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June 9, 2022

ADDENDUM NO. 02

CONTRACT NO.: 20518.2 – UV Disinfection Equipment
OWNER: Coweta County Water & Sewerage Authority
PROJECT: Shenandoah WWTF – UV Disinfection Equipment RFP

BID DATE: June 15, 2022
TO: ALL PROSPECTIVE CONTRACTORS AND SUPPLIERS

The changes, modifications, and/or additions covered by and set forth in this Addendum No. 02 shall become part of and be incorporated in the Contract Documents for the above referenced project:

CLARIFICATIONS:

AD2.1 **Question:** Section 44 44 16 – 3.4 D. 6 – Please confirm if a 3rd party is required for this testing.

Krebs Response: Testing is provided by the Contractor under the supervision of the Vendor's technician.

AD2.2 **Question:** Please confirm that the inlet slide gates are not controlled by the UV system.

Krebs Response: Inlet slide gates are not controlled by the UV system.

AMENDED SPECIFICATIONS:

AD2.3 In specification 44 4416, replace section 2.2, H. with the following:

H. Automatic level control (ALC) system:

The UV Manufacturer shall provide an automatic level control system as required for the operation of their UV system and to meet the specified disinfection requirements herein. The ALC shall maintain the water level within the UV channels for proper operation of the system. The water level upstream of the UV banks shall not exceed elevation 800.50.

1. The water level of the UV channels shall be controlled with an electrically actuated downward opening gate weir.
2. The stainless steel downward opening gates shall be provided by the UV

- equipment manufacturer and installed by the contractor.
3. The weir gate frame shall be suitable for surface or in-channel mounting.
 4. An ultrasonic level sensor shall monitor the water level in the channels and the system control panel shall provide modulating control of the weir gates.

SUPPLEMENTAL SPECIFICATIONS:

AD2.4 See attached supplemental specification section:

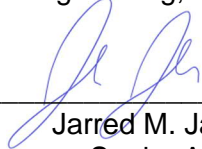
- a. 26 05 19 POWER CONDUCTORS AND CABLES 51V-600V
- b. 26 05 53 ELECTRICAL IDENTIFICATION
- c. 33 12 15 HYDRAULIC GATES
- d. 22 05 25 VALVE AND GATE ACTUATORS

AD2.5 See attached revised Life Cycle Cost Spreadsheet. Lines 68 – 70 have been revised.

This Addendum No. 02 shall be attached to the front of your set of specifications and made a part of the Contract Documents. Receipt of this Addendum No. 02 shall be acknowledged on of the Proposal Form.

Krebs Engineering, Inc.

By _____



Jarred M. Jackson, PE
Senior Associate

SECTION 22 05 25 - VALVE AND GATE ACTUATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of actuators:
 - 1. Electric Actuators (Valves and Gates)

1.3 SUBMITTALS

- A. Product Data: Provide product data for each type of actuator to be provided. Provide a schedule of actuators that lists each actuator and the corresponding valve or gate. The schedule should indicate the type, size, opening and closing speeds, description of use and/or location, sizing calculations, and other useful information for each actuator and valve or gate. A detailed list of accessories should also be provided for each actuator.
- B. Electrical and SCADA system requirements

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare actuators for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Seal and secure actuators to protect from dust, moisture and damage during shipping.
- B. Use the following precautions during storage:
 - 1. Keep actuators sealed and protected from moisture.
 - 2. Store actuators indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in a dry location.

1.5 WARRANTY

- A. The equipment shall be warranted for twelve (12) months from the date of Substantial Completion.

PRODUCTS

1.6 MANUFACTURER'S

- A. Manufacturer's: Subject to compliance with requirements, provide products by one of the following:
 - 1. Rotork
 - 2. EIM
 - 3. Auma

1.7 ELECTRIC ACTUATORS (VALVES AND GATES)

- A. The operators shall include, but shall not be limited to, the declutch lever, handwheel, motor, gearing, limit switches, torque switches, and electrical control connections shall be of the top mounted configuration. Where specified, or located in hazardous areas defined on plans, or where otherwise noted on the plans, the electric actuators shall be Factory Mutual approved Explosion Proof protection Class I, Division 1, Groups B, C and D for hazardous locations.
- B. Declutching mechanism shall allow valve operation by means of permanently attached auxiliary handwheel, meeting the O.S.H.A. requirement of no more than fifty pounds (50) rim pull effort. Actuation of motor automatically returns the operator to the electric mode. Operation of the motor shall not cause the handwheel to rotate, and operation of the handwheel shall not cause the motor to rotate. Should power be returned to the motor while the handwheel is in use, the design of the unit shall prevent transmission of the motor torque to the handwheel. The handwheel shall have an arrow and the word "OPEN" indicating required rotation. The handwheel shall operate in the clockwise direction to close. External declutch lever will be padlockable in the motor mode. Actuators for sluice gates and/or gate valves larger than 48" in diameter shall be provided with an operating nut attached to the manual override drive mechanism that allows operation of the actuator in the manual mode by a powered drill or wrench operating at no more than 100 RPM.
- C. All motors, gearing switches, wiring terminals and electrical connections shall be completely sealed against the environment and protected against the ingress of water, humidity, and dust. Enclosure shall be rated NEMA 4X/6. No exposed wiring or terminals shall be allowed in the switch compartment. Switches (limit and torque) shall be in IP 66 enclosure such that no dirt, dust water, etc. may interfere with the contact when limit switch compartment is removed. Actuators shall be supplied with a watertight seal between external wiring connection and the actuator housing. This seal shall prevent water ingress due to moisture penetration into conduit or external wiring connections.
- D. Actuators intended for submerged applications shall be tested to IP68 standard and shall be capable of submersion to 20 feet for a period not to exceed seventy-two (72) hours.
- E. Drive motor shall be designed for 460V/3PH/60Hz supply voltage and shall be of sufficient size to open or close valve against maximum differential pressure when voltage to the motor terminals is 90 percent of the nameplate rating, without loss motion considered. The motor shall be specifically designed for actuator service. Motor shall

be of the squirrel cage induction type and shall be totally enclosed, non-ventilated construction. Insulation shall be Class F, tropicalized and suitable for temperatures of up to 310 degrees F. Motor shall be of the "thermally protected" type, with three (3) thermal switches imbedded in motor windings one hundred twenty (120) degrees apart. Motor nameplate shall be in accordance with NEMA standard MGI. Motors for modulating service shall be capable of a minimum of 1,200 starts per hour.

- F. All gears must meet A.G.M.A. specifications. Gearbox is to be 100% lubricant filled. To assure zero leakage, each gearbox is to be pressure tested while submerged and a visual inspection made of all seals before lubricant is installed. Gear housing shall be ductile iron or cast iron. Spur gear and worm shall be steel. Worm gear shall be bronze. Nonmetallic gears in power train are not acceptable. All gears and shafting shall be supported on anti-friction bearings. All gearing and bearings shall be grease or oil lubricated. Seals shall be provided at all exit points of the gear case to prevent leakage of lubricant.
- G. Actuators with auxiliary gearing require that auxiliary gearing shall be of the wormgear type. All wormgears shall have 360 degree gearing. Gear segments are not acceptable. Mechanical stops must be adjustable from 80 to 120 degree rotation.
- H. Operator is to have separate drive nut assembly with thrust bearing assembly mounted so operator may be easily mounted and removed without having to unload the valve stem, and also allow operation of the valve without operator in emergency situations. For quarterturn applications, valve stem to gearbox mounting shall be through splined coupling of not less than 32 teeth. For multi-turn applications, attachment to the valve shall be via a mounting flange together with bronze stem nut and thrust bearings to form one (1) assembly, which is bolted to the actuator. The design of the drive system shall be such that the actuator shall be capable of removal from the valve, retaining the output drive assembly and stem nut on the valve. Emergency operation of the valve must be possible with the actuator removed.
- I. Limit switches with a minimum of twelve (12) contacts rated 5A to 250VAC shall be provided for each operator (3 N.O & 3 N.C for opening and 3 N.O. & 3 N.C for closing, one pair of which shall be dry contacts available for remote voltage interrogation). Limit switch drive to be of counter gear design and shall be "in step" with the output drive at all times in both the motor drive and manual (handwheel) modes. Limit switches shall be adjustable to change state at any point between or beyond the fully open and fully closed positions, with easy set declutch. All contacts on the limit switch assembly to be sealed in minimum IP 66 enclosure to maintain the integrity of the contacts and to eliminate shorting out. Indicating lamp circuitry shall include motion assurance to indicate when the operator is in motion, and direction in which it is traveling. Motion assurance shall be wired into lamps on operator, and available for remote light circuits when specified. Position indication shall be accomplished by means of an indicator dial in full step at all times with valve travel, whether in power or manual operation. The indicator dial shall be graduated in 25% increments (closed, 25% open, 50% open, 75% open and 100% open). Limit switch gearing shall be grease lubricated. The drive mechanism shall be totally enclosed to prevent entrance of foreign matter. Metallic gears shall be used.
- J. Each operator shall have a separately adjustable opening torque switch and closing torque switch. Adjustment range shall be responsive to opening or closing loads such that switches operate to protect valve and operator from damage when there is over-

torque during opening or closing. All contacts shall be sealed to insure the integrity of the contacts and to eliminate shorting out. When required, opening torque switch shall be able to control predetermined back seating thrust of a valve. Closing torque switch shall control predetermined seating thrust required for torque seating of wedge gate or globe valves. Seating torque shall be constant and independent of wear in valve disc or seat. Torque switches shall be of the SPDT, double break type with contacts rated 5A at 250VAC.

- K. The actuator electrical junction box (terminal compartment) is to be completely isolated from the switch compartment and shall include the terminals for the motor leads up to 15 h.p. No separate junction box or external conduit shall be needed for the motor. Bolts shall be "captive" to prevent loss when disconnected.
- L. The actuators shall be supplied with integral control housings that include reversing motor contactors, electrically and mechanically interlocked, equipped with auxiliary contacts. Contactor shall be completely wired to the complete electrical control assembly shall be contained in a minimum NEMA 4X/6 rated housing integral to the operator. Control power transformer shall be grounded with fused secondary and capable of transforming 460V, 3phase, 60 Hz to 24V DC. A minimum of three (3) threaded hubs for electrical conduit entry in controller compartment shall be provided, one (1) for primary power and two (2) for control circuits. All internal wiring in the housing shall be to terminal strips or plug assembly and all switches shall be wired to these terminals. Open-stop-close controls shall be by means of a three (3) push buttons and two (2) lights, Green for Open, Red for Closed. Local-Off-Remote control shall be by means of a three (3) position selector switch, padlockable in three positions. Auxiliary contacts shall be provided on the Local-Off-Remote selector switch to facilitate remote indication of switch position. Padlocks shall be provided for each actuator and shall be common keyed with all actuators. Actuator control packages shall be easily wall mountable remote from the actuator if required on plans. Controls packages shall be supplied with internal phase discriminator, monitor relay for collective fault signal and surge protection to 10 KV exceeding IEEE 587. An internal phase correction device shall be provided to prevent incorrect phase rotation of three phase actuators.
- M. Modulating valves and gates shall meet the above requirements, and shall include solid state starters with provisions for a 4-20mA position control input signal. The position comparator circuit shall be of solid state printed circuit board design and shall include (but not be limited to) separate controls for a zero span and deadband adjustment. LED lamps shall be furnished for indication of control status and shall include as a minimum, indications for open, close and fault. One (1) watt mylar potentiometers shall be used and shall be capable of providing linearity of +/- 1% and shall be rated for up to 250 degrees F. Internal power supply shall provide regulated 24VDC power to power solid state comparator circuit (positioner) and shall have the capability to supply power to an internal, solid state 4-20 mA feedback device.
- N. Actuated quarter turn valves 12" and smaller shall move from the fully open to fully closed position in 30 seconds; actuated valves larger than 14" and all valves for modulating service shall move from the fully open to fully closed position in no less than 60 seconds. Gates or valves of all sizes shall move from fully open to fully closed at a rate equal to or greater than 60 seconds per 12" of gate or valve travel.

- O. If actuator floor stands are to be provided, then they shall be constructed of carbon steel or cast ductile iron sufficient to withstand the loads required to operate the actuated valve and shall be painted in accordance with the specifications. Floor stands shall be provided with permanently sealed and lubricated shaft bearing at the base of each floor stand.
- P. The Contractor shall coordinate, furnish, and install all conduit, wiring, contacts and appurtenances necessary for incorporating the equipment into the SCADA system as shown and/or specified in the Contract Documents.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Examine actuators for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine actuators for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent gate movement during shipping and handling.
- C. Do not attempt to repair defective actuators; replace with new actuators.

2.2 ACTUATOR INSTALLATION

- A. General
 - 1. Drawings indicate general arrangement of gates and/or actuators.
 - 2. Comply with manufacturer's detailed written instructions for installing equipment.
 - 3. Electrical Connections: Rough-in electrical connections according to requirements in Division 26.

2.3 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure equipment is without damage or deterioration at the time of Substantial Completion.

2.4 START-UP ASSISTANCE AND TRAINING

- A. A factory-authorized service representative of the actuator manufacturer shall perform all necessary on-site assistance for actuator installation supervision and pre-startup wiring verification, and shall perform eight (8) hours of on-site start-up assistance/operator training once the equipment has been installed correctly and is operating as intended.

END OF SECTION 22 05 25

SECTION 26 05 19 - POWER CONDUCTORS AND CABLES 51V-600V

PART 1 - GENERAL

1.1. DESCRIPTION

- A. Power Wires and Cables
- B. Low Voltage Wires and Cables

PART 2 - PRODUCTS

2.1. POWER WIRES AND CABLES - 600 VOLT

- A. General: Conductors shall have current carrying capacities as per N.E.C. and with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.
- B. General Application (see below for exceptions):
 - 1. At or Below Grade (including within slab-on-grade):
 - a. #8 or larger conductors:
 - 1) XHHW or RHH/RHW/USE stranded (in conduit).
 - b. #10 or smaller conductors for circuits terminating at motors:
 - 1) THHN/THWN or XHHW stranded (in conduit).
 - c. #10 or smaller conductors (excluding circuits terminating at motors):
 - 1) THHN/THWN or XHHW stranded (in conduit).
 - 2. Above Grade:
 - a. #8 or larger conductors:
 - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
 - b. #10 or smaller conductors for circuits terminating at motors:
 - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
 - c. #10 or smaller conductors (excluding circuits terminating at motors):
 - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
 - 3. Power Wire and cable shall be as manufactured by Southwire, Rome, Encore Wire, American Insulated Wire, Okonite, Phelps-Dodge, Americable, Aetna or approved equal.
- C. VFD Cabling
 - 1. Wiring/Cabling installed between each VFD (Variable Frequency Drive) and the associated motor shall be multi-conductor shielded VFD power cable with the following characteristics:
 - a. Multi-conductor cable with three (3) power conductors and three (3) ground conductors
 - b. Soft annealed flexible stranded copper conductors.
 - c. 1kV cross-linked polyolefin insulation (to resist the potential reflected voltages experienced in 600VAC VFD applications).
 - d. Metallic shielded providing 100% shield coverage
 - e. Oil, abrasion, chemical & sunlight resistant thermosetting compound outer jacket.
 - f. Flexible TC-ER rated, UL listed for use in cable trays.
 - g. Equal to AmerCable #37-108VFD cable.

- D. Class 1 Control Cabling (120VAC Control Circuits, Etc.)
1. Unless specified otherwise, Class 1 control cabling shall:
 - a. Be rated for exposed cable tray installation.
 - b. Be plenum rated (Class 1 Control cabling and Instrumentation cabling installed in conduit or exposed in cable tray in non-plenum areas is not required to be plenum-rated).
 - c. Be UL-rated for the proposed application.
 - d. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
 - e. Utilize copper conductors.
 - f. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
 - g. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
 - h. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.
 - i. Be rated for 600V.
 - j. Be industrial grade.
 - k. Have stranded conductors.
 - l. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
 2. Control cabling shall be as manufactured by Belden, AlphaWire or General Cable.
- E. Fixture Wiring
1. Conductor Types:
 - a. Type TFFN or XFF.
 2. Minimum Sizes:
 - a. For fixtures up to 300 watts: #16.
 - b. For fixtures over 300 watts up to 1500 watts: #14.
 - c. For fixtures over 1500 watts: as required.
 - d. Conductors to concrete pour fixtures: #12.
 3. Fixture wire shall extend only from fixture to first junction, and not over 6 feet, except for concrete pour units.

2.2. WIRE CONNECTIONS:

- A. All connector types:
1. Shall be properly rated for the proposed application by UL and per the manufacturer.
- B. At Motor Connections (within motor terminal boxes):
1. On Unshielded Wire:
 - a. Single conductor per phase: shall be made with insulated set screw connectors or 3M 5300 Series 1kV Motor Lead Connections kits with mechanical lugs as required.
 - b. Multiple conductors per phase: shall be made with insulated mechanical lugs, rated for the associated motor cable types, by Polaris or IIsco.

2. On Shielded Power Wire:
 - a. The braided shields and internal grounding conductors of shielded power (not instrumentation) cables shall be grounded at BOTH ends (at VFD/starter and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.

- C. Other Dry locations:
 1. On Wire larger than #10: shall be made with solderless, non-insulated compression-type connectors meeting requirements of Federal Specification WS-610e for Type II, Class 2 and shall be covered with Scotch #33 electrical tape so that insulation is equal to 150% of conductor insulation.
 2. On Wire #10 and smaller: shall be made with one of the following:
 - a. Ideal Wing Nuts or equal by 3M .
 - b. Ideal Push-In Wire Connectors (for #12 and smaller only).

- D. Other Wet/Damp locations:
 1. On Wire larger than #10: shall be made with underground/direct-burial, waterproof rated EPDM or TPE-insulated connectors by IIsco, Burndy or T&B.
 2. On Wire #10 and smaller: shall be made with one of the following:
 - a. Ideal Weatherproof or Underground Wire Connectors pre-filled with 100% silicone sealant as required by the application.

PART 3 - EXECUTION

3.1. GENERAL INSTALLATION

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise.
- B. All joints and splices on wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation.
- C. No splices shall be pulled into conduit.
- D. No conductor shall be pulled until conduit is cleaned of all foreign matter.
- E. Wire and cable shall be neatly formed, bundled and tied in all panelboards, wireways, disconnect switches, pullboxes, junction boxes, cabinets and other similar electrical enclosures.
- F. All wires and cables installed in underground or other wet locations shall be rated by the manufacturer for wet locations.
- G. Network cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.
- H. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See above for general termination hardware requirements.

3.2. POWER WIRE AND CABLE INSTALLATION:

- A. No power conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.
- B. Multi-wire lighting branches shall be used as indicated.
- C. Where more than three current-carrying conductors are installed in a single raceway or cable, conductors shall be derated as indicated in NEC Table 310.15(B)(3)(a).
- D. Raceways/cables shall generally not be installed exposed to sunlight on roofs unless specifically required. Where raceways or cables are installed exposed to sunlight on roofs, conductors shall be derated with ampacities adjusted per NEC Table 310.15(B)(3)(c).
- E. In installing parallel power conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, the same type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded at both ends in an approved manner.
- F. In installing overhead main power services, a minimum of 5'-0" of cable per run shall be extended beyond the weatherhead(s) for connection to service drop. Confirm exact requirements with local utility company.

3.3. WIRE CONNECTIONS

- A. See Part 2 above for material types.
- B. Aluminum Wire Connections:
 - 1. Where aluminum wiring is allowed, connections shall utilize compression fittings, no exceptions (Anderson Versa Crimp or equal).
- C. Any stranded wire connection to wiring devices shall be made with crimp type terminals.
- D. All electrical connections and terminals shall be tightened according to manufacturer's published torque-tightening values with calibrated torque wrenches as required to clearly indicate final torque value to the contractor. Where manufacturer's torque values are not provided, those specified in UL 486A & 486B shall be used.
- E. All connections and connector types shall be installed in strict compliance with all requirements of the connector manufacturer.
- F. Under no condition shall the specified conductors be connected to terminals rated less than 75°C. Where conductors sized #1 or smaller are shown to be terminated at equipment and the terminals of that equipment are rated for less than 75°C, contractor shall install junction box near equipment to capture the specified conductors, splice with compression connections (rated for a least 75°C) and extend conductors with ampacity rating as required by NEC (based on terminal temperature rating) to equipment terminals. The length of the conductors to be terminated shall be as directed by the AHJ but not less than 48 inches.

3.4. SHIELDED CABLE INSTALLATION

- A. Shielded VFD (power) cables:
 1. The braided shields and internal grounding conductors of shielded VFD (power) cables shall be grounded at BOTH ends (at VFD and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.
 2. Contractor shall coordinate the necessary size of conduit with the outer diameter of the proposed cable type to verify that the raceway loading does not exceed NEC requirements prior to rough-in of the conduit system.
- B. Shielded instrumentation (low voltage) cables:
 1. The outer foil of shielded instrumentation cables shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.

3.5. LOW VOLTAGE (LESS THAN 50V) CONTROL AND NETWORK CABLE INSTALLATION:

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise. Low voltage control and/or network cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
 1. Cabling shall be plenum-rated, multi-conductor.
 2. Cabling shall be supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
 3. Cabling shall be properly bundled with plenum-rated Velcro straps on intervals not to exceed 30" on center.
 4. Properly-sized conduit(s) shall be provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings or through walls). End bushings shall be provided on both ends of all raceway terminations. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.

3.6. CIRCUITS AND BRANCH CIRCUITS

- A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

3.7. LABELING AND COLOR CODING OF WIRE AND CABLE

- A. Refer to Specification Section 26 05 53 for all labeling requirements.
- B. A color coding system as listed below shall be followed throughout the network of branch power circuits as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
A	BLACK	BLACK	BROWN
B	RED	ORANGE (FOR HI-	ORANGE

C	BLUE	LEG)	YELLOW
NEUTRAL	WHITE	BLUE	GRAY
GROUND	GREEN	WHITE	GREEN
		GREEN	

- C. Where dedicated neutrals are installed for multi-wire branch circuits, the neutral conductors shall be color coded as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
NEUTRAL A	WHITE W/ BLACK TRACER	WHITE W/ BLACK TRACER	GRAY W/ BROWN TRACER
NEUTRAL B	WHITE W/ RED TRACER	WHITE W/ ORANGE TRACER (FOR HI-LEG NEUTRAL)	GRAY W/ ORANGE TRACER
NEUTRAL C	WHITE W/ BLUE TRACER	WHITE W/ BLUE TRACER	GRAY W/ YELLOW TRACER

- D. Control Conductors: Shall be color coded by use of colored “tracers”. No control circuit shall contain two identical conductors. For example, a set of five (5) control conductors for a pushbutton station represents one (1) control circuit which would require five (5) uniquely-colored control conductors.

3.8. TESTING

- A. The insulation resistance of all feeder conductors (feeding electrical distribution equipment such as switchboards, panelboards, transfer switches, transformers, etc.) shall be tested at the load side of the feeder breaker with a 1000-volt DC Megger Tester prior to energization or final termination. Any feeder conductor with an insulation resistance less than the recommended minimums in the latest version of NETA Acceptance Testing Specification (“ATS”) standard shall be replaced by the contractor at the contractor’s expense. All final test results shall be clearly documented (with date, time, feeder, results, test equipment, etc.), and the final test results shall be submitted to the design team for review.

END OF SECTION 26 05 19

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1. DESCRIPTION

- A. Wire and cable identification.
- B. Pullbox & Junction Box Identification
- C. Electrical distribution & utilization equipment identification.
- D. Emergency and Standby Power receptacle identification.
- E. Instrument and control device identification.
- F. Raceway identification.

PART 2 - PRODUCTS

2.1. WIRE AND CABLE IDENTIFICATION

- A. Intermediate Locations:
 - 1. Wires and cable labels shall be white, thermal transfer, halogen-free, flame-retardant marker plates (sized to accommodate three lines of text) permanently affixed to the associated cable with UV-resistant plastic wire ties. Labels shall be Panduit #M200X/300X series or equal.
- B. Circuit/Cable Termination Locations:
 - 1. Wires and cable labels shall be non-ferrous identifying tags or pressure sensitive labels unless noted otherwise.

2.2. ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

- A. Labels on electrical distribution & utilization equipment shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive unless noted otherwise.

2.3. EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

- A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as follows:
 - 1. Emergency System source: Red engraved lettering to read "EMERGENCY".
 - 2. Legally-Required or Optional Standby Generator source:
 - a. If only part of facility is fed with generator backup: Black engraved lettering to read "FED FROM GENERATOR".
 - b. If entire facility is fed with generator backup: No "...GENERATOR..." label required.

2.4. INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

- A. Instruments and control device labels shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment or the adjacent, visible mounting surface with silicone adhesive or stainless steel wire ties.

2.5. RACEWAY IDENTIFICATION

- A. Raceway labels shall be white thermal transfer marker plates permanently affixed to the associated raceway with stainless steel wire ties, with two wire ties (one on either end of marker plate to provide a flush installation) where possible. Labels shall be Panduit #M300X series or equal.

PART 3 - EXECUTION

3.1. GENERAL

- A. Any proposed deviation in identification methods and materials from those described herein shall be submitted to Engineer for review and comment prior to installation.
- B. Contractor shall provide all labeling or identification required by applicable local, state and national codes. These specifications do not intend to itemize all code-required labeling or identification requirements.
- C. All labels/identification shall be positioned such as to be readable from the normal perspective without adjusting wiring/cables/labels. For example, labels/identification of wires/cables within cable trays shall be positioned to point towards the viewer (typically downward for overhead cable trays, or upward for cable trays within trenches).
- D. All labels/identification (except for handwritten labels on concealed pullbox/junction box covers as noted below) shall be typewritten/printed/engraved in a neat, workmanlike, permanent, legible, consistent and meaningful manner. Labels shall not be handwritten unless specific approval is granted by engineer.

3.2. WIRE AND CABLE IDENTIFICATION

- A. General:
 - 1. Where cabling is exposed (such as within cable trays), provide two wire ties per cable (one on either end of marker plate to provide a flush installation). Where cabling is concealed (such as within pullboxes/wireways), one wire tie per cable will be acceptable.
- B. Intermediate Locations:
 - 1. Thermal transfer labels shall be securely fastened to all wiring and cabling in the following locations:
 - a. Wireways
 - b. Pullboxes/Junction boxes larger than 4-11/16"
 - c. Pullboxes/Junction boxes through 4-11/16" where wires and cables are not easily identifiable via the color coding and box labeling
 - d. Vaults & Manholes
 - e. Approximately every 50 feet within cable trays (especially at locations where cables exit or diverge). Labels within cable trays shall be grouped (rather than being pre-labeled on cables and pulled into cable trays).

- f. Other similar intermediate locations.
- 2. Labels shall be stamped or printed with the following data so that the feeder or cable can be readily identified and traced:
 - a. From where the circuit originates (including panel designation and circuit number):
 - 1) Ex: "FROM: PP-A CIR. 3 (IN MAIN ELEC ROOM)"
 - b. To where the circuit extends (using the common name of the equipment):
 - 1) Ex: "TO: RTU-6 (ON ROOF)"
 - c. The purpose of the circuit:
 - 1) Ex: "POWER"
 - d. The set number (If parallel power feeds are used).
 - 1) Ex: "SET NO. 3 OF 4"

C. Circuit/Cable Termination Locations:

- 1. Where multiple termination points exist within a circuit origination point (panelboard, switchboard, MCC, starter, etc.) or other similar circuit endpoint (control panel, etc.), labels shall be securely fastened to all ungrounded and neutral conductors to clearly identify the terminal and/or circuit number associated with each conductor. For example, within lighting panels, each phase and neutral conductor shall be labeled near the terminals at a clearly visible location with the associated circuit number(s), so that if all conductors were unterminated, the labels would clearly indicate which conductor was associated with each circuit.

- D. Refer to Specification Section 26 05 19 for all color-coding requirements of wires and cables.

3.3. PULLBOX & JUNCTION BOX IDENTIFICATION

A. Concealed pullboxes/junction boxes:

- 1. Front surface of all pullbox/junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be neatly marked with the ID of circuits/cables contained with permanent black marker on cover of box (Ex: "RP-1A Cir. 1, 2 & 3"). Additionally, front surface of box shall be painted red where box contains fire alarm system cabling.

B. Exposed pullboxes/junction boxes:

- 1. Interior surface of all pullbox/junction box covers in exposed areas shall be labeled "Power", "Telecommunications", "Fire Alarm" or with other similar general text neatly with permanent black marker to indicate function of box. Circuit/cable labeling within box (see above) shall identify specific cables contained. Additionally, interior surface of cover shall be painted red where box contains fire alarm system cabling.

- C. Where pullboxes/junction boxes are named on contract documents (Ex: "PULLBOX #3"), an engraved nameplate shall be installed on the front surface of the box to identify the name.

3.4. ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. General:

1. All new and existing equipment modified by this project shall include arc-flash warning labels in accordance with NEC article 110.16.
- B. All Panels, Motor Control Centers, Switchboards, Switchgear, Transformers, Etc.:
1. Engraved nameplates identifying name of equipment, nominal voltage and phase of the equipment and where the equipment is fed from shall be installed on front surface of all panels, motor control centers, switchboards, switchgear, transformers, etc.:
 - a. Ex: First Line: "NAME: RP-A", Second Line: "120/208V-3Ø-4W", Third Line: "FED FROM: PP-A CIR. 4 (IN MAIN ELEC ROOM)"
 2. Refer to Panelboard Specification Sections for additional labeling requirements (circuit directory cards, permanent circuit labels, permanent circuit numbers, etc.) required inside panelboards.
- C. Safety/Disconnect Switches and Utilization Equipment (HVAC Equipment, Pumps, Powered Valves, Control Panels, Starters, Etc.):
1. Engraved nameplates identifying equipment being fed and where the equipment is fed from shall be installed on front surface of all disconnect switches (including both visible blade type switches and toggle-type switches) and on utilization equipment (where not clearly identified by immediately adjacent local disconnect switch):
 - a. Ex: First Line: "RTU-6", Second Line: "FED FROM: PP-A CIR. 5"
 2. Where safety/disconnect switches are installed on the load side of variable frequency drives, the safety/disconnect switch shall be furnished with an additional engraved nameplate to read: "WARNING: TURN OFF VFD PRIOR TO OPENING THIS SWITCH".
 3. Safety/Disconnect switches feeding equipment that is fed from multiple sources (such as motors with integral overtemperature contacts that are monitored via a control system) and Utilization Equipment fed from multiple sources shall be furnished with an additional BLACK-ON-YELLOW engraved nameplate to read: "WARNING: ASSOCIATED EQUIPMENT FED FROM MULTIPLE SOURCES – DISCONNECT ALL SOURCES PRIOR TO OPENING COVER".
- D. Emergency Systems:
1. A sign shall be placed at the service entrance equipment (and at any remote shunt trip operators, or similar, for service equipment) indicating the type and location of on-site emergency power sources (such as generators, central battery systems, etc.) per NEC requirements.
 2. All boxes and enclosures (including transfer switches, generators, power panels, junction boxes, pullboxes, etc.) dedicated for emergency circuits shall be permanently marked with white-on-red engraved nameplates so they will be readily identified as a component of an emergency circuit or system.
- E. Services:
1. All Service Equipment:
 - a. Engraved nameplates identifying maximum available fault current, including date the fault current calculation was performed, in accordance with NEC article 110.24.
 - 1) Ex: First Line: "AVAILABLE FAULT CURRENT: 16,154 AMPS",
Second Line: "DATE CALCULATED: JULY 8, 2013"
 - b. All service entrance equipment shall be clearly labeled as being service entrance rated.

2. Where a building or structure is supplied by more than one service (or any combination of branch circuits, feeders and services), a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders & branch circuits supplying that building or structure and the area served by each, per NEC requirements.

F. Generators:

1. Generators shall be labeled with engraved nameplates identifying name of equipment.

3.5. EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

- A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as described above.

3.6. INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

- A. New Instruments and control devices (whether furnished by contractor or not) shall be labeled with black-on-white engraved nameplates permanently affixed to the equipment or to the adjacent, readily-visible mounting surface with silicone adhesive or stainless steel wire ties.
1. Instruments and process control devices (float switches, etc.) shall be labeled with instrument name and, where available, instrument ID number.
 2. Pushbutton stations shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all pushbutton stations.
 3. Thermostats and other similar HVAC control devices installed in process areas shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all thermostats and other similar HVAC control devices.

3.7. RACEWAY IDENTIFICATION

- A. Each exposed raceway shall be labeled at the point where it becomes concealed, such as where it enters a concrete floor slab, a concrete wall, the ground, etc.
- B. Each raceway entering in-grade or on-grade pullboxes/junction boxes, where the conduits are only visible inside the box, shall be labeled within the box at the point where the raceway becomes concealed.
- C. Raceway nameplates shall identify:
1. The location of the other end of the raceway ("TO MCC-1" or similar). If the other end of the raceway is at an intermediate, named pullbox ("INSTRUMENTATION PULLBOX #4" or similar), that pullbox name shall be labeled rather than the endpoint of the circuitry.

3.8. OTHER IDENTIFICATION

- A. Factory-engraved coverplates identifying functions of light switches and other similar devices shall be installed where so required by plans/specifications.

END OF SECTION 26 05 53

SECTION 33 12 15 - HYDRAULIC GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Slide Gates - The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C561 Standard for Fabricated Stainless Steel Slide Gates as modified herein. The allowable leakage rate for the stainless steel gates in this specification shall be 1/2 the allowable leakage listed in the latest revision of AWWA C561.
 - 2. Weir Gates - The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C561 Standard for Fabricated Stainless Steel Slide Gates as modified herein. The allowable leakage rate for the stainless steel gates in this specification shall be 1/2 the allowable leakage listed in the latest revision of AWWA C561.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Furnished specialties
 - 2. Size
 - 3. Accessories
 - 4. Details of construction relative to materials
 - 5. Dimensions of individual components
 - 6. Profiles
 - 7. Finishes.
 - 8. Description of all materials.
 - 9. Complete bill of materials.
 - 10. Complete motor data (if applicable).
 - 11. Structural design calculations.
 - 12. Description of surface preparation, shop priming, and finish painting of gates.
- B. Shop Drawings Showing:
 - 1. Complete dimensional data.
 - 2. Gate Locations.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with

project names and addresses, names and addresses of Engineer and owners, and other information specified.

- D. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent professional engineer, indicate compliance of gates for applicable codes, based on comprehensive testing within the last two years of current products.
- E. Maintenance Data: For gates to include in the maintenance manuals specified in Division 1. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.4 QUALITY ASSURANCE

- A. The equipment specified herein shall be located as shown or described and installed in conformance with the manufacturer's suggested method as approved by the Engineer.
- B. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 10 years experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.
- C. Source Limitations: Obtain each gate component as a complete unit from one source and by a single manufacturer.
- D. Comply with all safety regulations for gates.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store gate in a manner to avoid significant or permanent damage to equipment.
 - 1. In general, comply with the manufacturer's written instructions for storage of gates.
 - 2. The equipment shall be stored in a clean, dry location free from construction dust, precipitation and excess moisture.

1.6 WARRANTY

- A. Gate Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace gate components that fail in materials or workmanship within the specified warranty period.
- B. Warranty Period: Five (5) years from the date of Substantial Completion.

1.7 MAINTENANCE SERVICE

- A. Contractor shall provide a manufacturer's technical representative for the equipment specified at the job site and/or classroom designated by the Owner for the minimum person-days listed for the services listed below:
 - 1. One (1) person-days for installation assistance, inspection, functional and performance testing, and certification of the installation.

2. One (1) person day for start up.
3. Start-up services shall be at times requested by the Contractor and approved by the Owner.

B. Spare Parts

1. Contractor shall furnish to the Owner one set of all special tools required for the proper servicing of all equipment supplied under these specifications.
2. Contractor shall furnish all spare parts not including required lubrication as recommended by the manufacturer for one year's normal operation and maintenance of the equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Stainless steel slide gates:
 - a. Whipps
 - b. Waco
 - c. Golden Harvest
 - d. Waterman Industries
 - e. Hydro Gate
2. Stainless steel downward opening weir gates
 - a. Whipps
 - b. Waco
 - c. Golden Harvest
 - d. Waterman Industries
 - e. Hydro Gate

2.2 SLIDE GATES

A. General:

1. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings.
2. The gate shall utilize self-adjusting seals. Due to the difficulty of accessing gates when they are in service, gates that utilize adjustable wedges, wedging devices or pressure pads are not acceptable.
3. All structural components of the frame and slide shall be fabricated of 304 stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
4. Slide gate frames shall be shipped fully assembled with the invert member welded to the side frames and the slide installed in the frame unless the overall width of the slide gate exceeds 96 inches or the overall height of the slide gate exceed 25 feet.
5. All welds shall be performed by welders with AWS D1.6 certification.

6. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale. All iron and steel components shall be properly prepared and shop coated with a primer.

B. Frame:

1. The frame assembly, including the guide members, invert member and yoke members, shall be constructed of formed stainless steel plate with a minimum thickness of 1/4-inch.
2. Frame design shall allow for embedded mounting, mounting directly to a wall with stainless steel anchor bolts and grout or mounting to a wall thimble with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as shown on the Contract Drawings.
3. All wall mounted or wall thimble mounted gates shall have a flange frame. Flat frame gates are not acceptable.
4. The structural portion of the frame that incorporates the seat/seals shall be formed into a one-piece shape for rigidity. Guide members that consist of two or more bolted structural members are not acceptable. Guide member designs where water loads are transferred through the assembly bolts are specifically not acceptable.
5. Gussets shall be provided as necessary to support the guide members in an unseating head condition. The gussets shall extend to support the outer portion of the guide assembly and shall be positioned to ensure that the load is transferred to the anchor bolts or the wall thimble studs.
6. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening gates or downward opening weir gates.
7. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by two structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide.
8. A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flushbottom type on upward opening gates.
9. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
10. A rigid stainless steel member shall be provided across the invert of the opening on downward opening weir gates.

C. Slide:

1. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4-inch.
2. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head.
3. When the width of the gate opening multiplied by the maximum design head is greater than 120 square feet, the portion of the slide that engages the guide members shall be of a "thick edge" design. Minimum material thickness of all members of the slide shall be 1/4 inch (6 mm).

4. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.
5. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

D. Stems:

1. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. On rising stem gates, the threaded portion shall engage the operating nut in the manual operator or motor actuator. On non-rising stem gates, the threaded portion shall engage the nut on the slide.
2. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
3. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.
4. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Contract Drawings.
5. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
6. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the crank or handwheel with a safety factor of 2, using the Euler column formula.
7. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
8. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
9. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be bolted to the stems.
10. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.

E. Stem Guides:

1. Stem guides shall be provided as required to meet stem buckling design criteria and positioned as recommended by the manufacturer.
2. The guides shall incorporate a UHMWPE bushing supported by a stainless steel wall bracket adjustable in both horizontal directions.

F. Seals:

1. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification.
2. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
3. The seat/seals shall extend to accommodate the 1-1/2 x the height of the slide when the slide is in the fully closed or fully opened position.

4. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.
5. All downward opening weir gates shall be provided with UHMW polyethylene seat/seals across the invert member.
6. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
7. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.
8. The seals shall be mounted so as not to obstruct the water way opening.
9. Gates that utilize rubber "J" seals or "P" seals are not acceptable.
10. The seal system shall have been factory tested to confirm negligible wear (less than 0.01") and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

G. Manual Operators:

1. Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self-contained gates or on the pedestal of non-self-contained gates.
2. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 25 lb effort when the gate is in the closed position and experiencing the maximum operating head.
3. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
4. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
 - a. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - b. Handwheel operators shall be equipped with roller bearings above and below the operating nut.
 - c. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - d. The handwheel shall be removable and shall have a minimum diameter of 16 inches.
5. Crank-operated gearboxes shall be fully enclosed and shall have a cast aluminum or ductile iron housing.
 - a. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
 - b. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - c. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
 - d. Gears shall be steel with machined cut teeth designed for smooth operation.
 - e. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.

- f. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - g. The crank shall be cast aluminum or cast iron with a revolving nylon grip and have a minimum radius of 12”.
 - h. The crank shall be removable.
6. All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.
- a. Interconnecting shafting shall be constructed of aluminum or stainless steel.
 - b. Flexible couplings shall be provided at each end of the interconnecting shaft. Couplings shall be stainless steel or non-metallic.
 - c. One crank shall be provided to mount on the pinion shaft of one of the gearboxes.
7. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non-gear operator, is located over 48-in above the operating floor. Chain wheels are not acceptable.
- a. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.
 - b. The extended operator system shall lower the centerline of the pinion shaft to 36-in above the operating floor.
 - c. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60-in or less above the operating floor.
8. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
- a. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36-in above the operating floor.
 - b. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.
 - c. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb effort on the crank or handwheel.
 - d. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts, and accessories as part of the gate assembly.
9. Operators shall be equipped with fracture-resistant clear butyrate or lexan plastic stem covers.
- a. The top of the stem cover shall be closed and have a ventilation hole.
 - b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
 - c. Stem covers shall be complete with indicator markings to indicate gate position.

10. When shown on the Contract Drawings, provide 2-inch square nut, mounted in a floor box, with a non-rising stem.
 - a. The square nut shall be constructed of bronze.
 - b. The floor box shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown.
11. Provide one aluminum or stainless steel T-handle wrench for operation.

H. Motorized Actuators

1. When required by the gate schedule or the drawings, motorized actuators shall be supplied as specified in section 22 05 25.

I. Anchor Bolts:

1. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
2. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.
3. Anchor bolts shall have a minimum diameter of 1/2-inch.

2.3 WEIR GATES

- A. The gates shall be downward opening with sealing on three sides, designed for water or wastewater applications. They shall have level control capability by allowing flow over the top of the gate slide. The gates shall be either open-frame or self-contained as specified herein or shown on the drawings.

B. Slide:

1. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4-inch.
2. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head.
3. When the width of the gate opening multiplied by the maximum design head is greater than 120 square feet, the portion of the slide that engages the guide members shall be of a "thick edge" design. Minimum material thickness of all members of the slide shall be 1/4 inch (6 mm).
4. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.
5. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.
6. The slide shall be designed for full travel equal to its height.

C. Frame:

1. The gate frame shall be made of formed plates or structural members creating the clear opening of the specified dimensions in a rigid one-piece unit. The mounting

and bolting flange of the frame to the wall shall be separate and independent from the seating and sealing plane of the slide.

2. The bottom of the frame will be equipped with wiper-type seal preventing flow between the frame and slide.
3. Stresses in the frame under the design head shall not exceed 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less. The minimum material thickness of all members of the frame shall be $\frac{1}{4}$ in.
4. The frame shall incorporate stoppers in both directions, built to resist the design load, to prevent the slide to be raised above or lowered below the gate bottom seal. The stopper design load shall be the same as the yoke design load described below.

D. Yoke:

1. Gates specified as self-contained design shall include a yoke consisting of a beam made of formed plates or structural members mounted on top of the frame to permit mounting of the actuator with proper stem alignment by the use of slotted holes in both directions.
2. The yoke shall be sized to limit deflection under the design load to a maximum of $\frac{1}{360}$ of the gate opening width or $\frac{1}{4}$ in (6mm) whichever is less. The yoke design load must be considered as the vertical thrust generated by a 80 lbs (356 N) force on the crank or handwheel (for a manual actuator) or by the actuator in locked rotor condition (for an electric actuator).
3. Per the latest edition of AWWA C561, the stresses in the yoke generated by the design load shall not exceed (for a manual actuator) 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less, or (for an electric actuator) $\frac{2}{3}$ of the yield strength.

E. Guiding and Seating:

1. The slide shall seat and travel on guides made of ultra high molecular weight polyethylene (UHMWPE) designed to perform for the life of the slide gate without replacement.
2. The slide shall be kept in positive contact with the guides on both its upstream and downstream faces, all along its travel in the gate clear opening by an elastomeric cord.
3. Below the gate clear opening, the guides shall extend enough to ensure that the slide is supported on a minimum of $\frac{1}{2}$ of its height when fully lowered.
4. The low friction guides shall be secured to the frame by bolted retainers permitting field adjustment of the contact pressure with the slide.
5. The surface of contact on the side seats shall be large enough to limit the stress under the design head to 600 psi (4137 KPa) without considering the top and bottom seats as load bearing.

F. Sealing:

1. The guides combined with the elastomeric cord will provide sealing on both sides of the opening.
2. The compression cord shall push and close the UHMWPE seal as the gate opens

to prevent grit and dirt to penetrate the guiding slot. Wide channel shaped guiding slots allowing accumulation of dirt and grit will not be accepted.

3. Sealing at the bottom section of the gate will also be achieved with a UHMWPE seat maintained in contact by an elastomeric cord.
4. In the fully raised position with no flow over the top of the slide, the seals shall restrict leakage to a maximum of 0.04 gpm/ft (0.5 l/min/m) of sealing the perimeter. The manufacturer shall be able to demonstrate that the sealing system will retain its performance even after 25,000 operating cycles.

G. Stem Connection:

1. In the case of gates with rising stems, the stem or its extension will be connected to the slide by means of a pinned connection. For gates with non-rising stems, the connection to the slide shall be by means of a threaded thrust nut matching the stem threads.
2. Stem connection design shall limit the stress under the design load to a maximum of 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength. The stem connection design load shall be the thrust and torque developed when a 80lbs (356N) efforts is applied the crank or handwheel (for a manual actuator), or 1.5 times the thrust and torque developed with the actuator in stalled condition (for electric motors).

H. Stem:

1. See section in Slide Gates above.

I. Stem Guides:

1. See section in Slide Gates above.

J. Manual Operators:

1. See section in Slide Gates above.

K. Motorized Actuators

1. See section in Slide Gates above.

L. Anchor Bolts:

1. See section in Slide Gates above.

2.4 FACTORY TESTS

- A. The gates shall be tested in the factory for leakage and operating force. Leakage shall be measured at the unseating design pressure. Operating force shall be measured with and without the design pressure. Factory test reports shall be made available on request for all gates provided.

PART 3 - EXECUTION

3.3 EXAMINATION

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

3.4 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's detailed written instructions for installing gates.

3.5 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure gate is without damage or deterioration at the time of Substantial Completion.

3.6 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 4. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 33 12 15

THIS IS THE LAST PAGE

Attachments to Addendum No. 02 preceding this page:

A total of 31 pages or sheets of drawings (including this page) have been included in Addendum No. 02.

General Contractors are requested to return this page as an acknowledgement that you have received this Addendum by e-mail. This will NOT be mailed. A copy of this Addendum may be picked up at the office of the Engineer.

Return to Krebs Engineering, Inc. by email to Jarred.Jackson@krebseng.com.

Received By _____

Contractor _____

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