

SECTION 1411

BUTTERFLY VALVES

1411.0100 GENERAL

1411.0101 Description of Work. The work under this Section shall consist of furnishing all labor, materials, and equipment required for the installation of butterfly valves, all in accordance with the details shown on the plans and requirements of these specifications.

The Contractor shall provide butterfly valves and appurtenances, complete and operable, in accordance with the Contract Documents, plans, and specifications, including NSF/ANSI 372 requirements.

1411.0102 Reference Specifications, Codes, and Standards.

- ANSI/ASME B16.1 Gray Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250
- ASME B16.5 Pipe Flanges and Flanged Fittings
- ASME B16.34 Valves—Flanged, Threaded, and Welding End
- ASTM A48 Gray Iron Castings
- ASTM A536 Ductile Iron Castings
- ASTM A564 Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
- ASTM B62 Composition Bronze or Ounce Metal Castings
- AWWA C207 Steel Pipe Flanges for Waterworks Service, Sizes 4 Inches through 144 Inches
- AWWA C213 Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipes and Fittings
- AWWA C504 Rubber-Seated Butterfly Valves
- AWWA C550 Protective Interior Coatings for Valves and Hydrants

1411.0103 Submittals. For valves 16 inches and larger, the Contractor shall furnish submittals within 14 days of contract award. Submittals shall be given to the Engineer for approval prior to acceptance of the butterfly valve. When it is questionable whether the

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manufacturer's product conforms to the specifications, the Owner reserves the right to require submittal of more complete information before the valve is approved. All submittals shall reference the project plan number and specification section. At a minimum, the Contractor shall include the following information in the submittal:

- (1) Documentation of the manufacturer's qualifications, including facility name; facility owner; and contact name, address, and telephone number.
- (2) Certification by the butterfly valve manufacturer that the manufacturer is responsible for the selection of valve actuators and that the actuator is sized for a 250B pressure-class valve and conforms to the requirements of Subsection 1411.0201(D)(10).
- (3) Documentation of butterfly valve torque input requirements and actuator torque output with flow to both directions for asymmetrical discs, including the number of turns required to close the valve. This shall also include proof of design to AWWA C504 for AWWA butterfly valves, unless modified by the specifications, plans, or special provisions.
- (4) Standard data and catalogs for the specific make, model, and size of the butterfly valve being furnished. Information shall include:
 - General arrangement drawings showing dimensions, weights, and stem diameters
 - Parts drawings showing complete parts lists
 - Actuator parts drawings and number of turns to operate
- (5) Information required to assemble, install, operate, and maintain the butterfly valve.
- (6) Certification that the butterfly valve and all component parts to be furnished are manufactured and tested in accordance with the latest edition of AWWA C504, unless modified by the specifications, plans, or special provisions.
- (7) Manufacturer's size, make, and model number of the butterfly valve to be furnished, along with actuator manufacturer and model.
- (8) A list of at least 10 of the manufacturer's butterfly valve installations in the U.S., of comparable size and complexity to units indicated in this Section. The valve manufacturer shall have at least 10 years' experience manufacturing butterfly valves.

1411.0104 Delivery, Storage, and Handling. Prior to shipment of butterfly valves from the manufacturer's premises, the Engineer may require visual inspection of the butterfly valve to determine compliance with this specification. Butterfly valves shall be delivered to the site,

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stored, and handled in accordance with the manufacturer's instructions except as modified by the plans, special specifications, or as directed by the Engineer.

1411.0200 PRODUCTS

1411.0201 Materials.

(A) **Standards.** Butterfly valves and the materials used in their manufacture shall comply with the most recent revision of the standards in Appendix B.

(B) **Pressure Class.** The design pressure for butterfly valves shall be 150 pounds per square inch or 250 pounds per square inch, whichever is noted in the plans or special specifications.

(C) **Stainless Steel.** Stainless steel as specified herein shall be type 316 in accordance with ASTM A276 or ASTM A536.

(D) **Component Parts.** Butterfly valves covered by this specification are 16 inches in diameter and larger. 4- to 12-inch butterfly valves are for aboveground applications only. Component parts of the butterfly valves shall be in accordance with AWWA C504. All butterfly valve components shall be tested and certified by an approved testing laboratory located in the United States, and all parts shall be readily available.

(1) **General.** Butterfly valves for water working pressures up to 150 pounds per square inch shall conform to ANSI/AWWA C504 Class 150B. Butterfly valves for water working pressures greater than 150 pounds per square inch shall conform fully to the design requirements of ANSI/AWWA C504 Class 250B, subject to the following requirements:

(a) Valves shall be of the size and class indicated in the plans or specifications.

(b) Unless otherwise noted, all valves shall be sized for bi-directional water service, full rated pressure, and a line velocity of 16 feet per second.

(c) Lifting lugs will be provided for all valves 24 inches and larger.

(2) **End Connections.** Valve ends shall be mechanical joint, conforming to AWWA C110 unless otherwise specified in the Contract Documents. Mechanical joint connection bolts and nuts shall be manufactured of Corten steel or approved equal in accordance with ASTM A242. Where specified in the Contract Documents, valve ends shall be flanged in accordance with AWWA C110 for 125/150-pound flanges and ASME/ANSI B16.1 for 250/300-pound flanges 48 inches and smaller. For flanges larger than 48 inches, flange outside diameter, number of bolts, diameter of bolt circle, and diameter of bolts shall comply with ANSI/AWWA C207 Class E, and the flange thickness shall be designed in accordance with ASME Section VIII, flange design requirements.

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Flange connection bolts and washers shall be manufactured of type 316 stainless steel, and nuts shall be manufactured of type 316 stainless steel with a Xylan coating or approved equal.

(3) **Body.** Valve bodies shall be ductile iron ASTM A536 Grade 65-45-12. In no case shall the minimum port diameter of the valve be less than 1-1/2 inches smaller than the nominal valve diameter.

(4) **Disc.** The disc shall be ductile iron ASTM A536 Grade 65-45-12. For valves larger than 24 inches in diameter, the disc shall be mechanically fastened to the valve shaft using type 316 stainless steel squeeze pins, taper pins, or a tangential pin locked in place with lock washers and Nylon nuts. For valves 30 inches in diameter and larger, the valve disc shall incorporate in its design an off-set disc design to provide an uninterrupted 360-degree seating edge and a flow-through disc design to increase flow. Discs containing hollow chambers or any surfaces that cannot be coated and inspected shall not be acceptable.

(5) **Shaft.** Valve shafts shall be stainless steel ASTM A276 type 316 for Class 150B valves, and stainless steel ASTM A564 type 630, condition H1100 or H1150 for Class 250B valves. Valve shaft diameters shall comply with AWWA C504.

(6) **Seat.**

(a) **Mechanically Retained Seat on Body.** The resilient seat shall be Buna-N or EPDM rubber, mechanically retained, and fully adjustable by means of type 316 stainless steel rings or clamp attachment hardware. Mechanically retained seats shall have the capability for adjustment without means of injection. Rubber seat material shall not be sulfur cured. Valve seats shall be field adjustable and replaceable without disassembly of the disc and shaft and without removal from the line. The design of the seat shall provide tight shutoff with flow in either direction per the required test in Subsection 1411.0302(D)(2). Valves with mechanically retained rubber seats on the body shall have a type 316 stainless steel surface retained on the edge of the disc. The mechanically retained seat shall compress with the stainless steel ring on the disc.

(b) **Epoxy Retained Seat.** The peroxide-cured EPDM rubber valve seats shall be epoxy retained in the valve body for valves 24 inches in diameter and larger. For valves 3 to 20 inches in diameter, the peroxide-cured EPDM rubber seat shall be molded and bonded to the valve body. The EPDM rubber seat material shall not be sulfur cured. Valve seats shall be field adjustable and replaceable without disassembly of the disc and shaft and without removal from the line.

(c) **Mechanically Retained Seat on Disc.** This will be approved at the discretion of the Engineer based on valve diameter. The resilient seat shall be

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Buna-N or EPDM rubber, mechanically retained, and fully adjustable by means of type 316 or 304 stainless steel ring or clamp attachment hardware. When the rubber seat ring is mechanically retained on the disc, the rubber seal shall mate against a type 316 or 304 stainless steel ring seat welded to the valve body per AWWA 4.5.5.3.3.

(7) Shaft Seals. Shaft Seals shall be designed for use with standard self-compensating chevron style split V-type packing. Valves utilizing stuffing boxes are not acceptable.

(8) Key and Shear Pin. Key and shear pin shall be able to withstand twice the amount of torque needed to fully open and close valve.

(9) Bearings. Valve bearings shall be of non cold-flowing phenolic, stainless steel backed PTFE, or Teflon-lined fiberglass backed for sizes up to 24 inches. All stainless steel parts shall be fabricated from ASTM A276 type 316 stainless steel. All bronze parts shall conform to ASTM B62, containing not more than 5 percent zinc or more than 2 percent aluminum, and with a tensile strength of 60,000 pounds per square inch, minimum yield strength of 40,000 pounds per square inch, and an elongation of at least 10 percent in 2 inches.

(10) Manual Actuators. Unless otherwise indicated, all manually actuated butterfly valves shall have an AWWA 2-inch square operating nut. Actuators shall be of the totally enclosed, traveling nut type, or locking worm and gear with adjustable stops, factory set, to limit disc travel. Actuators shall conform to the latest edition of ANSI/AWWA C504, Class 250B, sized for the most severe conditions listed in the stated standard, except for the following modifications:

(a) The required valve torque shall be based on the rated pressure at 16 feet per second with stop-limiting devices to withstand 450 foot-pounds of input torque without failure.

(b) All actuators shall be self-locking and shall hold the valve disc in the closed, open, and any intermediate position without creeping or fluttering.

(c) Actuator cases shall be designed for installation and operation in a buried or submerged location per IP68 rating (International Protection Rating or Ingress Protection Rating) with 90 percent grease fill.

(d) Actuators shall be sized to produce a torque of 1.5 times the required valve torque.

(e) Actuators for aboveground installation shall be provided with a position indicator and hand wheel. The hand wheel shall be a minimum of 12 inches

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in diameter and mounted on a 2-inch square operator nut. Hand wheels of larger diameter shall be noted on plans.

- (f) Actuator manufacturer and model number must be permanently identified on the actuator.

(11) Input Shaft Revolutions. Minimum and maximum number of revolutions of operator input shaft to open or close each valve shall be in accordance with Table 1411-1 below, unless otherwise approved by the Engineer.

**Table 1411-1
Input Shaft Revolutions**

Nominal Valve Size (inches)	Number of Revolutions	
	Minimum	Maximum
3 – 12	20	35
14 – 16	25	40
18 – 20	30	45
24	35	50
30	40	55
36	40	80
42	70	150
48	150	250
54	150	250
60	200	350
66	200	350
72	200	350

(12) Hardware. All fasteners and hardware shall be type 316 stainless steel.

(13) Protective Coating.

(a) Internal Coating. All interior ferrous surfaces exposed to fluid flow shall be factory coated with 2 or more coats of a thermosetting or fusion-bonded epoxy coating. The coating shall be safe for potable water used in accordance with ANSI/AWWA C550 and NSF61. The coating shall be holiday free and have a minimum total dry film thickness of 8 millimeters.

(b) External Coating. All exterior ferrous surfaces exposed to fluid flow shall be factory coated with 2 or more coats of a thermosetting or fusion-bonded epoxy coating. The coating shall be safe for potable water used in accordance

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with ANSI/AWWA C504 and NSF61. The coating shall have a minimum total dry film thickness of 12 millimeters.

(c) **Protective Coating Testing.** All internal ferrous surfaces shall be holiday free and shall be tested for coating thickness and porosity. Porosity shall be tested using the low-voltage spark method.

(d) **Surface Preparation.** Surface preparation—exterior and interior—shall be in accordance with SSPC-SP10 for near white blast cleaning prior to prime coat application.

(14) **Shop Testing.** The Contractor shall either provide the Engineer with notification to be present for shop testing of the butterfly valve or receive a waiver for Engineer witness of shop testing.

Failure by the Engineer to inspect or witness tests at the manufacturer's plant shall not be construed as waiving inspection upon delivery.

Contractor shall submit test reports to the Engineer showing each valve is in conformance.

(a) **Valve Body Hydrostatic Test.** Hydrostatic pressure test shall be twice the pressure rating of the valve to the inside of the valve per AWWA C504. During the hydrostatic test, there shall be no leakage through any portion of the valve, the metal, end flange joints, or the valve shaft seal, and there shall be no permanent deformation of any valve component.

(b) **Seat Leakage Test.** To be performed per Subsection 1411.0302(D).

(c) **Protective Coating Testing.** All specified holiday-free surfaces coated with epoxy shall be tested for coating thickness and porosity. Porosity shall be tested using the low-voltage spark method.

1411.0300 EXECUTION

1411.0301 **General.** Valves shall be furnished with flanged ends when specified on the plans, special specifications, or as directed by the Engineer. Prior to ordering butterfly valves, the Contractor shall verify the clearance of the valve disc and all connecting pipe.

1411.0302 Installation.

(A) **General.** Butterfly valves shall be installed in accordance with AWWA except as modified herein. All fittings, valves, flexible couplings, and repair clamps shall be encased with an 8-millimeter polyethylene wrap in accordance with AWWA C105, Method C.

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Valves designed for underground service shall be installed with the valve shaft in a horizontal position and the operating shaft in a vertical one, unless otherwise noted. Contractor shall install valve according to the direction of flow, or at the Inspector's discretion for maintenance accessibility and access.

(B) Workmanship. All the Contractor's or subcontractor's personnel shall be skilled and knowledgeable regarding installation procedures for the valves and appurtenances being installed.

(C) Actuator Inspection. Prior to installation, the Contractor shall perform an actuator inspection to confirm actuator manufacturer and model number.

(D) Seat Leakage Test. On the project site, at surface grade, and prior to installation, all butterfly valves 16 inches in diameter and larger shall be subject to an internal hydrostatic pressure test, equivalent to the pipe hydrostatic test pressure. If no pipe pressure is given, pressure shall be the valve class pressure rating. Test duration shall be 15 minutes. The test shall be performed on one side using either a mechanical cap or flange with a 2-inch outlet rated equivalent to, or higher than, the test pressure. The valve disc will act as the second side for testing, and the Engineer will determine the side to be tested. During the hydrostatic test, there shall be no leakage through the metal, end joints, shaft seals, or disc. If leakage occurs, adjustment is allowed per manufacturer's recommendation, and a test must be performed again, until there is no drop in pressure and no visible leakage.

(E) Turn Count. Prior to installation, the Contractor shall operate each valve 16 inches and larger from fully open to fully closed to allow the Engineer to record the total number of turns on the as-built drawings. Each valve shall be inspected in the closed position to assure proper closure and seating prior to installation. All adjustments and the seat leakage test must take place before the turn count is performed.

1411.0303 Warranty. The butterfly valve manufacturer shall warrant all valves and their operator against material and workmanship defects for the Contract Warranty Period (2 years).