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HYDRAULIC GATES

PART 1 - GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American Water Works Associations (AWWA): C563 Standard for Fabricated Composite Slide Gates.

2. ASTM International (ASTM):
   a. A193/A193M, Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
   b. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications.
   c. A276, Standard Specification for Stainless Steel Bars and Shapes.
   d. D635-81 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
   e. D648-82 Test Method for Deflection Temperature of Plastics Under Flexural Load.

3. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

1.02 DEFINITIONS

A. Slenderness Ratio: The ratio of the maximum unsupported stem length to the stem cross-section radius of gyration.

B. Self-Contained: The arrangement of gate operator, supported by gate frame, such that operating thrust loads are not applied external to the assembly.

1.03 SCOPE OF WORK:

The work to be performed under this Section shall include furnishing all labor, materials, tools and equipment necessary to install and test all hydraulic gates, consisting of, but not limited to frames, discs, seals, stems, operators, floor stands, stem guides, anchorage, and all other appurtenances, in place and complete, as manufactured by Ashbrook-Simon-Hartley, Plasti-Fab, or an approved equal.

1.04 SUBMITTALS:

A. Action Submittals:

1. Shop Drawings:
   a. Make, model, and weight of each equipment assembly.
   b. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Detailed structural and mechanical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment associated therewith.
   d. Gate operator and stem calculations for each gate and service condition.
   e. Gate opening and closing thrust forces that will be transmitted to the support structure with operator at extreme positions and load.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance.

2. Special shipping, storage and protection, and handling instructions.

3. Manufacturer's written/printed installation instructions.

4. Routine maintenance requirements prior to plant startup.

5. Manufacturer's Certificate of Proper Installation in accordance with Section 01 43 33, Manufacturers' Field Services.

6. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING:

All equipment shall be delivered in suitable packaging, cases, or crates and stored or placed in the appropriate manner. Each package shall have an identifying mark and a complete list showing contents.

1.06 WARRANTY AND GUARANTEE:

The manufacturer shall guarantee the gates, when installed and operated as recommended by the manufacturer with a documented maintenance program, trouble-free operation for a period of ten (10) years. If the Owner or Engineer is not completely satisfied with the performance of the product, the manufacturer shall remedy the problem at no cost or

refund the materials and installation cost upon the return of the equipment The manufacturer shall guarantee the following:

A. Leakage shall be no more than that allowed by the AWWA C563 Standard during the guarantee period.

B. Disc shall be free of sticking or binding as judged by the Engineer (move freely via operator provided) with no exercising required. Gate operators are to be warranted by the operator manufacturer.

1.07 OTHER GATE REQUIREMENTS:

A. P-Bulb or J-bulb type seals attached to the disc/mounted to the frame, or any seal that needs replacement in less than ten (10) years shall not be acceptable. No part of the seal shall protrude into the clear opening.

B. All gates shall be supplied by the same manufacturer who shall be fully experienced, reputable and qualified in the manufacturing of the equipment furnished and who has been building said equipment for a minimum period of ten (10) years.

C. All portions of the gates that will be in contact with the process water shall be constructed of materials suitable for contact with potable water as specified by NSF Standard 61.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

Gates shall be designed for the seating and unseating heads as listed in the Hydraulic Gate Schedule and shall conform to AWWA C563. Conformance to AWWA C563 applies to discs and frames with a safety factor of five (5) with regard to tensile, compressive and shear strength. Leakage shall not exceed 0.1 gallon per minute per foot of gate periphery under both seating and unseating head conditions. Calculations shall be submitted to show conformance. Materials of construction shall be suitable for the environment in which the gates shall be installed and operated.

2.02 GATE CONSTRUCTION

A. Rising stem type, with assembly styles as listed in the Hydraulic Gate Schedule and designated as follows:

1. Style A: Upward opening type for wall surface mounting on the concrete structures.

2. Style B: Upward opening type for mounting in channels with concrete embedded frame and invert.

3. Style C: Downward opening weir gate type with P-type invert seal for wall surface mounting on the concrete structures.

B. Guide Frames:

1. Guide frames shall be Type 316L stainless steel and shall have a slot suitable for mating with the disc. Plastic coated steel or externally reinforced disc shall not be acceptable.

2. Guide frames shall be wall mounted as shown on the Drawings against a 1" grout base.

3. Where guides are extended above the operating floor, they shall be sufficiently strong so that no further reinforcements are required.

4. The head rail shall be affixed so as to allow the gate to be removed from the guide without disassembly.

5. The head rail shall have a maximum deflection of 1/4" when subjected to a horizontal force of four times the 40-pound maximum handwheel effort.

6. Where the guide frame extends above a concrete wall, the top anchor bolt shall be not more than 6" below the top of the wall

7. The sealing arrangement for the reinforced composite sluice gates shall comprise of sealing faces and side guides constructed of ultra high molecular weight polyolefin having an extremely low coefficient of friction and a backing constructed of highly resilient expanded neoprene.

8. Join vertical guide frames and invert with factory welded comers.

9. Size guided slot to provide a minimum disc engagement of 1 inch on each side.

10. No thimbles or flanges are allowed.

C. Disc:

1. Construct disc from a reinforced rigid composite plastic material.

2. Disc shall have an internal matrix of carbon steel of suitable strength for the specified service.

3. Each disc shall be molded individually to the exact dimensions specified.

4. Outer surface of the disc shall be nontoxic and stabilized against UV light.

5. Surface shall be free of exposed reinforcing fibers.

D. Seals: The sealing arrangement shall comprise of sealing faces and side guides constructed of UHMW polyolefin having an extremely low coefficient of friction and a backing constructed of highly resilient expanded neoprene. Guides and seating of the gate shall be easily adjustable (min. 5/8-inch). All moving contact surfaces shall be compatible to each other by minimizing sticking/jamming and making the operation smooth.

E. Operator Support Head Rail (Yoke):

1. For self-contained gate operators, attached to the vertical extensions of the guide frames.

2. Constructed from at least two (2) Type 316L stainless steel angles, or two (2) other suitable shapes, and bolted in place to provide a rigid assembly.

3. Maximum Deflection: Not to exceed 1/4 inch under full operator applied loading.

F. Stems:

1. l-1/4 inch minimum diameter, ASTM A276, Type 316 stainless steel.

2. Stems shall have ACME threads. Extend threaded portion of stem 2 inches above operator when gate is in CLOSED position.

3. Ratio of the unsupported stem length to the radius of gyration, both in inches, shall not exceed 200.

4. Stems to withstand in compression, without damage, the thrust equal to at least 2-1/2 times the rated output of the hoisting mechanism, with a 40-pound effort applied to the handwheel.

5. Stems shall be furnished with adjustable stem guides spaced as necessary to maintain a slenderness ratio L/R of less than 200.

6. Provide adjustable stop collar for the CLOSED position.

7. Stem shall be fixed to the disc by a threaded and keyed assembly into a lifting nut attached to the disc in a lifting bracket.

8. Gates having a width greater than twice the height shall have dual stems. For downward opening weir type gates, locate stems near outside edges of gate.

G. Stem Covers:

1. Transparent plastic, vented pipe stem cover and cap.

2. Provide with OPEN/CLOSED designators with l-inch graduations on clear mylar pressure sensitive, adhesive tape, suitable for outdoor application.

2.03 FASTENERS:

All fasteners shall be of Type 316 stainless steel. All anchor bolts, assembly bolts, screws, nuts, etc. shall be of ample section to safely withstand the forces created by operation of the gate while subjected to the heads specified.

2.04 GATE OPERATORS

A. General:

1. Components: Withstand a minimum of 250 percent of design torque or thrust at extreme operator positions without damage.

2. Mount at walkway level, 36 inches above floor, unless otherwise indicated.

3. Gear train and gate stem sections shall produce a self-locking drive train.

4. Lift Nuts: Internally threaded with cut or cold-rolled Acme threads corresponding to stem threading.

5. Roller Bearings: Ball-thrust or tapered above and below lift nut to support both opening and closing thrusts.
   a. Grease lubrication fittings for bearings.
   b. Input pinions with needle or ball bearings.

6. Lubrication: Furnish rising stem gates with an insert lubricator flange in lift, with grease fitting for greasing stem threads below stem nut.

B. Type 1: Yoke with Electric Actuator:

1. Provide as indicated in the Hydraulic Gate Schedule.

2. Weatherproof housings, mounted on head rail (yoke), as shown on the Drawings.

3. Shall include the motor, operator unit gearing, limit switch gearing, limit switches, torque switches, stem nut, declutch lever and auxiliary handwheel.

4. The motor operator shall drive the gate stem at a rate of one (1) foot per minute.

5. A handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation, but shall be responsive to manual operation at all times except when the motor is in operation. The motor shall not rotate during hand operation, nor shall a fused motor prevent hand operation. When in the hand operating position, the unit shall remain in this position until the motor is energized, at which time the operator shall automatically return to electric operations and shall remain in the electric position until hand operation is again desired. This movement from electric to hand operation shall be accomplished by a positive declutching lever which shall disengage the motor and motor gearing mechanically, but not electrically. It shall be impossible to place the unit in hand operation when the motor is running. Manual effort shall not exceed 40 pounds of force.

6. A weatherproof locking device shall be provided on the gate operator to prevent use of the manual operator and prevent access to the locally mounted electric controls. The device shall allow remote operation.

7. Furnish fracture-resistant clear butyrate plastic stem covers complete with indicator markings to indicate gate position. Stem covers shall not discolor or become opaque for a minimum of five (5) years after installation. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting.

8. Enclosures shall be FM certified or UL listed and shall be provided with space heaters to prevent condensation.

9. Each operator shall be provided with its own electrical controls housed in a NEMA 4X Type 316 stainless steel enclosure (unless otherwise shown) which shall be part of the operator. For outdoor installation, the controls

shall be completely factory wired to the motor, limit switches and torque switch such that the only field wiring connection required, shall be for power supply and signal. All field wiring shall be to terminal strips.

10. Electrical operators arranged for open-close operation shall open and close the gate between the limit switch settings in response to a local or remote signal. The controls shall consist of a combination lockable circuit breaker and reversing starter with control power transformers. Control power shall be 110 Volt. A Raise-Stop-Lock-Lower pushbutton station shall be furnished and mounted as an integral part of the controls. A lockable Hand-Off-Remote selector switch shall also be provided to allow response to a remote Raise-Stop-Lower control. In addition to the mechanical position indicator, two indicating lights, one green and one red, shall be furnished. The lights shall be wired such that the green light shall be illuminated when the gate is fully closed, the red light shall be illuminated when the gate is fully open and both lights shall be illuminated when the gate is in any intermediate position. The power supply to the gate operator shall be 480 Volts, 3 Phase, 60 Hertz.

C. Type 2, Manual: Yoke with Handwheel and Benchstand:

1. Provide as indicated in the Hydraulic Gate Schedule.

2. Weatherproof housings, mounted on floor stand or head rail, as shown on the Drawings.

3. Solid Bronze Lift Nut: Integrally threaded with Acme threads.

4. Ball Thrust or Tapered Roller Bearings:
   a. Locate above and below operating nut flange to support opening and closing thrusts.
   b. Include grease lubrication fittings and input pinions.

5. Manual Effort: Not to exceed 40 pounds of force.

6. Furnish fracture-resistant clear butyrate plastic stem covers complete with indicator markings to indicate gate position. Stem covers shall not discolor or become opaque for a minimum of five (5) years after installation. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting.

7. Handwheel to be perpendicular in orientation to the gate (horizontal).

D. Type 3, Manual: Floor Stand with Crank:

1. Provide as indicated in the Hydraulic Gate Schedule and as shown on the Drawings.

2. Use single or tandem steel or cast iron pedestals as shown on the Drawings or as required for proper operation.

3. Floor stand shall include solid bronze operating nut.

4. Ball Thrust or Tapered Roller Bearings:
   a. Locate above and below operating nut to support opening and closing thrusts.
   b. Include grease lubrication fittings and input pinions.

5. Manual Effort: Not to exceed 40 pounds of force. Provide appropriate gearing to meet maximum effort limitation. Design gearing, shafting, and stem to withstand force resulting from 200 pound effort on crank.

6. Furnish fracture-resistant clear butyrate plastic stem covers complete with indicator markings to indicate gate position. Stem covers shall not discolor or become opaque for a minimum of 5 years after installation. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting.

7. Provide horizontal shafting between tandem floor stands. Shafting material shall match stem material. Provide clear cover on horizontal shafting.

8. Provide corrosion resistant factory finish suitable for outdoor service or shop prime and apply finish coating in field per Section 09 90 00, Painting and Coating.

E. Identification Tagging Requirements:

1. For each gate operator, provide 1-1/2-inch minimum diameter heavy brass tag, bearing the gate tag number shown in the schedule.

2. Attach the tags to the operator by soldered split key rings to that ring and tag cannot be removed. Use block type numbers and letters with 1/4-inch minimum high numbers and letters stamped on and filled with black enamel.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install products in accordance with the manufacturer's written instructions.

B. Field mount operators after installing gates.

C. Frames and guides shall be installed in a true vertical plane with 90-degree corners.

D. Accurately place Type 316 stainless steel anchor bolts using templates furnished by the manufacturer and as specified in Section 05 50 00, Metal Fabrications.

E. Lubricate stems before operating.

3.02 FIELD QUALITY CONTROL

A. Functional Tests: Conduct on each gate.

B. Performance Test:

1. Conduct on each slide gate.

2. Maximum gate leakage shall be as defined in the Performance Requirements of this Specification, herein.

3. Perform under actual or approved simulated operating conditions.

4. Test for a continuous 3-hour period without malfunction.

5. If gates, operators, and appurtenances do not meet specified requirements, corrective measures shall be taken by the Contractor, or the equipment shall be removed and replaced with equipment that satisfies the conditions specified.

3.03 START-UP AND INSTRUCTION

A. Furnish services of manufacturer's technical representative to inspect the completed installation, correct or supervise correction of any defects or malfunctions, and instruct operating personnel in proper operating and maintenance procedures as described in this Section.

3.04 SUPPLEMENTS

A. The supplement listed below, following "End of Section", is a part of this Specification.

1. Hydraulic Gate Schedule.

END OF SECTION

HYDRAULIC GATE SCHEDULE					
Location	**Assembly Style**	**Number of Units**	**Wall Opening (W x H)**	**Design Operating Head (ft) Seating/Unseating Condition**	**Operator Type/ Control Style**
Intake Structure	Style A	3	8'-0" x 8'-0"	13/13	Type 1
Influent Channel Upstream of Flocculation Basins	Style C	12	2'-0" x 2'-0"	3/3	Type 2
GAC Contactor Influent Channel	Style C	1	4'-0" x 6'-0"	6/6	Type 2
Downstream End of Disinfection Contact Basin	Style C	1	10'-0" x 4'-0"	4/4	Type 3
Clearwell and Finished Water Pump Chamber	Style A	2	6'-0" x 6'-0"	14/14	Type 3

Notes:

1. Frames and discs for influent channel weir gates shall be sized to allow the weir crest to be adjusted between elevation 635.50 and 638.50.
2. Frames and discs for GAC contactor influent channel weir gate shall be sized to allow the weir crest to be adjusted between elevation 621.00 and 627.00.
3. Frames and discs for disinfectant contact basin weir gate shall be sized to allow the weir crest elevation to be adjusted between elevation 600.75 and 605.00.