwise specified or shown on the Plans.
- B. Valves 2-1/2 inches and larger shall have a 316 stainless steel body with a minimum non-shock W.O.G. working pressure rating as specified in the valve schedule. Ball shall be 316 stainless steel with PTFE double seal seats. Stem shall be 316 stainless steel with PTFE seals. Valves shall have ANSI 125 lb. standard drill flat faced flanges and lever operators unless otherwise specified or shown on the Plans.

## **Contract Drawings**

**Updated Contract Drawings will be provided to primary plan holders with a signed non-disclosure agreement filed with the City. A copy of the non-disclosure agreement is located in Appendix C of the Contract Documents.**

*Revise Drawing G-001 Cover Sheet*

*Revise Drawing C-106 Bird Hills Entrance Site Plan & ARV's (1/6)*

*Revise Drawing C-107 Bird Hills Detailed Site Plan ARV's (2/5) & (3/4)*

*Revise Drawing P-005 Barton Pump Station Process Flow Diagrams*

*Revise Drawing P-101 Group 1 Step 1 – Sluice Gate Demolition*

*Revise Drawing P-202 Group 2 Step 2 – Valves (1-4) Installation*

*Revise Drawing P-203 Group 2 Step 3 – Valve (5) Installation*

**Revise Drawing P-204 Group 2 Step 4 – Valve (8) Installation**

**Revise Drawing P-701 Pipe & Valve Details - 1**

**Revise Drawing P-702 Pipe & Valve Details - 2**

**Add Drawing E-001 General Electrical Notes, Abbreviations and Symbols**

**Add Drawing E-100 Electrical Site Plan**

**Add Drawing E-101 Electrical Pre-Eng. Site Plan and Light Panel Schedule**

**Add Drawing E-500 Electrical Details**

**Add Drawing I-001 General Instrumentation Symbols and Abbreviations**

**Add Drawing I-100 Instrumentation PLC I/O Wiring**

## **II. QUESTIONS AND ANSWERS**

The following Questions have been received by the City. Responses are being provided in accordance with the terms of the RFP. Respondents are directed to take note in its review of the documents of the following questions and City responses as they affect work or details in other areas not specifically referenced here.

Question 1: What is the pipe material for the existing 24-inch inlet and the 24-inch discharge lines?

Answer 1: The existing material for the 24-inch inlet is cast iron. The 24-inch discharge line is a combination of cast iron and ductile iron pipe, depending on exact location along the pipe.

Question 2: Please confirm that the 42-inch discharge and 36-inch inlet are both AWWA C301 Pipe? Are the 36" and 42" inch pipes standard push joint or are they restrained joint? Do you have any shop drawing or submittal information on this pipe?

Answer 2: Both the 42-inch discharge pipe and 36-inch inlet pipe are Prestressed Concrete Lined Cylinder Pipe per AWWA C301 with standard push joints. Shop Drawings from the original project are attached for reference.

Question 3: For the work at Valves No. 3 and 4, how is the 36-inch line isolated on the powerhouse side of the replacement section? Is a line stop necessary or are there existing isolation valves than can be used? Please provide as built drawings for the entire 36-inch line including any related elements of the powerhouse?

Answer 3: The contract document sequence for Valves No. 3 and 4 is based on the assumption that the sluice gate would be replaced and used for isolation at the powerhouse. The 36" line can also be isolated with stop logs, although some manageable leakage should be anticipated with a stop log installation. A line stop is not required.

Question 4: For the work at Valve No. 1, how is the 42-inch line isolated on the WTP side of the replacement section? Is a line stop necessary? Are there existing isolation valves than can be used or do we drain the entire line to the high point?

Answer 4: The 42-inch discharge will be isolated at the water treatment plant. This will require draining approximately 5,200 feet of 42-inch water main. The air release points along the 42-inch shall be used to introduce air into the pipe during draining.

- Question 5: Specification 01 14 00 indicates that line stops are required for Group 2 Step 3. Drawing P-203 only refers to Valves No. 1 and 6 for isolation of this stage. Can valves 1 and 6 and the existing isolation valves in the pump station be used to isolate without the need for line stops?
- Answer 5: Valves No. 1 and 6 will provide isolation on the discharge (west) side of the 24-inch and 42-inch mains. Line Stops No. 3 and 4 should be installed prior to Step 3 so that the 42-inch discharge main can be returned to service immediately once the new 16-inch valve is installed on the flange from the 42-inch main. These line stop locations are shown on the drawings.
- Question 6: Does the 6-hour duration for Group 2 Step 3 exclude the time required to close all isolation valves and drain the 36-inch and 42-inch lines?
- Answer 6: The 6-hour duration will begin as soon as the 42-inch discharge pipe is fully isolated. Since Valve No. 1 will already be installed, approximately 115 feet of 42-inch main will need to be drained. The 42-inch main will be restored to service as soon as the new 16-inch valve is installed on the existing flange from the 42-inch main.
- Question 7: For Group 2 Step 4, is the East point of connection for the new 24-inch line within the limits of existing concrete encasement? Can the connection point be adjusted to the west to avoid the section of pipe that is concrete encased?
- Answer 7: The limits of pipe replacement on the 24-inch water main will end at the concrete encasement around the existing cross. No removal of concrete encasement will occur under this project. Contractor shall field verify limits of concrete encasement to determine final limits of pipe replacement. Assumed length of pipe replacement shall be based on the drawings.
- Question 8: For Stage 2 step 4 can existing valve 9 be used to isolate the 24-inch line east of the replacement section? Are both stopples 3 and 4 required for this stage or just No. 3?
- Answer 8: Prior work along the 24-inch water main has not successfully isolated the portion of pipe where work must occur on Stage 2 Step 4. Both line stops have been included based on the assumption that Valve No. 9 potentially does not seal. There are also concerns about pipe restraint at Valve No. 9 if properly restrained line stops are not utilized. Contractors should verify shutdown requirements during field verification steps prior to the work occurring. If field isolation conditions differ, Contractors are encouraged to submit alternate isolation plans.
- Question 9: The drawings show 3 new line stops (3, 4 and 5). Are these the only new line stops required for this project?
- Answer 9: Yes, only the three line stops are anticipated to be required for isolation during construction. Line stops No. 1 and 2 are existing line stop fittings along the 24-inch discharge and will both be removed under this project.
- Question 10: Group 3/Steps 3 & 4 and Group 5/Steps 1 & 2, both have a maximum duration of 14 days. Do Groups 3 and 5 have to occur simultaneously with a duration of 14 days, or can they occur consecutively both with a combined duration of 28 days?
- Answer 10: This work should occur simultaneously with a total duration of 14 days.
- Question 11: Will Group 1 step 1 sluice gate replacement be used for flow isolation for the subsequent work groups and associated steps?
- Answer 11: The current sequence assumes the sluice gate provides flow isolation for subsequent work on the 36" intake. Isolation of the 36" intake can also be obtained by installation of stop logs at the powerhouse, although manageable leakage should be anticipated while utilizing the stop logs. If the new sluice gate is not

available prior to the start of the first low demand season, stop logs can be used for isolation.

Question 12: Does the 6-hour duration for Stage 2 Group 3 exclude the time required to close all isolation valves and drain the 36-inch and 42-inch lines?

Answer 12: The 6-hour duration will begin as soon as the 42-inch discharge pipe is fully isolated. Since Valve No. 1 will already be installed, approximately 115 feet of 42-inch main will need to be drained. The 42-inch main will be restored to service as soon as the new 16-inch valve is installed on the existing flange from the 42-inch main.

Question 13: Given the extensive phasing and low water demand seasonal constraints, it is imperative that the Contractor be afforded two full October 1st to March 15th periods (2022/2023 and 2023/2024) in order to complete the work. To this end will the Owner delay issuing a Notice to Proceed until after March 15, 2022?

Answer 13: Notice to Proceed is not anticipated until after March 15, 2022. The intent is to provide two periods of low demand to fully complete the work.

Question 14: Specification 40 05 39 requires field pressure testing and disinfection. The PCCP is untreated raw water and the replacement sections are no more than 20 feet at either location. Will pressure testing and disinfection be required or can these requirements be waived for the PCCP replacement sections?

Answer 14: Disinfection on all water mains shall only consist of swab chlorination at the time of installation. PCCP mains shall be placed back in service for visual inspection of leaks prior to encapsulating steel closure pieces in concrete. Standard pressure testing and disinfection will not apply.

Question 15: To what extent does the existing meter vault need to be abandoned. Please clarify.

Answer 15: The meter vault structure only needs to be abandoned to the extent required to properly install Valve No. 8 and associated piping. If the bottom slab is left in place, a minimum of four (4) 4-inch holes shall be cored through the bottom slab.

Question 16: Where specifically does the thrust block / Sheet Pile detail shown on Drawing P-701 apply?

Answer 16: The meter vault structure only needs to be abandoned to the extent required to properly install Valve No. 8 and associated piping. If the bottom slab is left in place, a minimum of four (4) 4-inch holes shall be cored through the bottom slab.

Question 17: Where specifically does the drain port detail shown on Drawing P-701 apply? Is it limited to the Pump Station Piping?

Answer 17: Yes, this detail is limited to the interior pump station piping. Tentative locations for confirmation by Owner during shop drawing review are identified on drawings P-303, P-304, and P-401.

Question 18: Where specifically does the PCCP drain pipe detail shown on Drawing P-701 apply? Is it limited to the outlet for the No. 6 hydrant valve on the 36-inch inlet from the Barton pump house?

Answer 18: Yes, this detail only applies to the outlet for the fire hydrant assembly installed along the 36-inch intake pipe at Valve No.4 as shown on P-202.

Question 19: Note 3 on drawing P-203 indicates the existing line stop is to be reused to isolate the 24-inch DI line for the step 3 work. Is the existing butterfly valve adjacent to the line stop in working order?

Answer 19: This note is incorrect and will be removed via addendum. The existing butterfly valve, valve no. 6, as shown on P-203 shall be used to isolate the 24-inch discharge pipe.

- Question 20: Drawing P-101 Note 5 indicates we are to perform the sluice gate field inspection in the wet. Note 8 indicates that the contractor is to be responsible for Stop log installation and sealing to perform the sluice gate installation. This indicated inspection in the wet installation in the dry. Specification section Work Restriction section 1.4 G number 3 indicates demo and installation will be in the wet. Please clarify wet or dry installation?
- Answer 20: Inspection should be performed in the wet. Demo and installation may be performed either in the wet or dry. Specification has been updated.
- Question 21: From the field visit, it appeared there were stop logs for both sides of the gate and the Contractor is responsible to install them and dewater. Is this correct, or does installing them on one side provide isolation such that the Contractor can drain the work area to install the new gate in the dry?
- Answer 21: The Contractor can install one set of stop logs in the forebay to isolate the sluice gate work area. The wood stop logs are available at the Barton Dam Powerhouse and are the property of the Owner. The Owner has previously installed them by moving them by hand and lowering them with a gantry. Contractor shall be responsible for proper installation of the stop logs and maintaining isolation during the work. Stop logs shall be removed and returned to the Owner at the completion of the work. Any damage to the stop logs shall be repaired at the Contractor's expense.
- Question 22: Can we leave the stop logs in overnight or do we need to remove them daily? Can we isolate dewater and leave in place for the 7 days to install the new gate in the dry.
- Answer 22: Yes, the stop logs can remain in place for the duration of the sluice gate installation and are not required to be removed daily. They can also be installed in lieu of the sluice gate for subsequent steps requiring isolation of the 36-inch intake. Durations of shut down shall be equivalent in either case.
- Question 23: When we perform the sluice gate inspection in the wet, can we remove the old gate frame to make the template?
- Answer 23: No.
- Question 24: If we are performing the sluice gate inspection in the wet, how many hours will the station be shutdown and isolated so that we can have divers in the well? Will any stop logs need to be put in place during this time?
- Answer 24: Per the specifications, the inspection in the wet shall last no longer than one day. Stop logs are not required. The 36-inch intake will be isolated at the pump station.
- Question 25: Drawing P-101 cut section shows stop log channels on the river side of the gate. Based on the as-built drawing we cannot see a channel on the downstream side of the gate to isolate just the gate area to perform the work in the dry. Please confirm if there is another channel and stop logs for it.
- Answer 25: There is no stop log channel on the downstream side of the gate, so the downstream piping will require partial dewatering to perform the work in the dry.
- Question 26: Do additional As-built drawing exist? Can we get copies of them? The current as-builts for the gate replacement are insufficient to develop a means and method to replace the sluice gate.
- Answer 26: Yes, additional drawings associated with the area of the gate replacement are included with the Addendum. These drawings are only available to those bidders that have provided a signed Non-Disclosure Agreement.

Question 27: On Drawing P-102 there is a dotted line after the new Sluice gate labeled sluiceway. Is the dotted line representing the work area? Or is the room/chamber open to the ceiling?

Answer 27: The sluiceway was modified during subsequent projects to directly connect to the Barton PS intake. The dashed line represents the piping that forms the intake.

Question 28: On Drawing P-102 the actuator on the left section view is orientated in the direction face the front side of the gate. In the right section view it is orientated 90 of the face of the gate. Which is correct?

Answer 28: The left section view is correct, and the actuator should be facing downstream.

Question 29: On Drawing P-103, the top right detail for the gate actuator shows a stem guide off the wall. Drawing P-102 shows mid support beams, but no steam guide off the wall. Please clarify.

Answer 29: One or both may be required based on field inspection and recommendations from gate manufacturer. Contractor and manufacturer responsible for final design based on inspection.

Question 30: On Drawing P-302, we are installing a new 36-inch BFV (Group 3 Step 2), Valve No. 11. Next to it is an existing 24" BFV. Note on the drawing indicates to blind flange the 36" BFV and the 24" BFV. There will not be any room to perform that task. Can we at this point remove the 24" BFV and blind flange the 36" BFV and the 24" pipe/flange?

Answer 30: Yes. Removal of the 24" BFV will require the line stop to be installed on the 24" intake. Custom 36" x 16" tee can also be adjusted to allow space for flange(s).

Question 31: Can alternate materials be submitted for review and approval prior to bidding?

Answer 31: No. Contractors are encouraged to submit alternate materials or equipment utilizing Bid Form Section 2 "Material, Equipment and Environmental Alternates" located in the Front End of the Contract Documents. This form provides Contractors a place to propose alternate material and equipment from those included in the project design. Contractors should follow the instructions on this form if they are intending to propose the use of an alternate item. Any change in price or schedule related to the alternate should be identified on this form.

Question 32: Can the pre-bid meeting sign-in sheet be provided?

Answer 32: Yes, the pre-bid meeting sign-in sheet is attached.

Offerors are responsible for any conclusions that they may draw from the information contained in the Addendum.



## **SECTION 26 05 00**

### **ELECTRICAL SYSTEM GENERAL REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Work Included
- B. Codes and Standards
- C. Drawings
- D. Record Drawings
- E. Operation and Maintenance Manuals
- F. Site Examination
- G. Utilities
- H. Temporary Power
- I. Storage at Site
- J. Equipment and Materials
- K. Workmanship and Completion of Installation
- L. Cutting and Patching
- M. Coordination
- N. Sanitary Lift Station Equipment Wiring and Control
- O. Miscellaneous

##### **1.2 RELATED SECTIONS**

- A. The requirements set out in the contract documents, contract forms, general conditions, supplementary general conditions and general requirements apply to all work specified herein.

##### **1.3 WORK INCLUDED**

- A. Refer to the entire set of contract documents to become familiar with the project. Contractor is responsible for all equipment mounting, conduit routing and incidental work which may be necessary because of construction requirements, whether or not they are shown on the electrical drawings.

- B. The Contractor shall furnish all materials, labor, transportation, tools, permits, fees and incidentals necessary for the installation of a complete electrical system.
- C. It is the intent of the contract documents to provide an installation complete in every respect. In the event that additional details or special construction are required for work indicated or specified, it shall be the responsibility of the Contractor to provide all materials and equipment which are usually furnished with such systems in order to complete the installation, whether mentioned or not.

#### **1.4 PAYMENT RESTRICTIONS**

- A. Electrical equipment included in Division 26 shall be paid for in the following payment sequence:
  - 1. Upon equipment delivery – 30% of the contract amount.
  - 2. Upon completion of equipment installation – 30% of the contract amount.
  - 3. Upon successful startup and testing – 30% of the contract amount.
  - 4. Upon completion of system validation – 10% of the contract amount.
- B. Retainage shall apply to the payment sequence.

#### **1.5 CODES AND STANDARDS**

- A. All work shall be in compliance with all applicable portions of the edition recognized by the Authority Having Jurisdiction (AHJ) of the National Electrical Code (NEC), the National Electrical Safety Code (NESC) and all city and county codes and ordinances, which may or may not be specifically referenced in these contract documents. None of the terms or provisions of these contract documents shall be construed as waiving any of the rules, regulations or requirements of these authorities.
- B. In any instance where these contract documents call for construction materials of a better quality or larger size than required by the codes, the provisions of the contract documents shall take precedence. The codes shall govern where violations are indicated in the construction documents. In any instance where there is a conflict between the drawings and specifications, the larger size, higher quantity or better quality shall be provided, unless the Owner's Representative directs otherwise.

#### **1.6 DRAWINGS**

- A. The accompanying drawings are intended to show the general arrangement and extent of the work. The exact location and arrangement of all parts shall be determined as the work progresses to conform in the best possible manner with the surroundings and as directed by the Owner and/or Engineer.
- B. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner's Representative for review. No departures shall be made without prior written acceptance of the Owner and/or Engineer.

- C. Figured dimensions shall be followed without reference to scale. Where dimensions are not shown, measurements shall be scaled.

## **1.7 RECORD DRAWINGS**

- A. The Contractor shall maintain a set of electrical drawings at the job site neatly marked with all changes from the original contract drawings. This set of drawings shall not be used for construction purposes and shall be available to the Owner and/or Engineer at all times. Drawings shall be kept up to date as the job progresses and shall be delivered to the Owner and Engineer at the completion of the contract.
- B. The Contract shall maintain record drawing per the requirements of Division 1.

## **1.8 OPERATION AND MAINTENANCE MANUALS**

- A. The Contractor shall furnish of operation and maintenance manuals to the Owner and and/or Engineer per the requirements of Division 1.

## **1.9 SITE EXAMINATION**

- A. The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, and verify all dimensions in the field. The Contractor shall advise the Owner's Representative of any discrepancy at least seven days prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit, the coordination of all existing conditions and the inclusion of all considerations for existing conditions.

## **1.10 UTILITIES**

- A. The contract documents reflect the general location, voltage, capacity, size and manner of routing for all utilities known to be required on this project. It shall be the responsibility of the Contractor to visit the site and to meet with the local utility companies in order to coordinate and confirm the exact requirements for all electrical utilities, including, but not limited to, all facilities required to provide complete and operative electrical power and telephone services. The bid submitted by the Contractor shall include costs for all such coordinative work as well as any and all utility company charges and/or fees.

## **1.11 TEMPORARY POWER**

- A. The Contractor shall coordinate with the Owner, and other trades involved to determine requirements for temporary power on this project. No additional charges shall be made to the Owner for wiring, connections, poles, fixtures or devices required to facilitate construction.
- B. The Contractor shall provide the necessary wiring, connections, service switches, poles, wiring protective devices, lighting fixtures, lamps, outlet devices, disconnect switches, etc., as required for temporary lighting. In addition, a similar system shall be provided for the distribution of single- and three-phase power of voltage levels and adequate ampacity as required to facilitate the construction of the project. These services shall be installed in accordance with requirements of the NEC and OSHA.

## **1.12 STORAGE AT SITE**

- A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust and physical damage.
- B. Store major electrical equipment (switchboards, panelboards, lighting fixtures, dry type transformers, VFDs, etc.) sealed in original factory wrapping in a clean, dry and conditioned environment protected from the weather. Storage outdoors is not acceptable.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT AND MATERIAL**

- A. All materials shall be new and of high quality. All materials of a type for which the Underwriters' Laboratories, Inc. (UL) has established a standard shall be listed by UL and shall bear the UL label.

## **PART 3 - EXECUTION**

### **3.1 WORKMANSHIP AND COMPLETION OF INSTALLATION**

- A. All work shall be performed by competent electricians, skilled in their trade, and shall be executed in a thorough and substantial manner.
- B. The Contractor shall be held responsible for transportation of his materials to and on the job, and for their storage and protection until the final acceptance of the job.
- C. The Contractor shall be held responsible for timely placing of all conduit and outlet boxes, cabinets and other wiring devices in the walls, ceilings, slabs, beams, etc., as construction progresses.
- D. Contractor shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds, and all labor required for the safe and expeditious execution of his contract.
- E. All equipment shall be installed in a manner to permit access to parts requiring service. All electrical equipment shall be installed in such a manner as to allow removal for service without disassembly of other equipment, and shall have working clearances as required by NEC. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to fit through finished openings, shall be placed before enclosing structure is completed. Following placement, such apparatus shall be completely protected from damage.
- F. The Contractor shall, at all times, keep the premises free from accumulations of waste material and packaging debris. This debris shall be removed daily from the construction site.

### **3.2 CUTTING AND PATCHING**

- A. Where it becomes necessary to drill or cut through any floors, walls or ceilings to permit the installation of any work under this contract, or to repair any defects that may appear prior to the expiration of the warranty, such cutting shall be done under the supervision of the

Owner's Representative by the Contractor. After the necessary work has been completed, the damage shall be repaired by the Contractor, who shall pay all costs of such cutting and repairing.

- B. No joists, beams, girders or columns shall be cut by the Contractor without first obtaining written permission from the Owner's Representative.
- C. All drilling for expansion bolts, hangers and other supports shall be done by the Contractor, subject to the approval of the Owner's Representative. Labor and materials required to replace or rebuild parts cut or injured shall be furnished at the Contractor's expense, subject to the satisfaction of the Owner's Representative.
- D. All openings made in fire-rated walls, floors and ceilings shall be patched by the electrical contractor in a manner maintaining the original fire rating.

### **3.3 COORDINATION**

- A. The Contractor shall coordinate the work of the different trades so that interferences between piping, equipment, structural and architectural work shall be avoided.
- B. The Contractor is responsible for ensuring that all conduit sleeves are timely installed and are sealed, flashed or caulked to the satisfaction of the Owner's Representative.

### **3.4 SANITARY LIFT STATION EQUIPMENT WIRING AND CONTROL**

- A. In general, the Contractor shall provide the control wiring from the pre-packaged to the mechanical furnished devices (pump, front, etc.). The electrical drawings will indicate only branch circuit power supplies to serve the station equipment.
- B. If substitution of controls or mechanical equipment for that specified requires any changes in the electrical work, any extra cost of the equipment or electrical work will be the responsibility of the Contractor.

### **3.5 MISCELLANEOUS**

- A. Each piece of floor-mounted equipment, such as control panels, etc., shall be set on a concrete base. Bases shall not be less than 4 inches high and shall be pinned to the floor.
- B. The Contractor shall furnish and install vibration isolation means for all equipment and materials furnished under this contract which may transmit perceptible noise or vibration, structure borne or air borne, to occupied areas.
- C. All transformers and other equipment indicated shall be mounted on 1-inch-thick cork rib or rubber pads or steel spring isolator units properly sized, spaced and loaded, as specified herein, which in turn shall rest on a 4-inch minimum concrete base.
- D. Electrical conduit shall be isolated from all dry type transformers and rotating or reciprocating machinery with flexible metal conduit. Use lengths approximately 10 diameters in length.

END OF SECTION

**SECTION 26 05 03**

**EQUIPMENT INSTALLATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Section specifies receiving, unloading, storing, installing, connecting electrical circuits, and placing in operation all electrical equipment, including but not limited to the following:
  - 1. Disconnect switches.
  - 2. Pump Station Controller.
  - 3. Underground Conduits.
  - 4. Above Grade Conduits.
  - 5. Inter Connections.

**1.2 RECEIVING, STORAGE, AND HANDLING**

- A. Receiving: Receive, uncrate, and inspect equipment for defects or damage. If defective or damaged equipment is discovered take necessary action to repair or replace equipment. Notify Owner/Engineer if project schedule will be affected.
- B. Storage: Store equipment in dry, clean, and secure area until time of installation.
- C. Handling: Handle equipment in accordance with manufacturer's instructions. Use lifting points where provided to move equipment. Protect painted and machined surfaces where exposed.

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

**3.1 GENERAL INSTALLATION**

- A. Grounding: Comply with Section 26 05 26 for grounding requirements in addition to specific grounding methods covered in the following articles.
- B. Identification: Comply with Section 26 05 50.
- C. Cleaning: Clean interior of enclosures prior to installation of components or pulling conductors.
- D. Supports and Fastenings: Comply with Section 26 05 29.
- E. Enclosure Application:
  - 1. NEMA 12 for indoor locations unless indicated otherwise on Drawings.

2. Alum NEMA 3R or stainless steel NEMA 4X for outdoor installations.

### **3.2 FLOOR OR PAD MOUNTED EQUIPMENT**

- A. General: Install floor sills, anchor bolts, shims, and hardware required to level, align, secure, and connect equipment components in accordance with manufacturer's instructions. Make electrical connections in accordance with Section 26 05 19 for supply and load circuits and leave items in operating condition.

### **3.3 WALL MOUNTED EQUIPMENT**

- A. General:
  1. Enclosures:
    - a. Mount enclosures plumb, level, and rigidly attached to structure.
    - b. Mount 1 inch off structure with top 6'-6" above finished floor.
    - c. Install supports in a manner to permit vertical flow of air behind enclosure.
    - d. Use steel supports fabricated from standard rolled structural steel shapes specified in Section 26 05 29.
  2. Wiring: Make electrical connections in accordance with Section 26 05 19 for supply and load circuits.
- B. Disconnect Switches: Install properly rated fuses.
- C. Dry-Type Transformers:
  1. Mounting: Refer to Section 26 05 29 for proper support and anchorage.
  2. Raceway Connections: Connect raceways to transformer enclosure using flexible conduit specified in Section 26 05 33.13. Use lengths of flex approximately 10 diameters in length.
- D. Panelboards:
  1. Enclosure: Close unused circuit positions with blanking plates.
  2. Wiring: Check buses for proper insulation resistance prior to energizing.
  3. Circuit Breakers: Set circuit breaker instantaneous trip adjustments to minimum setting unless designated otherwise on Drawings.
  4. Fusible Units: See section 26 22 00 for fuse requirements.
  5. Flush Mounted Panelboards: From each flush mounted panelboard extends into an accessible location a 3/4-inch empty conduit for every three spare branch circuits and spaces or as shown on Drawings.

- 6. Application:
  - a. Power and Lighting and Receptacle Type Panelboards: As designated by Panelboard Schedules on Drawings.
  - b. Ground Fault Circuit Interrupters: Provide for 120-volt circuits supplying 15 and 20 ampere receptacles installed outdoors or as shown on Drawings.
- E. Molded Case Circuit Breakers: Set adjustable instantaneous trips to minimum, unless indicated otherwise on Drawings. On magnetic breakers in combination with starters, set trips at lowest value that will permit motor starting, but not higher than 13 times motor nameplate full-load current.
- F. Low Voltage Motor Controllers and Contactors in Individual Enclosures:
  - 1. On motor circuits, connect power circuits for proper phase rotation.
  - 2. Set circuit breaker instantaneous trips at proper value and install correct size fuses and thermal overload heater elements.
  - 3. Check interconnection and operation of control devices, interlocks, indicating lights, and control relays. Set timers and time delay relays for correct intervals. Check controller-operating coil for correct voltage rating. Program relay settings for exterior lighting controls per manufacturer's specification and coordinate time schedules with owner.
  - 4. See Specification Section 26 29 13 – Motor Starters
- G. Self-Contained Emergency Power Pack: Connect each unit to equipment ground conductor by means of a crimped ring-type terminal connector secured to housing with a self-tapping screw.

END OF SECTION



## SECTION 26 05 19

### LOW VOLTAGE COPPER WIRE AND CABLE

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Section specifies copper wire, cable, associated connectors, and termination hardware used on systems operating at 600 volts or less.

##### **1.2 QUALITY ASSURANCE**

- A. Furnish wire, cable, associated connectors, and termination hardware bearing UL label.
- B. Furnish wire, cable, associated connectors, and termination hardware bearing the label of, or listed by a Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

#### **PART 2 - PRODUCTS**

##### **2.1 CONDUCTORS**

- A. Soft drawn, annealed copper, Class "B" stranding.

##### **2.2 POWER WIRE AND CABLE**

- A. Acceptable Manufacturers: Single source manufacture is required for power wire and cable specified in this Section.
- B. General: Conform to UL 83 and NEMA WC 5.
  - 1. Single Conductor: Type THWN-THHN (75°C wet/90°C dry) or XHHW (75°C wet/90°C dry) cable rated 600 volts.

##### **2.3 SIGNAL CABLE**

- A. Type PLCC (Power Limited Control Cable):
  - 1. General: Rated 300 volts, 90 deg. C, single pair (Pr.), triad (Tri.) or quad (Qd.).
  - 2. Single Pr., Tri. Or Qd.: No. 16 AWG, stranded copper conductors, twisted and covered with a 100% aluminum-mylar shield, with drain wire and overall PVC jacket.
  - 3. Multiple Pr., Tri. Or Qd.: Same as single construction except No. 20 AWG conductors and an overall aluminum-mylar shield in addition to individual shields.
  - 4. Direct Burial Cable: Same as single or multiple constructions with addition of aluminum sheath and weatherproof outer jacket.

## **2.4 CONNECTORS AND TERMINALS**

- A. Insulated Crimp Type Connectors and Terminals: Nylon insulated, Burndy "INSULINK" and "INSULUG," or Thomas & Betts "Sta-Kon."
- B. Split Bolts: High-conductivity copper alloy, Burndy "SERVIT" or Thomas & Betts "Split-Bolt."
- C. Compression Terminals: Copper long barrel, Burndy "HYLUG" or Thomas & Betts "Color-Keyed," or aluminum alloy Buchanan "Cytolok CL500" series.
- D. Bolted Terminals: Cast copper alloy, Burndy "QIKLUG" or Thomas & Betts "Locktite."

## **2.5 MISCELLANEOUS COMPONENTS**

- A. Tape:
  - 1. Vinyl Plastic: 3M "Scotch 33+" or "Scotch 88."
  - 2. Varnished Cambric (VC): 3M "Irvington 2920."
  - 3. Friction: Black friction tape.
  - 4. Color Coding: 3M "Scotch 35."
  - 5. Fireproofing: 3M "Scotch 77."
  - 6. High Temperature Glass Cloth: 3M "Scotch 69" (180°C).
  - 7. Electrical Insulation Putty: 3M "Scotchfil."
- B. Splice Kits: 3M "Scotchcast 82 Series".
- C. Pulling Lubricants: Ideal "Yellow 77" or Polywater "Type J."
- D. Wire Markers:
  - 1. Individual Wires: Write-on type with self-laminating vinyl overwrap, 3M "ScotchCode," Ideal "Write-On," or Thomas & Betts "WSL."
  - 2. Multi-Conductor Cables or Groups of Wires as a Cable: Nylon tie on marker, Thomas & Betts "Nylon I.D. Ties Ty-Raps."
- E. Wire and Cable Ties: Thomas & Betts "Ty-Raps."

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Wire and Cable:
  - 1. General:

- a. Limit pulling tension to maximum values recommended by manufacturer.
  - b. Do not pull through boxes, fittings, or enclosures where a change of raceway alignment or direction occurs. Use of shieves is acceptable.
  - c. Do not cut strands from conductors to fit lugs or terminals.
  - d. Do not splice control or signal wiring.
- B. Compression Connectors and Terminals: Install on wire and cable with approved tool and die to recommended compression pressure.
- C. Bolted Connectors and Terminals:
- 1. Torque to manufacturer's recommended foot-pounds for size and class of connector.
  - 2. Where manufacturer's published torquing requirements are not indicated, tighten connectors and terminals to comply with UL 486A torque values.
  - 3. Use plated bolts and lock washers on terminal connections.
- D. Wiring in Enclosures:
- 1. Form and tie conductors in panelboards, cabinets, control panels, motor controllers, wireways, and wiring troughs in a neat and orderly manner.
  - 2. Use Thomas & Betts wire and cable ties of appropriate size and type.
  - 3. Limit spacing between ties to not more than 6 inches.
- E. Taping:
- 1. Above Ground and Dry Locations: Fill voids and irregularities with half-lapped layers of VC (two minimum) or electrical insulation putty. Insulate with three half-lapped layers of vinyl plastic and one half-lapped layer of friction tape.
  - 2. Below Ground and Wet Locations: In lieu of taping protect connection with resin splicing kit.
  - 3. Fireproofing: Same as specified for above ground and dry locations plus one half-lapped layer of fireproofing.
- F. System Separation:
- 1. Control and Signal Wiring: Provide separate raceways or barriers in raceways to separate each of the following systems from other wiring:
    - a. 120-volt control wiring.
    - b. Analog 4-20 Milliamp.
    - c. Digital (Pulse).

### 3.2 APPLICATION

#### A. Wire and Cable:

1. THWN-THHN or XHHW for power wiring through No. 2 AWG, and control wiring in conduit. XHHW for sizes above No. 2 AWG in conduit.
2. Bare copper for ground conductors, which penetrate finished floor or grade and ground loops.
3. No. 12 AWG minimum for power circuits and No. 14 AWG minimum for control circuits unless noted otherwise on Drawings.

#### B. Connectors and Terminals:

1. Motor Terminations (Single Conductor Circuits): Insulated ring tongue crimp type connectors or compression terminals, connected back-to-back with plated bolt, nut and lockwasher, and then taped. Where strap screw devices are present use split tongue connectors in lieu of ring tongue connectors.
2. Motor Terminations (Parallel Conductor Circuits): Gang compression terminals on a 1/4-inch-thick copper bar.
3. Transformer Terminations: Split bolt connectors for pigtail connections. Compression terminals for all other connections.

#### C. Multiconductor Control Cable: 14 AWG conductors except 16 AWG may be used in control enclosures.

### 3.3 COLOR CODING

#### A. Power Wiring: Provide color coding for single and multi-conductor power circuits as follows:

<u>Voltage</u>	<u>ØA</u>	<u>ØB</u>	<u>ØC</u>	<u>Neutral</u>
240 volts and below	Black	Red	Blue	White
250 - 600 volts	Brown	Orange Yellow		Natural Gray

1. For specified insulations and jackets not manufactured with integral colors, use conductors with black insulation or jacket and color coding tape.
2. Color code conductors entering boxes, troughs, cabinets, and other enclosures.
3. Color code conductors in wireways, trenches, and other locations where conductors are continuously accessible at intervals not exceeding 5 feet.

#### B. Insulated Equipment Ground: Green.

- C. Control Cables:
  - 1. Single Conductors: Red (AC), Blue (DC).
  - 2. Multi-conductor: Comply with ICEA S-66-524, "Method 1", Table K-2.
- D. Signal Cables: Comply with ICEA S-82-552, "Method 9", Table E-2. In addition, number multiple pairs, triads, and quads.

### **3.4 IDENTIFICATION**

- A. Cables: Attach nylon tie on markers on both ends of cable denoting cable type and number as noted on Drawings. Where a number of 1/C wires are identified as a single cable, group conductors using "Ty-Raps" and attach markers.
- B. Conductor Identification: Attach conductor markers on both ends of wire and label as indicated on Drawings.

END OF SECTION

## **SECTION 26 05 26**

### **GROUNDING**

#### **PART I - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Section specifies grounding of electrical systems and equipment and grounding of conductive machine frames, enclosures, appliances, structures and other equipment for protection of life, equipment, circuits, and systems.
- B. All switchboards, transformers, load break switches and metering shall be grounded per the Utility and NEC requirements.

##### **1.2 QUALITY ASSURANCE**

- A. Refer to Section 26 05 00, Electrical System General Requirements for Codes and Standards.
- B. In addition to the Codes and Standards summarized in Section 26 05 00, Grounding shall comply with the requirements of IEEE 142, NFPA 70 Article 250 and UL 467.
- C. UL Labeling or Listing: Furnish grounding fittings bearing label of or listing by UL.
- D. NRTL Labeling or Listing: Furnish grounding fittings bearing label of or listing by a Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

##### **1.3 SUBMITTALS**

- A. Test Reports: Submit to Engineer two (2) copies of grounding system test report certified by testing technician and Owner's representative.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Conductors: Copper, refer to Section 26 05 19.
- B. Exothermic Welding: Molds and charges by Erico Products, Inc. "Cadweld" or Continental Industries, Inc. "Thermoweld".
- C. Ground Rods: (5/8)-inch diameter, 10 feet long, copperclad sectional ground rods.
- D. Grounding Clamps: O-Z/Gedney or Steel City "G" series.
- E. Connectors, Terminals, and Tape: Refer to Section 26 05 19.
- F. Flexible Conduit Connectors: Refer to Section 26 05 33.13.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install grounding system comprised of the following major components:
1. Steel reinforcing bars in column footings with Eufer ground bonded together as grounding electrodes to provide connection to earth.
  2. Ground loop.
  3. Driven rod at service entrances.
  4. Continuous equipment grounding conductors in electrical raceways and cable runs to ensure a positive path for connection of equipment that must be grounded.
  5. Water pipe electrode.
  6. Continuous bond of all items listed above. Connection of Equipment to Framing
- C. Steel:
1. General: Connect below grade and concealed conductors using exothermic welds. Connect above grade using mechanical connectors.
  2. Transformer Neutrals: Connect 9 KVA and larger transformer neutrals to the grounding system using conductor sized in accordance with NEC Table 250.66 but no smaller than No. 2 AWG.
  3. Distribution Equipment: Connect ground bus in switchgear assemblies, motor control centers, motor control panelboards, and power panelboards to the grounding system using a conductor sized in accordance with NEC Table 250.122 but no smaller than No. 2 AWG.
  4. Motor Frames: Connect motor frames rated above 300 volts and located within 6 feet above finished floor to the grounding system using a conductor sized in accordance with NEC Table 250.122 but no smaller than a No. 2 AWG.
  5. Tanks and Vessels: Provide No. 2 AWG conductor from each metal tank or vessel to the nearest grounding system.
  6. Telephone Equipment: Provide No. 4/0 AWG conductor from the grounding system into each telephone equipment room or telephone service entrance terminal cabinet and terminate as directed by the telephone company.
- D. Equipment Grounding:
1. Provide electrically continuous equipment grounding conductors sized per NEC Table 250.122, or as indicated on Drawings, in electrical raceways containing conductors rated higher than 30 volts.
  2. Bond grounding conductors to grounding bushings, grounding locknuts, grounding lugs, equipment, fixtures, enclosures and transformer neutrals.

- E. Flexible Metal Conduit: Provide an external grounding jumper on flexible conduit runs longer than 6 feet.
  - 1. Spiral wrap the grounding conductor through a minimum of 360° around outside of flexible conduit.
  - 2. Terminate jumper and flex on each end with an insulated grounding fitting.
  - 3. Size jumper same as equipment grounding conductor in the flexible conduit but no smaller than No. 6 AWG.
- F. Expansion Joints: Provide No. 4/0 AWG jumper with 6 inches of sag across structure expansion joints.
  - 1. Bond jumpers to framing steel on both sides of the joint using exothermic welds.
  - 2. Provide a jumper every 50'-0" maximum along expansion joint with a minimum of two jumpers per expansion joint.

### **3.2 FIELD QUALITY CONTROL**

- A. Tests: After complete installation of grounding system, measure ground resistance using the three terminal "Fall-of-Potential" method.
  - 1. Comply with IEEE 81.
  - 2. Space electrodes so that the potential electrode is located from the reference starting point a distance equal to 62% of the sum of the distances from the reference starting point of the test object and the current electrode.
- B. Testing Firm: Employ an independent testing firm using NETA certified testing technicians.
- C. Test Values: Maximum resistance value of the ground electrode system is not to exceed 5 ohms. If test results exceed 5 ohms, proceed as directed by the Engineer.

END OF SECTION



## SECTION 26 05 29

### SUPPORTS AND FASTENERS

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes: Supports and hangers, anchors, and fastenings for mounting and anchoring electrical raceways, equipment, and fixtures.
- B. Related Sections: Additional support requirements for specific items are specified elsewhere in Division 26.

#### **PART 2 - PRODUCTS**

##### **2.1 FIELD FABRICATED SUPPORTS**

- A. Structural steel shapes shall be hot-dipped galvanized for outdoor locations.
- B. 3/8-inch minimum, continuous thread, plated or galvanized hanger rod.
- C. Prefabricated structural systems manufactured by American Electric Kindorf, Power-Strut, or Unistrut.

##### **2.2 CONDUIT SUPPORTS**

- A. Clamps: Steel City or American Electric Kindorf "RC" and "PC" clamps.
- B. Straps:
  - 1. Conduit Straps: Plated steel or hot-dipped galvanized, "two-hole" straps.
  - 2. Channel Straps: American Electric Kindorf "C-105," Power-Strut "PS-1300," or Unistrut "P1100" and "P1400."
- C. Hangers:
  - 1. Conduit Hangers: Steel City Series "6H" or Erico Products, Inc. Caddy "CD" series.
  - 2. Lay-In Pipe Hangers: American Electric Kindorf "C-149," Power-Strut "PS-3200," or Unistrut "J1200."
- D. Clips: Erico Products, Inc. "Caddy M" Series snap-lock conduit clip in combination with a "Caddy Universal" drive-on beam clamp or threaded rod.

##### **2.3 ANCHORS**

- A. Toggle Bolts: Star "3000" series.
- B. Plastic Anchors: Star "06" series with appropriately sized metal screws.
- C. Lead Shields and Lag Bolts: ITW Ramset/Red Head "LS" series or Star "1800" series.

- D. Hollow Wall Anchors: ITW Ramset/Red Head "WA" series or Star "2700" series.
- E. Threaded Expansion Anchors: ITW Ramset/Red Head "J," "S" or "JS" series, or Star "3400" series.
- F. Wedge Anchors: ITW Ramset/Red Head "WS" series or Star "3500" series.

## **2.4 FASTENERS**

- A. Bolts and Nuts: ASTM Grade 2, low carbon, plated or galvanized, hex head.
- B. Beam Clamps: American Electric Kindorf "E-160" or "E-231," Power-Strut "PS800" and "PS2000," or Unistrut "P2600" or "P2700" clamps with retainers.
- C. Channel/Angle Clamps: American Electric Kindorf "E-177" or equal.

## **2.5 GALVANIZING REPAIR PAINT**

- A. ASTM A 780.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. General:
  - 1. Fabricate and install supports so that supported installation does not weaken or overload structure.
  - 2. Do not impose weight of electrical equipment, raceways, or fixtures on supports provided for non-electrical systems unless indicated otherwise on Drawings.
  - 3. Secure steel supports to structure by bolting or welding.
  - 4. Use retaining device when making connections with setscrew-type beam clamps or C-clamps.
  - 5. Maximum diameter of drilled holes in beam flanges shall not exceed 15% of width of flange.
  - 6. Drill holes to leave minimum of 1/2 inch of steel from edge of member to edge of hole.
  - 7. Support loads from bottom chord member of trusses or steel joists only where diagonal members attach to bottom chord.
  - 8. Do not support loads from metal roof or floor decking.
  - 9. Do not weld to steel joist.
- B. Outdoor Supports: Coat bolted and field welded supports with galvanizing repair paint.

## 3.2 APPLICATION

- A. Supports for Single Conduits:
  - 1. Conduit in Direct Contact with Steel Framing: "RC" and "PC" clamps.
  - 2. EMT, 1 Inch and Smaller in Direct Contact with Steel Framing: Conduit clips.
  - 3. Suspended Conduit 1-1/4 Inch and Below: Hanger rod and conduit hanger.
  - 4. Suspended Conduit 1-1/2 Inch and Above: Hanger rod and lay-in pipe hanger.
  - 5. On Walls: Steel "one-hole" straps.
- B. Supports for Multiple Parallel Conduits:
  - 1. In Direct Contact with Steel Framing: Attach prefabricated 1-1/2 inch wide channel, of sufficient depth to support the load, directly to framing and attach conduits to channel straps.
  - 2. Suspended: Assemble a "trapeze" hanger using prefabricated 1-1/2 inch wide steel channel of sufficient depth to support load, and two or more hanger rods. Attach conduits to channel using channel straps.
- C. Wall Anchors:
  - 1. Hollow Masonry Units: Support light loads such as one and two-hole straps, and outlet boxes with plastic anchors and screws. Support heavy loads such as panelboards, safety switches, and multiple conduit runs with toggle bolts.
  - 2. Solid Masonry Units: Lead shields and lag bolts; use through-bolts for tension loads.
  - 3. Gypsum Board: Hollow wall anchors.
- D. Concrete Floor and Overhead Slabs:
  - 1. For overhead equipment loads less than 400 lbs., use at least two (2) 3/8-inch minimum diameter threaded expansion anchors. For equipment loads in excess of 400 lbs., but less than 1,000 lbs., use at least two (2) 3/8-inch minimum diameter wedge anchors.

END OF SECTION

**SECTION 26 05 33.13**

**METALLIC CONDUIT AND FITTINGS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Rigid metal conduit (RMC).
- B. Flexible metal conduit.
- C. Liquidtight flexible metal conduit.
- D. Associated fittings.

**1.2 QUALITY ASSURANCE**

- A. Furnish conduit and fittings bearing UL labels.
- B. Furnish conduit and fittings bearing label of a Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.
- C. All exposed conduits shall be RMC.

**PART 2 - PRODUCTS**

**2.1 CONDUIT**

- A. RMC: ANSI C80.1 and UL 6, hot dipped galvanized, zinc metalized or sheradized, heavy wall, steel.
- B. Flexible Conduit: Provide flexible conduit sized 1-1/4 inches and smaller that is UL approved for use as a grounding conductor.
  - 1. Flexible Metal (Greenfield): UL 1, hot dipped or electro-galvanized steel.
  - 2. Liquidtight Flexible Metal Conduit (Sealtite): UL 360, hot dipped or electro-galvanized steel with thermoplastic outer covering.

**2.2 FITTINGS**

- A. Fittings: UL 514B. Provide fittings of same type by same manufacturer.
- B. Conduit Bodies:
  - 1. Zinc coated, cast malleable, ferrous metal, threaded fittings, Appleton "Form 35 Unilets" or Crouse-Hinds "Form 7 Condulets."
  - 2. Conduits 1-1/4 Inch and Larger: Cast malleable or aluminum "Mogul" size bodies.
  - 3. Gaskets: Where installed outdoors or in areas with gasketed enclosures, furnish neoprene cover gasket.

- C. Insulated Bushings:
  - 1. Thermoplastic: Appleton "BBU," O-Z/Gedney "IB," or Thomas & Betts "510" Series.
  - 2. Thermosetting Phenolic: O-Z/Gedney "A."
  - 3. Grounding: O-Z/Gedney "BLG."
- D. Flexible Connectors: Flexible conduit fittings sized 1-1/4 inches and smaller shall be UL approved for use as a grounding device.
  - 1. Metal: Thomas & Betts "3100" series "Tite Bite," insulated.
  - 2. Liquidtight Metal: Thomas & Betts "5200/5300" series or Appleton "ST" series, insulated.
- E. Sealing Hubs: Appleton "HUB" or "HUB-U" series or Thomas & Betts "370" series.
- F. Expansion Fittings:
  - 1. Exposed: O-Z/Gedney type "AX" or "EX" or Appleton type "XJ" with bonding jumper.
  - 2. Concrete Embedded: O-Z/Gedney "DX."
- G. Unions: Appleton type "EC" or Thomas & Betts "670/680" series "Erickson" coupling.
- H. Seals: Provide seals with interior cross section to allow 40% wire fill capacity.
  - 1. Enclosure Termination and Stub-ups Into Switchboards, Distribution Panels, and Other Similar Locations: O-Z/Gedney "CSB" series sealing bushing.
  - 2. "In-Line": Gasketed "C" conduit body, filled with Dow Corning "Fire Stop" sealant.
  - 3. Hazardous Area Seals: Appleton type "EYSEF", "EYDEF", "ESU" or "SF" or Crouse-Hinds type "EYSX", "EZS" or "EYDX" with manufacturer's recommended fiber filler and cement.
  - 4. Miscellaneous Fittings: Locknuts, caps, plugs, reducers, elbows, and other accessories required for a complete installation.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General:
  - 1. Do not make unnecessary bends or offsets.
  - 2. Do not heat conduits for making bends or bend conduit through more than 90 degrees of arc.

3. Install conduits so that vertical runs are plumb and horizontal runs are level and parallel or perpendicular to principal structural features.
  4. Maintain 6-inch clearance from steam lines, hot water lines, flues, and other heat producing lines or devices where practicable.
  5. Make up joints tight and do not use running threads.
  6. Clean inside of conduits and swab dry before installing conductors.
  7. Support conduits 2-1/2" and smaller in accordance with NEC. For conduits 3" and larger support at intervals of 10'-0" or less.
- B. Bending Radius: Comply with NEC 344.24 for minimum bending radius on both field bends and factory bends.
- C. Concrete Embedded: Anchor conduit to reinforcing in concrete; plug or cap open ends until concrete and masonry operations are completed.
- D. **Below Grade: Encase conduits installed below grade in a 2-inch concrete envelope unless noted otherwise on Drawings.**
- E. Conduit Terminations (RMC):
1. NEMA 1 Areas: one interior and one exterior locknut with thermoplastic bushing.
  2. Gasketed Enclosure Areas: One interior locknut and one exterior-sealing locknut with appropriate type bushing.
  3. Outdoor Areas: Use sealing hubs in top and sides of enclosures. Use an exterior locknut, interior sealing locknut, and bushing in bottom of enclosures.
  4. Service Entrances and Circuits above 600 Volts: Same as specified for NEMA 12 areas except use grounding bushing.
- F. Expansion Fittings: Furnish for building expansion joints where conduit is rigidly attached to building structure or rod supported within 18 inches of structure.
- G. Seals:
1. Install seals where conduit passes from a conditioned space into an unconditioned space, in enclosures mounted outdoors, and in conduits entering structures from outside or underground.

### 3.2 APPLICATION

- A. RMC :
1. Below grade, under load bearing concrete slabs and asphalt roadways unless concrete encased.
  2. Below grade sweeps up to finish floor or grade.
  3. Above-grade areas subject to physical damage.

4. Do not use RMC conduit smaller than 3/4 inch.
- B. Flexible Metal Conduit: Use for final connection to vibrating equipment, enclosed transformers, lay-in lighting fixtures, lighting fixtures with flexible supports, and equipment or devices requiring adjustment, such as motors and limit switches.
1. Greenfield:
    - a. Indoor areas where gasketed enclosures are not required.
  2. Liquidtight:
    - a. Outdoor areas.
    - b. Where gasketed enclosures are required.

END OF SECTION

**SECTION 26 05 33.16**

**BOXES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Section specifies electrical outlet, device, pull, junction boxes and wireways and installation.

**1.2 DEFINITIONS**

- A. Outlet Box: A box used as a wiring enclosure that may be used as a device box with the addition of a plaster ring or special cover.
- B. Device Box: A box designed to house a switch, receptacle or other wiring devices.

**1.3 QUALITY ASSURANCE**

- A. Furnish boxes bearing label or listing of a Nationally Recognized Testing Laboratory (NRTL), as defined in OSHA Regulation 1910.7.

**PART 2 - PRODUCTS**

**2.1 OUTLET AND DEVICE BOXES**

- A. General:
  - 1. UL 514A and 514B for all boxes.
  - 2. NEMA OS 1 for sheet steel boxes.
- B. Cast Iron Boxes: Crouse-Hinds or Appleton "FS/FD" and "ALC" series.
- C. Cast Aluminum Boxes: Crouse-Hinds "FS-SA"/"FD-SA" or Appleton "FS-A"/"FD-A" Series.
- D. Sheet Steel Boxes: Pressed steel, galvanized, 4-inch octagonal or 4-inch square (or "gang") boxes, depth as needed to accommodate devices and associated wiring.
- E. Accessories: Provide fixture studs, plaster rings, extension rings, and covers as required for application. Galvanized steel indoors and galvanized cast ferrous metal or cast aluminum with neoprene gaskets outdoors.
- F. Floor Boxes;
  - 1. Acceptable Products:

	<u>Hubbell</u>	<u>Steel City</u>
Single-gang box	B-2436	641
Two-gang box	B-4233	642



Three-gang box	B-4333	643
Duplex receptacle trim	S3625	P-64-DU
Telephone/Signal trim	S2425	P-64-3/4-2

2. Accessories: Provide necessary floor covering adapters, plugs, gaskets, nipples and sealing compound.

## 2.2 JUNCTION AND PULL BOXES

- A. Boxes (6 Inch Minimum Dimension):
  1. Welded galvanized sheet steel, of sizes required by NEC, without knockouts.
  2. 14-gauge metal for boxes with maximum dimension of less than 24 inches, 12 gauge for boxes with maximum dimension of 24 to 35 inches, and 10 gauge for boxes with any dimension greater than 35 inches.
  3. Provide removable, flame retardant, insulating cable supports in boxes with any dimension greater than 42 inches.
  4. Comply with UL 50 for boxes over 100 cubic inches volume.
  5. Provide screwed or bolted covers of same gauge as box.
- B. Boxes (4-11/16 Inch Maximum Dimension): Pressed steel, galvanized, 4 or 4-11/16 inches square, 1-1/2 or 2-1/8 inches deep.
- C. Weatherproof Boxes: NEMA 3R, continuously welded-seam, galvanized sheet steel enclosures with gasketed covers.
- D. Watertight Boxes: Galvanized cast iron with gasketed, bolt-on covers, tapped holes in bosses or hubs for conduit entrances, and integrally cast mounting lugs.

## 2.3 WIREWAYS

- A. Provide hinged cover NEMA 1 lay-in steel wireway assemblies of sizes indicated on Drawings.
- B. Provide special lengths, telescope fittings, box connectors, elbows and other fittings as required for a complete system.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  1. Mount boxes plumb and level and rigidly attach them to the structure.
  2. Clean interiors before installing trim and cover.

3. Close unused openings with blanking devices or threaded plugs.
  4. Install surface mounted units at least 1 inch off of walls with supports placed in such a manner to permit vertical flow of air behind the enclosure.
- B. Wireways:
1. Assemble and erect system so that access covers are on top of horizontal runs
  2. Do not mount wireways directly to building structure or machinery. Use a trapeze assembly to install wireways.

### **3.2 APPLICATION**

- A. NEMA 3R for outdoor installations.
- B. NEMA 1 for all other areas unless indicated otherwise on the Drawings.
- C. Cast iron "FS/FD" for use with surface mounted steel conduit unless noted otherwise on the Drawings or in other Specification Sections.
- D. One-piece stamped steel boxes for installation in partitions, walls, and suspended ceilings.
- E. Tile box, 3-½ inch deep for installation in poured concrete walls and concrete columns.  
4-inch octagonal box with removable back cover for installation in overhead concrete slabs.

END OF SECTION

## **SECTION 26 05 50**

### **IDENTIFICATION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes: Identification and information signs and warning signs for electrical equipment.
- B. Related Sections: Additional identification requirements for specific items are specified elsewhere in Division 16. See Specification Section 26 05 19, Low Voltage Copper Wire and Cable for wire identification.

##### **1.2 APPLICABLE STANDARDS**

- A. OSHA Subpart S.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Identification and Information Signs:
  - 1. Rigid laminated phenolic, per owner specific color requirements.
  - 2. Text size for equipment designations shall be as large as space allows, up to 1-1/2" maximum.
  - 3. 1/2-inch minimum text size.
  - 4. Contractor shall submit proposed lettering for approval by Owner.
  - 5. The Contractor shall coordinate names, abbreviations, and other designations used in the electrical identification work with the corresponding designations shown, specified and scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.
- B. Warning Signs:
  - 1. OSHA Subpart J - General Environmental Controls, Section 1910.145.
  - 2. Signs provided with equipment are acceptable provided all necessary signs are issued with equipment.
  - 3. Provide identical signs for each application.
  - 4. High voltage warning signs to read "DANGER - HIGH VOLTAGE - KEEP OUT."

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Identification and Information Signs:
1. Location: Place signs on the following equipment:
    - a. Power distribution switchboards.
    - b. Power distribution panels.
    - c. Panelboards.
    - d. Dry-type transformers.
    - e. Individually mounted motor controllers.
    - f. Control panels.
    - g. Safety/disconnect switches.
    - h. Junction boxes
  2. Minimum Information on Sign: Include the following information:
    - a. Equipment Designation.
    - b. Operating Voltage.
    - c. Served From equipment designation.
    - d. For branch circuit panelboards, include color coding for phase, neutral, and ground conductors for each voltage system used in accordance with NEC paragraph 210-5(c).
  3. Equipment Served Identification: Include Equipment Served on identification and information signs for the following equipment:
    - a. Dry-type transformers.
    - b. Individually mounted motor controllers.
    - c. Safety/disconnect switches.
- B. Panelboard Directories. Provide fully completed typewritten circuit directory cards. Identify each circuit using descriptions contained in panelboard schedules on Drawings.
- C. Mounting: Mount signs to clean, dry equipment surface with an epoxy adhesive.

END OF SECTION

**SECTION 26 05 93**

**CLEANING UNDERGROUND CONDUITS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. Scope:

1. Clean all new underground conduits following conduit installation and prior to the installation of conductors
2. Clean all existing conduits for which existing conductors are to be removed as indicated in the Drawings.

B. Related Sections:

1. Section 26 05 00 Electrical System General Requirements
2. Section 26 05 33.13 Metallic Conduit and Fittings

**1.2 SUBMITTALS**

A. Comply with the provisions and requirements of Section 01 33 00 Submittal Procedures.

B. Following the cleaning of the existing and new underground conduits, provide the following Submittals:

1. Cleaning Report, to include the following information:
  - a. List locations, types and sizes of conduits successfully cleaned.
  - b. Status of conduits which cannot be successfully cleaned (type of conduits, problems encountered, cause of problem, and exact locations measured from 2 adjacent manholes).
  - c. Report general conditions of the ducts (rusting steel, fiber delaminating, etc.).
  - d. Report of Conditions Within Manholes:
    - (1) Unracked cables.
    - (2) Missing or broken parts on cable racks.
    - (3) Equipment that is not grounded to a rod electrode (manhole frame, channel racks, metal ladders, splice shields).
    - (4) Cable arc-proofing damaged or missing.
    - (5) Conduits without end bells.

(6) Broken manhole covers.

e. Comments on any items that require future corrections.

### **1.3 QUALITY ASSURANCE**

- A. Qualifications of Supervisor: The person supervising the Work of this Section shall be personally experienced in this type of Work and shall have been regularly employed by a company engaged in underground pipe or conduit cleaning for a minimum of 2 years.
- B. Furnish to the Owner and Engineer the names and addresses of 3 similar projects which the supervisor has worked on.

### **1.4 PROJECT CONDITIONS**

- A. Existing Conditions: The spare conduits are to be cleaned with all high voltage cables within the manholes and vaults energized.
- B. Protection:
  - 1. Provide electrical insulating blankets, sleeves, gloves, etc., to protect workmen from electrical hazards.
  - 2. Provide heavy blankets, plywood or other devices to protect cables and equipment from physical damage.

## **PART 2 - PRODUCTS**

### **2.1 DRAG LINE**

- A. Minimum 1/8" polypropylene monofilament utility rope:
  - 1. American Synthetic Ropes' Flotorope.
  - 2. Greenlee Tool Co.'s 2 ply Rope 431.
  - 3. Ideal's Pro-Pull Rope 3/16.
  - 4. Thomas Industries/Jet Line Products Rope 232.

### **2.2 CONDUIT SEALS**

- A. Wood or plastic plugs designed for the purpose or a contrasting color cement/sand mixture. Seals shall be removable for future use of conduits. Seals shall include waterproof tag stating "CONDUIT CLEANED" and date (month, year).

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Dewater manholes.
- B. Remove all debris from manholes.
- C. Install protective devices on cables and equipment.
- D. Methods used for performing the Work shall have prior approval from the Owner and Engineer.

### **3.2 PERFORMANCE**

- A. Remove all dirt, scale, debris and projections by flushing, rodding, scrapping, wire brushing and swabbing the conduits with hand tools and power equipment designed for the purpose.
- B. Demonstrate to the Owner and Engineer the condition of the cleaned conduits.
  - 1. Use mandrel 1/2" less in diameter than the conduit. Paint sheath of mandrel with black lacquer. Pull mandrel through conduit. Conduit will be considered successfully cleaned if there are no roller marks or scratches on the mandrel.
  - 2. Other methods may be used to determine the status of cleaned conduits, if approved.
- C. Demonstrate to the Owner and Engineer any defect found in the conduits that cannot be satisfactorily eliminated.
- D. Provide a drag line in each cleaned conduit.
- E. Provide conduit seals at both ends of each cleaned conduit.
- F. Remove all debris from conduits and manholes resulting from the work of this Project.

END OF SECTION

## **SECTION 26 09 19**

### **ENCLOSED CONTACTORS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. General purpose contactors.
- B. Lighting contactors.

##### **1.2 REFERENCES**

- A. Refer to Section 26 05 00, Electrical System General Requirements for Codes and Standards.
- B. In addition to the requirements of Section 26 05 00, enclosed contactors shall comply with the following:
  - 1. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
  - 2. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

##### **1.3 SUBMITTALS**

- A. Comply with the provisions and requirements of Section 01330, Submittal Procedures.
- B. Provide dimensions, size, voltage ratings and current ratings.
- C. Include manufacturer's installation instructions.
- D. Provide record drawings in accordance with Section 26 05 00. Record the actual locations of each contactor and indicate circuits controlled on project record documents.

##### **1.4 QUALIFICATIONS**

- A. Manufacturer shall be a company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

##### **1.5 REGULATORY REQUIREMENTS**

- A. Refer to Section 26 05 00, Electrical System General Requirements for Codes and Standards.
- B. Conform to requirements of NFPA 70.
- C. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.



## **PART 2 - PRODUCTS**

### **2.1 GENERAL PURPOSE CONTACTORS**

- A. Manufacturers:
  - 1. Square D Company.
  - 2. General Electric.
  - 3. ASCO.
- B. Description: NEMA ICS 2, AC general purpose magnetic contactor.
- C. Coil Voltage: 120 volts, 60 Hertz unless otherwise noted.
- D. Poles: As indicated.
- E. Size: As indicated.
- F. Enclosure: ANSI/NEMA ICS 6, Type 1 for indoor installation and type 3R for outdoor installation.
- G. Accessories: As shown.

### **2.2 LIGHTING CONTACTORS**

- A. Manufacturers:
  - 1. Square D Company.
  - 2. General Electric.
  - 3. ASCO.
- B. Description: NEMA ICS 2, magnetic lighting contactor.
- C. Configuration: Electrically held 2 wire control.
- D. Coil Voltage: 120 volts, 60 Hertz unless otherwise noted.
- E. Poles: As indicated.
- F. Contact Rating: As indicated.
- G. Enclosure: ANSI/NEMA ICS 6, Type 1 for indoor installation and type 3R for outdoor installation.
- H. Accessories: As shown.

## **PART 3 - EXECUTION**

Not Applicable

END OF SECTION

BARTON PUMP STATION VALVE IMPROVEMENT PROJECT

## **SECTION 26 22 00**

### **DRY-TYPE TRANSFORMERS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Section specifies general purpose and specialty dry-type transformers with windings rated 600 Volts or less.

##### **1.2 RELATED SECTIONS**

- A. Section 26 05 00 Electrical System General Requirements
- B. Section 26 05 03 Equipment Installation
- C. Section 26 05 50 Identification
- D. Section 26 05 26 Grounding

##### **1.3 QUALITY ASSURANCE**

- A. Refer to Section 26 05 00, Electrical System General Requirements for Codes and Standards.
- B. In addition to the Codes and Standards summarized in Section 16010, dry-type transformers shall comply with the requirements, ANSI/IEEE C57.12.01, NEMA ST 1, NEMA ST 20, UL 506, and UL 1561.
- C. UL Labeling or Listing: Furnish transformers bearing UL label.
- D. NRTL Labeling or Listing: Furnish transformers bearing the label of a Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

##### **1.4 SUBMITTALS**

- A. Submit Product Data on each transformer showing ratings, number of phases, winding configuration, KVA capacities, overall dimensions, and weight in accordance with Section(s) 01 33 00, Submittal Procedures.
- B. Submit one copy of manufacturer's sound rating certification.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. General: Provide transformers with the following characteristics:
1. Ratings, Configurations, and Capacities: Primary and secondary voltage ratings, number of phases, winding configuration, and KVA capacities as shown on the Drawings.
  2. Windings: Electrical Grade Copper, two windings per phase, totally enclosed, non-ventilated, self-cooled. Aluminum windings are not permitted.
- B. Shielded isolation transformers shall be provided with an electrostatic shield between the primary and secondary windings.
- C. Primary Taps:
1. Below 30 KVA: 2@ 5% FCBN.
  2. 30 KVA and Above: 2@ 2-1/2% FCAN and 4@ 2-1/2% FCBN.
- D. Insulation: BIL shall be a minimum of 10kV.
1. Below 30 KVA: Class 185.
  2. 30 KVA and Above: Class 220.
- E. Temperature Rise (Over 40°C Ambient):
1. Below 30 KVA: 115°C.
  2. 30 KVA and Above: 150°C.
- F. Sound Rating: Do not exceed ANSI and NEMA maximum levels for specified KVA capacities. Sound levels shall be guaranteed by the manufacturer not to exceed the following.
1. 45db for transformers 15-50 kVA
  2. 50db for transformers 51-300 kVA
  3. 55db for transformers 301-500 kVA
- G. Sound levels for transformers mounted in Hospitals, Schools, Office Areas and other sensitive areas shall be nominally 5 db below ANSI levels referenced in paragraph 2.1 G above. Note: "other sensitive areas" will be designated on the drawings.
- H. Enclosure: Suitable for indoor locations (NEMA 1) or outdoor (NEMA 3R) locations with the addition of weathershield kit and including a wiring compartment suitable for conduit entry. All transformers shall be provided with rodent screens. Transformers through 75 kVA shall be designed so they can be either floor or wall mounted. Above 75kVA they shall be of a floor mounted design.

- I. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with grey, baked, enamel.
- 2.2 Buck/boost transformers shall be encapsulated type, suitable for 80°C rise in 40°C ambient. Secondary windings shall be rated 12/24V and/or 16/32V as indicated on the drawings.
- 2.3 Provide transformer with engraved nameplates with designation as indicated on the drawings or as directed by the Owner's Representative in accordance with Section 26 05 50 – Identification.
- 2.4 **ACCEPTABLE MANUFACTURERS:**
  - A. General Electric Company.
  - B. Square-D Company.
  - C. Siemens.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION.**

- A. Mounting: Refer to Section 16190 for proper support and anchorage. Provide 4-inch tall concrete housekeeping pads when transformers are mounted in equipment rooms or areas subject to occasional moisture on the floor. In all outdoor locations concrete transformer pads are required.
- B. Raceway Connections: Connect raceways to transformer enclosure using flexible conduit as specified in Section 26 05 33.13. Use pieces of flex approximately ten diameters in length.
- C. Wiring: Terminate wiring connections in accordance with Section 26 05 19.
- D. Grounding: Refer to Section 26 05 26.
- E. Assure National Electrical Code clearances on all sides for adequate ventilation.
- F. Transformers shall be installed in accordance with manufacturer's recommendations. In addition, all transformers shall be installed with Isomode, Aeroflex or Energy Kinetics vibration isolation devices under feet or contact points.
- G. Adjust transformer taps for proper secondary voltage.

END OF SECTION

## **SECTION 26 27 26**

### **WIRING DEVICES**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. Scope:
  - 1. The Contractor shall provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install receptacles.
- B. Related Sections: The Contractor shall coordinate the requirements of this Section with the requirements of the Sections listed below.
  - 1. Section 26 05 33.16, Boxes.
  - 2. Section 26 05 19, Low Voltage Copper Wire and Cable.

##### **1.2 QUALITY ASSURANCE**

- A. Comply with applicable provisions and recommendations of the following:
  - 1. National Electrical Code.
  - 2. UL Standard No. 1010, Electrical Receptacle - Plug Combinations for Use in Hazardous Locations.

##### **1.3 SUBMITTALS**

- A. Comply with the provisions and requirements of Section 01 33 00, Submittal Procedures.
- B. Provide submittals for all Receptacles proposed for use.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Receptacles for Non-Hazardous Locations:
  - 1. Duplex grounding receptacle, two pole, three wire, 125-volt AC, 20 amperes.
    - a. Product and Manufacturer: Provide one of the following:
      - (1) Catalog No. 5362, for dry indoor locations and Catalog No. 53CM62, for wet and corrosive locations, by Harvey Hubbell Incorporated.
      - (2) Catalog No. 5362, for dry indoor locations and Catalog No. 5362-CR, for wet and corrosive locations, by Arrow-Hart Incorporated.
      - (3) Or equal.

2. Single grounding receptacle, two pole, three wire, 125-volt AC, 20 amperes.
  - a. Product and Manufacturer: Provide one of the following:
    - (1) Catalog No. 53CM61, by Harvey Hubbell Incorporated.
    - (2) Catalog No. 5361-CR, by Arrow-Hart Incorporated.
    - (3) Or equal.
  
- B. Ground Fault Receptacles:
  1. Duplex receptacle, two pole, three wire, 125-volt AC, 20 amperes.
  2. Product and Manufacturer: Provide one of the following:
    - a. Catalog No. GF5362, by Harvey Hubbell Incorporated.
    - b. Catalog No. GF5342, by Arrow-Hart Incorporated.
    - c. Or equal.
  
- C. Surge Suppression Receptacles:
  1. Duplex grounding, surge suppression receptacle, two pole, three wire, 125-volt AC, 20 amperes, capable of absorbing a transient surge 6,000 volts minimum. Receptacle to include power on indicator light:
    - a. Product and Manufacturer: Provide one of the following:
      - (1) Catalog No. 5350S by Harvey Hubbell Inc.
      - (2) Catalog No. 5380-GY by Leviton Manufacturing Company.
      - (3) Or equal.
  
- D. Power Receptacles: 480-volt interlocked receptacle with enclosed safety switch service outlet: Provide service outlets, quantity as shown on the Drawings for portable equipment.
  1. Material: Copper free aluminum enclosure with operating handle, NEMA 4 with gasketed hinged door.
    - a. Switch: Heavy duty, three pole, with visible blades, a quick make and break mechanism with reinforced, positive pressure type blade and fuse clips. Switch shall be mechanically interlocked with the receptacle. The switch cannot be closed until the plug is fully inserted and the plug cannot be withdrawn or inserted, unless the switch is open.
    - b. Receptacle: As indicated on the drawings. Provide two matching plugs.
    - c. Type WSR, and Type APS plugs by Crouse-Hinds Company or equal.

- E. Power and Special Receptacles: Provide receptacles with number of poles and voltage and current rating as shown on the Drawings. Coordinate with equipment plugs. Provide matching plug for each receptacle.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install receptacles at locations as shown on the Drawings in outlet or device boxes in accordance with Section 26 05 33.16, Boxes, in non-hazardous locations.
- B. Install receptacles in PVC coated galvanized rigid steel conduit systems in hazardous locations.
- C. Install receptacles with ground pole in the down position.
- D. Mount receptacles 18-inches above finished floor, or in accordance with local building codes, in non-hazardous locations and 4 feet-6 inches above finished floor in hazardous locations, unless otherwise noted.
- E. Identify each conductor with the circuit number and the lighting panel number. Identification shall conform to the requirements of Section 26 05 19, Low Voltage Copper Wire and Cable.
- F. Identify each receptacle with a permanent phenolic tag. The tags shall include the circuit number and the lighting panel number.
- G. Installation shall conform to the National Electrical Code.

END OF SECTION

## **SECTION 26 27 29**

### **SNAP SWITCHES**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. Scope:
  - 1. Contractor shall provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install snap switches for lighting and other systems.
- B. Related Sections: Contractor shall coordinate the requirements of the work in this section along with the requirements of the sections listed below which include, but are not necessarily limited to, work that is directly related to this Section.
  - 1. Section 26 05 33.16, Boxes.
  - 2. Section 26 05 19, Low Voltage Copper Wire and Cable.

##### **1.2 QUALITY ASSURANCE**

- A. Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
  - 1. National Electrical Code.
  - 2. UL Standard No. 20, General Use Snap Switches.

##### **1.3 SUBMITTALS**

- A. Comply with the provisions and requirements of Section 01 33 00, Submittal Procedures.
- B. Provide Submittals for all switches proposed for use.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Switches for Non-Hazardous Locations:
  - 1. Single pole AC toggle switch, quiet type, 120/277 volt AC, 20 amperes, Ivory, specification grade.
    - a. Product and Manufacturer: Provide one of the following:
      - (1) Catalog No. 1221-I, by Harvey Hubbell Incorporated.
      - (2) Catalog No. 1991-I, by Arrow-Hart Incorporated.
  - 2. Single pole, 3-way AC toggle switch, quiet type, 120/277 volt AC, 20 amperes, Ivory, specification grade.



- a. Product and Manufacturer: Provide one of the following:
  - (1) Catalog No. 1223-I, by Harvey Hubbell Incorporated.
  - (2) Catalog No. 1993-I, by Arrow-Hart Incorporated.
- 3. Two pole AC toggle switch, quiet type, 120/277 volt AC, 20 amperes, Ivory, specification grade.
  - a. Product and Manufacturer: Provide one of the following:
    - (1) Catalog No. 1222-I, by Harvey Hubbell Incorporated.
    - (2) Catalog No. 1992-I, by Arrow-Hart Incorporated.
- B. Switch Covers:
  - 1. Indoor covers shall be Type 304, stainless steel.
  - 2. Outdoor or wet location covers shall be weatherproof and corrosion resistant.
- C. Key Operated On-Off Switches:
  - 1. Key operated switches shall be complete with legend plate and NEMA 4 enclosure and two keys for each switch.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install switches at locations as shown on the Drawings in outlet or device boxes in accordance with Section 26 05 33.16, Boxes, in non-hazardous locations.
- B. Mount wall switches 4 feet-6 inches above finished floor unless otherwise noted.
- C. Identify each conductor with the circuit number and the lighting panel number. Identification shall conform to the requirements of Section 26 05 19, Low Voltage Copper Wire and Cable.
- D. Install switches in conformance with National Electrical Code.

END OF SECTION

## **SECTION 26 28 13**

### **FUSES**

#### **PART 1 - GENERAL**

##### **1.1 SUBMITTALS**

- A. Product Data: Catalog sheets, specifications and installation instructions. Comply with the provisions and requirements of Section 01 33 00, Submittal Procedures

##### **1.2 MAINTENANCE**

- A. Spare Parts:
  - 1. Six spare fuses of each size and category, including any accessories required for a complete installation.
  - 2. Special tools if required for installation or removal of fuses.

#### **PART 2 - PRODUCTS**

##### **2.1 FUSEHOLDERS**

- A. Equipment provided shall be furnished with fuseholders to accommodate the fuses specified.

##### **2.2 FUSES RATED 600V OR LESS**

- A. Fuses for Safety Switches (Motor Circuits) and Service Disconnects:
  - 1. Cartridge Type (250 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-5, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Cooper Industries Inc.'s/Bussman Div. Type FRN-R.
    - b. Gould Inc.'s/Circuit Protection Div. (Shawmut) Type TR-R.
    - c. Littlefuse Inc.'s Type FLN-R.
  - 2. Cartridge Type (600 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-5, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Cooper Industries Inc.'s/Bussmann Div. Type FRS-R.
    - b. Gould Inc.'s/Circuit Protection Div. (Shawmut) Type TRS-R.
    - c. Littlefuse Inc.'s Type FLS-R.
  - 3. Cartridge Type (600 Volts or Less - Above 600 Amperes): Current limiting, UL Class L, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Cooper Industries Inc.'s/Bussmann Div. Type KTU.

- b. Gould Inc.'s Circuit Protection Div. (Shawmut) Type A4BY.
    - c. Littlefuse Inc.'s Type KLP-C.
- B. Fuses for Safety Switches (Lighting and Heating Circuits):
  - 1. Cartridge Type (250 Volts): Single element, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Cooper Industries Inc.'s/Bussmann Div., Type KTN-R.
    - b. Gould Inc.'s/Circuit Protection Div. (Shawmut) Type A2K-R.
    - c. Littlefuse Inc.'s Type KLN-R.
  - 2. Cartridge Type (600 Volts): Single element, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Cooper Industries Inc.'s/Bussmann Div. Type KTS-R.
    - b. Gould Inc.'s/Circuit Protection Div. (Shawmut) Type A6K-R.
    - c. Littlefuse Inc.'s Type KLS-R.

### 2.3 FUSES RATED OVER 600V

- A. Fuses for Metal Enclosed Interrupter Switchgear:
  - 1. Current Limiting, Silver-Sand Type: General Electric Co.'s Type EJ, or Westinghouse Elec. Corp.'s Type CLE.
  - 2. Boric-Acid Type: S & C Electric Co.'s Type SM with snuffler, or Westinghouse Elec. Corp.'s Type RBA with condenser.
- B. Fuses for 35KV Service Switch and Fuse Assembly: S & C Electric Co.'s Type SM-5.
- C. Fuses for Pad Mounted High Voltage Switch and Fuse Assembly: S & C Electric Co.'s Type SML.
- D. Fuses for Fused Load Break Interrupter Switches: General Electric Co. Type EJ, S & C Electric Co.'s Type SM, or Westinghouse Electric Corp.'s Type CLE.
- E. Fuses for Distribution Oil Cutouts: General Electric Co.'s Fuse Links 9F57CAA, or G & W Electric Co.'s Type FL.
- F. Fuses for Primary Cutouts:

1. Cutouts Rated 5.2KV: EEI-NEMA standard Type K (fast) distribution fuse links; Westinghouse Electric Corp.'s Universal Cable Type Fuse Links Series 632AO--A01.
2. Cutouts Rated 14.4KV: EEI-NEMA standard Type K (fast) distribution fuse links; S & C Electric Co.'s 265000 Series, or Westinghouse Electric Corp.'s Universal Cable Type Fuse Links Series 632A0--A01.
3. Cutouts Rated 38KV: EEI-NEMA standard Type K (fast) distribution fuse links, to suit primary cutouts.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install fuses in respective equipment.

END OF SECTION

**SECTION 26 28 16.13**

**MOLDED CASE CIRCUIT BREAKERS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Section specifies molded case circuit breakers in individual enclosures, panelboards, combination motor starters, and control panels.

**1.2 RELATED SECTIONS**

- A. Section 26 05 00 Electrical System General Requirements
- B. Section 26 05 03 Equipment Installation

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 26 05 00, Electrical System General Requirements for Codes and Standards.
- B. In addition to the Codes and Standards summarized in Section 26 05 00, molded case circuit breakers shall comply with the requirements of:
  - 1. NEMA AB 1.
  - 2. UL 489.
- C. UL Labeling or Listing: Furnish circuit breakers bearing UL label.
- D. NRTL Labeling or Listing: Furnish circuit breakers bearing label of a Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

**1.4 SUBMITTALS**

- A. Submit Product Data on each circuit breaker showing ratings, overall dimensions, enclosure type, and accessories in accordance with Section(s) 01 33 00, Submittal Procedures.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT**

- A. General:
  - 1. Voltage rating for the point of application, frame size, trip rating, and interrupting rating are noted on Drawings.
  - 2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism. Automatic tripping of the breaker shall be clearly indicated by handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of arc chutes.

3. All breakers shall be “bolt on” type.
  4. When used for switching lighting circuits, breakers shall be marked “SWD” (Switch Duty Rated).
  5. All multi-pole breakers shall have common trip. Wires, pins, etc., between single pole breakers to form common trip will not be acceptable.
  6. The use of “Pushmatic” or miniature “Quicklag” breakers shall not be permitted.
  7. Provide individually enclosed and panelboard mounted circuit breakers of the thermal-magnetic type with inverse time and instantaneous trip characteristics rated for operation in a 40°C ambient.
  8. Provide breakers used in combination with motor starters with adjustable instantaneous trips.
  9. Provide shunt trip devices, motor operators, interlocks, auxiliary contacts, bell alarm switches, and other modifications as noted on Drawings or specified in Section 26 29 13.
  10. Do not use “trunk type” latches on enclosures.
- B. Enclosures:
1. NEMA 1 for dry, indoor areas.
  2. NEMA 3R for damp or outdoor locations.
  3. Other ratings as noted.
- C. Acceptable Manufacturers:
1. General Electric Company.
  2. Square D Company.
  3. Siemens.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION:**

- A. Mounting: Refer to Section 26 05 29. Mount individually enclosed circuit breakers with top of enclosure 6'-6" above finished floor unless indicated otherwise on Drawings.
- B. Trip Settings:
- C. Set adjustable instantaneous trips to minimum, unless indicated otherwise on Drawings.
- D. On magnetic breakers in combination with starters, set trips at the lowest value that will permit motor starting, but not higher than 13 times the motor nameplate full-load current.

### **3.2 IDENTIFICATION**

- A. Refer to Section 26 05 29.

END OF SECTION

**SECTION 26 28 16.16**

**DISCONNECT SWITCHES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Section specifies fusible and non-fusible safety and disconnect switches, individually enclosed and group mounted or applied in combination with motor controllers/contactors in single or grouped installations.

**1.2 QUALITY ASSURANCE:**

- A. Refer to Section 26 05 00, Electrical System General Requirements for Codes and Standards.
- B. In addition to the Codes and Standards summarized in Section 26 05 00, disconnect switches shall comply with the requirements of NEMA 250, NEMA KS 1, and UL 98.
- C. UL Labeling or Listing: Furnish switches bearing UL label.
- C. NRTL Labeling or Listing: Furnish switches bearing label of a Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

**1.3 SUBMITTALS**

- A. Submit Product Data on each switch showing ratings, overall dimensions, enclosure type, and accessories, in accordance with Section 01 33 00, Submittal Procedures.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT**

- A. General: Fusible and non-fusible "Heavy Duty" safety and disconnect switches with ratings as shown on Drawings and 75°C or higher temperature rating.
- B. Components:
  - 1. Line terminal shields.
  - 2. Visible blades.
  - 3. Non-teasible, positive, quick-make, quick-break interrupter operating mechanism.
  - 4. Reinforced Class R rejection-type fuse clips.
  - 5. Handle whose position ("OFF" or "ON") is easily recognizable and can be multiple padlocked in "OFF" position.
  - 6. Defeatable door interlocks that prevent door from opening when operating handle is in "ON" position.



7. Auxiliary control contact operated by handle mechanism to signal that switch is in the closed position where indicated on Drawings.
  8. Factory installed ground lugs.
  9. Factory installed cover mounted metal nameplate containing a permanent record of:
    - a. Switch type.
    - b. Catalog number.
    - c. Horsepower ratings using both standard and time delay fuses.
- D. Horsepower Ratings:
1. Horsepower rated switches for use as motor disconnecting means, with sizes in accordance with individual manufacturer's published ratings.
  2. For applications in excess of switch ratings, provide non-automatic molded case circuit breakers rated not less than 125% of motor full load current.
- E. Fuses: Current-limiting-type UL RK1 with a minimum interrupting rating of 200,000 RMS symmetrical amperes and of continuous current ratings as shown on Drawings.
- F. Enclosures:
1. NEMA 1 for dry, indoor areas.
  2. NEMA 3R for damp indoor or outdoor locations.
  3. Others as noted.
- G. Acceptable Manufacturers:
1. General Electric Company.
  2. Square-D Company.
  3. Siemens

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Enclosure:
1. Mount switch enclosure plumb and level and rigidly attach to structure.
  2. Mount 1 inch off structure with top 6'-6" above finished floor.
  3. Install supports in a manner to permit vertical flow of air behind enclosure.

- 4. Use steel supports fabricated from standard rolled structural steel shapes as specified in Section 26 05 29.
- B. Wiring: Install all incoming and outgoing power circuits.
- C. Grounding: Refer to Section 26 05 26.
- D. Fuses: Install properly rated fuses.

### **3.2 IDENTIFICATION**

- A. Refer to Section 26 05 50.

END OF SECTION

**SECTION 26 29 13**

**MOTOR STARTERS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Manual motor starters.
- B. Combination magnetic motor starters.

**1.2 RELATED SECTIONS**

- A. Section 26 05 00, Electrical System General Requirements.

**1.3 REFERENCES**

- A. Refer to Section 26 05 00, Electrical System General Requirements for Codes and Standards.

**1.4 SUBMITTALS**

- A. Comply with the provisions and requirements of Section 01 33 00, Submittal Procedures.
- B. Product Data: Provide dimensions, mounting, weight, electrical ratings, control schematics, wiring diagrams and recommended overload heater sizes.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. General Electric
- B. Square D
- C. Siemens

**2.2 MANUAL MOTOR STARTERS**

- A. Shall have "quick-make, quick-break" toggle mechanism.
- B. Overload heater(s) shall be sized per motor nameplate and manufacturer's recommendations.
- C. Provide NEMA Type 1 enclosure unless otherwise shown on the drawings.
- D. Shall be suitable for the voltage, HP and the number of phases as shown on the drawings.

**2.3 COMBINATION MAGNETIC MOTOR STARTERS**

- A. Starters shall be combination, full voltage, nonreversing unless shown otherwise, and shall utilize motor circuit protectors or fusible switches as shown on the drawings.

- B. Starters shall be equipped with a fused control power transformer, 120-volt operating coil, ambient compensated overload relays and one NO and one NC spare auxiliary contacts wired to the terminal strip.
- C. Each starter shall be provided with the control devices shown on the drawings. If control schematics are not shown on the drawings, provide the following:
  - 1. A 'HAND-OFF-AUTO-COMPUTER' selector switch mounted on the cover.
  - 2. A red 'RUN' light and green 'STOP' light.
  - 3. The 'AUTO' side of switch shall be wired to the external terminal strip for connection to a field-mounted control device.
- D. Control power transformers shall be sized for the operating coil and any other loads shown on the drawings. One side of the control power transformer shall be grounded. Primary fusing shall be provided in accordance with the NEC.
- E. Motor circuit protectors (MCP) shall provide adjustable magnetic protection and be provided with a pin insert to stop the magnetic adjustment at 1,300 percent motor nameplate full load current. The MCP shall have a "tripped" position on the unit disconnect and a push-to-test button on the MCP. The MCP shall include a transient override feature for motor inrush current.
- F. Overload heaters shall be sized per motor nameplate and manufacturer's recommendations. A manual reset button shall be provided on the cover of the door.
- G. Control accessories shall be heavy-duty oil tight type. Indicating lights shall be transformer type with 6.3-volt lamps and push-to-test feature.
- H. Hour meters (elapsed time meters) shall be 2-1/2-inch square case type for flush panel mounting. The meter face shall have black trim on white or aluminized face. The meters shall have a six-digit nonreset register with the last digit indicating tenths of an hour.
- I. Terminal strips shall be provided for connection to external devices.
- J. Enclosures shall be NEMA type as shown on the drawings. Where NEMA type enclosures are not shown on the drawings, provide NEMA type most suitable for the environmental conditions where the motor starter is being installed.
- K. Enclosures shall be thoroughly cleaned, given a rust-inhibiting primer coat, and painted with manufacturer's standard colors.
- L. Provide nameplates for each control device on door in accordance with Section 26 05 00.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install per manufacturer's and NEC requirements.
- B. Ensure National Electrical Code clearances.
- C. Verify proper overload heater and fuse sizes and replace/adjust if required.
- D. Adjust all motor circuit protectors per manufacture's recommendations.
- E. Test all control and safety devices to ensure proper operation.

END OF SECTION

## SECTION 35 22 29

### STAINLESS STEEL SLUICE GATES

#### **PART 1 - GENERAL**

##### **1.1 SCOPE OF WORK**

- A. The equipment provided under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, Engineering data, instructions, and recommendations of the equipment manufacturer unless otherwise instructed in writing by the OWNER or ENGINEER.

Gates and operators shall be supplied with all the necessary parts and accessories indicated on the drawings, specified or otherwise required for a complete and properly operating installation, and shall be the latest standard product of a manufacturer regularly engaged in the production of stainless steel water control gates.

- B. Unit Responsibility: To ensure compatibility of all components directly related to the sluice gates, unit responsibility for the sluice gates, actuators, and accessories as described in this section shall be the responsibility of the sluice gate manufacturer and CONTRACTOR unless specified otherwise.
- C. CONTRACTOR is responsible for field verifying all dimensions associated with the sluice gates.

##### **1.2 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Submittal Procedures" and as specified herein.
- B. Submittals shall include:
1. Shop Drawings
  2. Manufacturer's operation and maintenance manuals and information.
  3. Manufacturer's installation certificate.
  4. Manufacturer's equipment warranty.
  5. Manufacturer's performance affidavit in accordance with Section 01 91 00 "Commissioning".
  6. Design calculations demonstrating lift loads and deflection in conformance to the application requirements. Design calculations shall be approved by a licensed ENGINEER (PE) and shall be submitted with the shop drawings.

### 1.3 QUALITY ASSURANCE

#### A. Qualifications

1. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 20-years of experience designing and manufacturing cast iron sluice gates. The manufacturer shall have manufactured cast iron sluice gates of the type described herein for a minimum of 20 similar projects.
2. The sluice gate shall be manufactured by Watermain Industries, or ENGINEER approved equal.

## PART 2 - EQUIPMENT

### 2.1 GENERAL

- A. The gates shall be non-self-contained with stem guides and operator, in accordance with the requirements of this specification.
- B. The gates shall be compliant with the latest version of AWWA C560, as described below.
- C. Specific configurations shall be as noted on the gate schedule or as shown on the plans.
- D. Materials:

COMPONENTS	MATERIALS
Frame, Cover Slide, Yokes	Stainless Steel: ASTM A240/A276 AISI Type 304
Stems	Stainless Steel: ASTM A276 AISI Type 304
Fasteners and Anchor Bolts	Stainless Steel ASTM F593 / F594 Type 304 CW
Flush Bottom Seals	Rubber: ASTM D 2000 BC 615/625 Grade BE 625
Seat/Seals	Ultra-High Molecular Weight Polyethylene (UHMW)
Stem Cover	Clear Butyrate with Mylar Strip
Stem Guides	Stainless Steel: ASTM A240/A276 AISI Type 304L UHMW Bushed
Pedestals	Steel: ASTM A36/A53
Finish	Mill Finish on all Stainless-Steel Surfaces

E. Gate Schedule:

Equipment Number	Gate Size, inch <sup>1</sup>	Gate Type + Mounting <sup>2</sup>	Opening Direction <sup>3</sup>	Bottom Seating <sup>4</sup>	Design Head, feet		Operator Type
					Seating	Unseating	
1	36" x 72"	WT-F	U	FB	26	0	Geared lift w/ side mounted handwheel

Notes:

1. Clear opening width by height.
2. W = wall mounted, T = Thimble (specify type E, F, or MJ), Y = self-contained, F = flatback, SC=square/circular
3. U = upward, D = downward
4. FB = flush bottom

**2.2 FRAME AND GUIDES**

- A. The gate frame shall be composed of stainless-steel guide rails with UHMW seat/seals upstream and downstream. The seat/seals shall form a tight seal between the frame and the slide. The weir gate invert seal shall be a wiper type seal equal to the Waterman Guardian Seal™.
1. The UHMW seats will impinge on the slide by way of a continuous loop neoprene seal. Seal designs incorporating neoprene or other resilient side and top seals in direct contact with the slide are not acceptable.
  2. The neoprene seal will perform the function of a seal between the frame and the UHMW as well as a spring force to maintain contact between the UHMW and the slide.
  3. The tight seal shall provide an allowable leakage rate of no more than 0.05 gallons per minute (GPM) per peripheral foot of opening for seating head and unseating heads.

**2.3 STEMS AND STEM GUIDE(S)**

- A. The stem shall be solid stainless steel of the specified grade.
- B. Stem threads shall be machine cut 29-degree full Acme or stub Acme type.
- C. Nominal diameter of the stem shall not be less than the crest of the threaded portion.
- D. Stem guides and brackets shall be fabricated stainless steel, with UHMW bushings.
- E. Two-piece guides shall be adjustable in two directions and shall be so constructed that, when properly spaced, they will hold the stem in alignment and still allow enough play to permit operation per AWWA C560.



- F. Stem guide spacing shall be as recommended by the gate manufacturer for the specific stem size, but in no case, shall the unsupported stem length/radius of gyration ( $l/r$ ) exceed 200.
- G. Stem guide brackets shall be secured to the wall by anchor bolts of sufficient strength and arrangement to prevent unacceptable stem guide deflection due to either axial and/or radial stem loading caused by gate operation forces during manual operation or caused by motor-operator locked rotor stall conditions.

## **2.4 SLIDE COVER**

- A. The slide cover shall be stainless steel plate reinforced with structural shapes welded to the plate.
  - 1. The slide cover shall not deflect more than  $1/720^{\text{th}}$  of the span, or  $1/16''$  at the sealing surface of the gate under maximum specified head.
  - 2. The stem connection shall be either the clevis type, with structural members welded to the side and a bolt or bolts to act as a pivot pin, or a threaded and bolted (or keyed) thrust nut supported in a welded nut pocket.
  - 3. The clevis or pocket and yoke of the gate shall be capable of taking, without damage, at least twice the rated thrust output of the operator at 40 pounds of pull on a hand wheel or hand crank.

## **2.5 SEATING FACES**

- A. All seating faces for both covers and frames shall be malleable corrosion resistant material (see materials section) of a shape that will fill and permanently lock in the dovetail grooves of the slide and the frame. No other means of attachment will be allowed.
- B. The seats shall be machined to a 63 micro-inch finish, or better.

## **2.6 FLUSH BOTTOM CLOSURE**

- A. Gates shall be furnished with a flush seal arrangement. A resilient seal with minimum width of exposed face of  $1-3/8''$  shall be securely attached to the frame along the invert, and shall extend to the depth of the guide groove. The resilient seal extrusion shall be constructed to be ribbed and self-retaining. Invert seal designs that require mechanical retention are not allowed.

## **2.7 WALL THIMBLES AND ANCHOR BOLTS**

- A. CONTRACTOR shall field verify the bolt pattern and dimensions of the existing wall thimble prior to ordering the gate.
- B. After machining, the front flange shall be marked with vertical centerline and the word "top" for correct alignment.
- C. A mastic type gasket shall be provided between the sluice gate and the wall thimble.

- D. Gate anchor bolts shall be Type 304 stainless steel. Size of bolts, installation details, embedment, etc. shall be included with the sluice gate design.
- E. CONTRACTOR to field verify the configuration of the existing wall thimble configuration "Type E, F, MJ, and/or Bell."

## **2.8 MANUALLY OPERATED LIFTS**

- A. Sluice gates shall be operated manually by a gear lift with side mounted handwheel operated pedestal.
- B. Each lift shall be provided with a threaded cast bronze lift nut to engage the threaded portion of the stem. The lift nut shall have a machined surface, fitted above and below with thrust ball or rolling element bearings.
- C. Handwheel lifts shall be without gear reduction. A maximum effort of 40 lbs. pull (25 lb. pull) on handwheel or crank shall operate the gates under the specified operating head.
- D. The gears, when required, shall be steel with machine-cut teeth. Pinion gears shall be supported by bronze bushings or rolling element bearings.
- E. The lift mechanism shall be totally enclosed within a cast iron housing.
- F. The pedestal shall be structural steel.
- G. All lifts for rising stems shall be provided with a galvanized steel stem cover, a tubular transparent plastic stem cover with mylar strip position indicator.
- H. Handwheels shall be approximately 36" from the operating floor unless otherwise shown or specified.
- I. The word "open" shall be cast onto the hand crank or handwheel indicating direction of rotation to open the gate.

## **2.9 PAINTING**

- A. The pedestal and hand actuator shall be painted in accordance with the section 09 91 00 found in these specifications.

## **2.10 SHOP TESTING**

- A. The completely assembled gate and hoist shall be separately shop-operated to insure proper assembly and operation.
- B. The gate shall be adjusted so that a .002" thick gauge (1/2 that required by AWWA standard) will not be admitted at any point between frame and cover seating surfaces.
- C. All gates and equipment shall be inspected and approved by a qualified shop inspector prior to shipment.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. All work required to isolate, remove and install the sluice gate including stop log installation/removal, crane/gantry installation, sealing, etc. shall be the responsibility of the CONTRACTOR.
- B. Installation of the gates shall be performed in accordance with standard industry practices. It shall be the responsibility of the CONTRACTOR to handle, store, and install the equipment specified in this Section in strict accordance with the Manufacturer's recommendations.
- C. The CONTRACTOR shall review the installation drawings and installation instructions prior to installing the gates.
- D. The gate frames shall be installed in a true vertical plane, square and plumb, with no twist, convergence, or divergence between the vertical legs of the guide frame.
- E. The CONTRACTOR shall fill any void between the guide frames and the structure with non-shrink grout as shown on the installation drawing and in accordance with the grout manufacturer's recommendations.

### **3.2 FIELD TESTING**

- A. After installation, all gates will be field tested in the presence of the ENGINEER and OWNER to ensure that all items of equipment are in full compliance with this Section. Each gate assembly shall be water tested by the CONTRACTOR at the discretion of the ENGINEER and OWNER, to confirm that leakage does not exceed the specified allowed leakage.

END OF SECTION



**CITY OF ANN ARBOR**  
**BARTON PUMP STATION VALVE IMPROVEMENT PROJECT, ITB #4703, DWSRF #7569-01**  
**PRE-BID MEETING SIGN IN SHEET**  
**FRIDAY, DECEMBER 17, 2021 AT 10:00 AM**

Name	Company/Agency	Email Address	Discipline (General, Electrical, Mechanical)
Joe Mulville	Weiss Construction	jmulville@weiss-construction.com	G.C.
Bret Solomon	Solomon Diving	Bret@Solomondiving.com	Diving Contractor
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Jennifer Duff	JETT Pump & Valve	jennifer@jettpump.com	



**CITY OF ANN ARBOR**  
**BARTON PUMP STATION VALVE IMPROVEMENT PROJECT, ITB #4703, DWSRF #7569-01**  
**PRE-BID MEETING SIGN IN SHEET**  
**FRIDAY, DECEMBER 17, 2021 AT 10:00 AM**

Name	Company/Agency	Email Address	Discipline (General, Electrical, Mechanical)
J GREENE	JETT PUMP & VALVE	JGREENE@JETTPUMP.COM	MECH/SUPPLY
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CITY OF ANN ARBOR  
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PRE-BID MEETING SIGN IN SHEET  
FRIDAY, DECEMBER 17, 2021 AT 10:00 AM

Name	Company/Agency	Email Address	Discipline (General, Electrical, Mechanical)
Nathan Hunter	Hamlett Environmental	nathanh@hamlettenvironmental.com	Supplier