



## HEAVY DUTY TITSEAL® (HDTS) SLUICE GATES

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. This section includes all gate systems required for the project.

#### 1.2 REFERENCES

- A. Design, fabricate, and test stop log systems and materials in accordance with manufacturer's recommended procedures and the following codes and standards:
  1. ASTM A276 - Stainless Steel Bars
  2. ASTM D256 - Izod Impact Strength
  3. ASTM D570 - Water Absorption Rate
  4. ASTM D638 - Tensile Strength
  5. ASTM D695 - Compressive Properties of Rigid Plastic
  6. ASTM D696 - Coefficient of Linear Expansion
  7. ASTM D790 - Flexural Properties
  8. ASTM D2583 - Indentation Hardness
  9. ASTM D2563-0 - Visual Defects
  10. ASTM D2584 - Resin, Glass & Filler Content
  11. ASTM A193 – Stainless Steel Anchor Bolts
  12. ASTM B584 – Alloy 865 Manganese Bronze
  13. ASTM D792 – Density and Specific Gravity at 25° C
  14. ASTM D1056 – Polymer Grade
  15. AWWA c-563- Fabricated Composite Slide Gates
  16. AWWA C-540 – Power Actuating Devices – Sluice Gates
- B. Manufacturer shall be experienced in the design and manufacture of stop logs and accessories for a minimum of 25 years.
- C. Manufacturer must provide warranty for 25 years against failure due to corrosion of composite materials.

#### 1.3 SUBMITTALS

- A. Submit the following for acceptance:
  1. Approval Drawings
    - a. Showing all critical dimensions
    - b. Showing principal parts and materials

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Ship all gates with suitable packaging to protect products from damage.
- B. Protect threads, flanges, stems and operators from damage.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Gate body shall be:
  1. Engineered composite fiberglass reinforced plastic (FRP) completely encapsulating an internal steel reinforcing structure.

- a. Infusion molded to create a seamless corrosion barrier impervious to moisture.
  - b. FRP resin shall be: **Choose a material**
  - c. Internal Steel Reinforcing: Carbon Steel as needed for deflection requirements.
  - d. Internal Core Foam: 2lb (0.9kg) polyisocyanurate closed cell rigid foam.
- B. Guide Frame
    - 1. Guide Frame Rails to be: **Choose a material**
    - 2. Operator Support Yoke: **Choose a material**
  - C. Stems and Gate Hardware
    - 1. Stem **Choose a material**:
    - 2. Gate Hardware: **Choose a material**
  - D. Seals
    - 1. Side, Top and Flush Bottom Seals: Hollow Bulb J Seal molded of extruded virgin EPDM.
  - E. J-Seal Clamping Bar and Fasteners
    - 1. Clamping Bar: **Choose a material**
    - 2. Fasteners: **Choose a material**
  - F. Lift Nuts and Thrust Nuts
    - 1. Manganese Bronze, ASTM B-584, Alloy 865.
  - G. Hand wheel
    - 1. Cast Iron, ASTM A-126, Class B.
  - H. Anchor Bolts
    - 1. **Choose a material**
  - I. Stem Cover
    - 1. Butyrate
  - J. Stem Guides (When applicable)
    - 1. UHMW

## 2.2 SLUICE GATES

- A. Acceptable Manufacturers:
  - 1. Plasti-Fab, Inc.
  - 2. Or approved equal. Pre-approved by Engineer at least 10 business days prior to bid date.
    - a. Manufacturer must have a qualified Engineer on staff with at least 5 years' experience with hydraulic control gates.
- B. Gates shall meet AWWA C-563 Requirements:
  - 1. Leakage:
    - a. Gates shall have a maximum leakage rate of 0.1 GPM per foot (1.24 LPM/m) of wetted perimeter under seating and unseating head pressures under full design head. Sluice gate shall be wedging and have adjusting bolts.

## 2.3 DESIGN CRITERIA

- A. Visual inspection for defects shall be made without the aid of magnification. Defects shall be classified as shown in Table 1 Level II of ANSI/ASTM D2563-0, approved 1977, (or any subsequent revision).
- B. Deflection
  - 1. Deflection across the gate width shall be limited to: L/360 or 1/4" (6mm), whichever is less, at the maximum operating head.
- C. Head Pressure
  - 1. Gate shall be designed for a maximum head pressure as per gate schedule.
  - 2. Gate size as shown on the contact drawings and/or gate schedule.
- D. Surface Conditions
  - 1. All sluice gates shall be flat and level.
  - 2. Warpage throughout the entire gate shall not produce a crown of more than 1/16" (1.6mm) in any direction.
  - 3. Gates having reinforcing members bolted or bonded to flat sheet stock will not be

- acceptable.
- E. Sealed Area
1. Sluice gate shall seal on all four sides.

## 2.4 CONSTRUCTION

- A. Gate Body
1. Sluice gate body shall be manufactured of fiberglass reinforced polyester totally encapsulating an internal reinforcing structure.
  2. Each gate shall be infusion molded individually to the exact dimensions specified. Seams and joints in and on the body are not acceptable.
  3. Sluice gates shall be manufactured of reinforced thermoset plastic.
  4. Gate body shall have UV Stabilizing pigment in the resin to provide long-term protection from UV.
  5. The surface shall be resin rich to a depth of 0.010 inches to 0.020 inches (.25 - .51mm) and reinforced with C-glass and/or polymeric fiber surfacing material.
  6. The surface shall be free of exposed reinforcing fibers.
  7. The composition of surface layers shall be approximately 95% (by weight) resin. The remaining laminate shall be made up of copolymer composite and reinforcing fibers in a form, orientation, and position to meet the mechanical requirements.
  8. Structural reinforcing shall be utilized to attain the necessary stiffness to meet deflection requirements, and shall be well encapsulated with a laminate not less than 1/4" (6mm) thick on each side to ensure against any permeation by water to the core areas.
  9. **Choose a material** stem mounting bracket shall fasten to the gate with through bolts. The through holes shall not pass through or be in contact with the internal mild steel reinforcing.
  10. Core material must be 100% resistant to decay and attack by fungus and bacteria and be resistant to hydrocarbons.
  11. Gate body shall be manufactured using advanced technology vacuum infusion resin transfer processes. The closed mold vacuum process must completely evacuate all air from the mold prior to infusing the mold with premium quality resin as specified. The vacuum infusion process must eliminate the potential of air entrapment and/or voids in the matrix of the gate body thus producing a finished product that is one-piece, seamless and uniformly impenetrable by fluids eliminating interior corrosion. Manufacturing techniques that employ adhesives or mechanical fasteners to attach individual panels to a pre-fabricated framework results in seams along vertical and horizontal axes of the gate body which create stress-potential areas, portals for fluid infiltration, subsequent de-lamination and product failure due to corrosion.
- B. Seals
1. The gate shall be equipped with elastomeric seals to reduce leakage.
  2. Elastomeric J-seals shall be made of molded or extruded EPDM having a hardness range of 55 to 65 shore A durometer and conforming to ASTM spec. D-2000 having a maximum compression set of 25%, and low temperature brittleness to meet suffix F-17 (-400).
  3. Seals, including bottom seals, shall be mounted on gate covers with **Choose a material** cap screws and **Choose a material** clamping bars thus providing a means of repair, and replacement without dewatering the channel.
  4. HDTs gates shall be designed and manufactured with the seals mechanically affixed to the gate body NOT the guide frames. When replacement of seals eventually becomes necessary (variables such as frequency of open-close cycles, chemical composition and abrasiveness of the fluid will ultimately determine the effective life of the seals) the HDTs gate shall be removable from the guide frame without de-watering the channel and, in a suitable work area, easily and economically refitted with new seals. Gates designed with seals integral to the guide frames, which require channel de-watering, scaffolding/lifts/ladders and time-consuming "non-workshop" conditions shall not be

- permitted.
5. Frames and Guides
    - a. Guides shall be styled for **Choose item** as shown on the contract drawings and/or gate schedule.
    - b. Guides shall be fabricated from **Choose a material** and shall have a slot suitable for mating with the gate body.
  6. Where self-contained guides are extended above the operating floor level to form the bench stand upon which the lift mechanism is fastened, they must be suitably strong and rigid without the use of additional stiffening members.
  7. The head rail shall be affixed so as to allow the gate to be removed from the guide without disassembly.
  8. The head rail shall have a maximum deflection of 1/4" (6mm) when subjected to a horizontal force of four times the 40 lb. (2.8 ksc) maximum hand wheel pull.
  9. Where a wall mounted guide frame extends above a concrete wall the top anchor bolt shall be not more than 6" (152mm) below the top of the wall.
  10. Gate inverts shall be flush with the channel bottom.
  11. If the Gate width is greater than 4' (1.2m) wide and 2x the gate height, a tandem stem shall be used.
  12. Guides to be bolted to the head wall shall be equipped with heavy duty mounting angle for ease of mounting to the channel wall by means of **Choose a material** anchor bolts.
  13. No wall thimbles shall be required for installation.
    - a. Adjustable Wedging Device
  14. Gates shall be fitted with an adjustable wedging assembly comprised of a **Choose a material** wedging bar and silicon bronze adjusting bolts with locking nuts. The adjusting bolts shall be non-galling for long-term easy adjustment. Gate wedging assembly shall be initially adjusted at the factory; however, they shall be easily adjusted to achieve the specified leakage rate. HDTS gates utilizing the Plasti-Fab wedging device shall be provided for ease of reliable manipulation, accessibility and adjustment if required
- C. Lifts & Operators
1. Operators shall be sized to start the gate moving under a maximum head pressure with a pull of not more than 40 lbs (2.8 ksc).
  2. A manual hand wheel or crank shall be supplied that is compatible with the lift.
- D. Electric, pneumatic or hydraulic Operators (OPTIONAL)
1. Gate Manufacturer shall provide actuators per Electric Motor Operator Manufacturer's recommended sizes based on Operating Forces and design requirements and shall be for open/close or modulating service as shown in the gate schedule.
- E. Operating Stems
1. Each HDTS gate shall be equipped with a rising or non-rising operating stem. The stem shall be **Choose a material**.
  2. The stem will have Acme threads and shall be provided with adjustable stop collars to limit upward and downward travel.
  3. Stems shall have a maximum L/R of 200.
  4. Stem guides with UHMW bushings shall be used to maintain an L/R of 200.
- F. Stem Covers
1. Transparent plastic stem covers shall be provided with vent holes to minimize condensation.
  2. The stem covers shall be marked with 'Open' and 'Closed' position indicators.
- G. Pedestals
1. For non-self-contained guide frames a **Choose item** pedestal shall be furnished for mounting the operator.
  2. Pedestal material shall be **Choose a material**

## 2.5 PHYSICAL PROPERTIES

- A. Structural characteristics for a 1/8" (3mm) glass mat laminate shall meet the following minimum physical properties:

Tensile strength	15,000 psi (1034 ksc)
Flexural Modulus	900,000 psi (70307 ksc)
Flexural Strength	20,000 psi (1406 ksc)
Compressive Strength	20,000 psi (1547 ksc)
Impact Strength	9.0 ft-lbs/in. (1.24 kgf.m/25mm)
Water absorption	0.12% (in 24 hours)

- B. Seals: Extruded EPDM seals shall have the following physical characteristics:

Specific Gravity	1.25
Hardness	55 – 65 Shore A Durometer
Tensile Strength	1500 psi min. (0.07ksc)
Elongation	300%
Low temperature brittleness	- 40°

- C. Wear Strips UHMW Polyethylene:

Tensile Strength	5,600 psi (0.7kg/cm <sup>2</sup> )
Flexural Modulus @ 73°F (23°C)	130,000 – 140,000 psi (9140 – 9843kg/cm <sup>2</sup> )
Coefficient of Friction	0.15
Water Absorption	0.01% in 24 hours

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Thoroughly clean and remove all shipping materials prior to setting.  
 B. Install gates per Manufacturer's recommendations.

## **END OF SECTION**