

Section 02522

BUTTERFLY VALVES

PART 1 GENERAL

1.01 SUMMARY

This Section includes the furnishing and subsequent installation of butterfly valves as shown on Plans and specified herein.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for butterfly valves 20-inches in diameter and smaller is on a unit price basis for each. Unit price includes cost of box (when required).
2. Payment for butterfly valves 24-inches in diameter and greater is on a unit price basis for each. Unit price includes cost of box (when required for butterfly valves 24-inches in diameter), manhole (when required for butterfly valves 30-inches in diameter and greater), actuator, and appurtenances necessary for complete installation of the valve.
3. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A.** This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B.** ASME B16.1: Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
- C.** ASTM A48/A48M: Standard Specification for Gray Iron Castings
- D.** ASTM A126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- E.** ASTM A 536 – Standard Specification for Ductile Iron Castings
- F.** ASTM A 564 – Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes

- G. AWWA C504: Standard for Rubber-Seated Butterfly Valves, 3 In. (75 mm) through 72 In. (1,800 mm).
 - H. AWWA C 516 – Large-Diameter Rubber-Seated Butterfly Valves, Sizes 78 in. (2,000 mm) and Larger.
 - I. AWWA C542: Standards for Electric Motor Actuators for Valves and Slide Gates
 - J. AWWA C550: Standard for Protective Interior Coatings for Valves and Hydrants
 - K. NEMA 250: Enclosures for Electrical Equipment (1,000 Volts maximum)
 - L. NAPF 500-03-05: Abrasive Blast Cleaning for Cast Ductile Iron Fittings
 - M. NSF/ANSI 61: Drinking Water Systems Components – Health Effects
- 1.04 SUBMITTALS
- A. Submit the following to the Engineer, in accordance with Sections 01330 – “Submittal Procedures” and 01782 – “Operations and Maintenance Data:”
 - B. Submit manufacturer’s product data for proposed valves and actuators for approval.
 - C. For valves 8-inch and larger and all valves with geared, cylinder, or electric operators. Include size, class, operator, orientation, valve and operator dimensions, and materials by ASTM designations.
 - D. Submit manufacturer’s affidavit for proposed valves and actuators certifying compliance with specifications.
 - E. Submit manufacturer’s affidavit that butterfly valves were manufactured in the United States, and conform to applicable requirements of AWWA C504 or AWWA C516 and that they have been satisfactorily tested in the United States in accordance with AWWA C504 or AWWA C516 using test pressure of 150 psi in both directions. Submit Proof-of-Design and hydrostatic testing procedure in accordance with AWWA C504 or AWWA C516.
 - F. Submit manufacturer’s affidavit that coating for interior surfaces of valves conform to applicable requirements of AWWA C550. Submit results of holiday test and thickness measurements of coatings.
 - G. Furnish, at time of delivery, affidavit of compliance, as specified in Section 6.3 of AWWA C504 certifying compliance with applicable portion of AWWA C504 and modification or supplements herein. Furnish certified drawings and material test records by manufacturer covering items included in Section 4.3 of AWWA C504, for review. Furnish certified copies of test reports covering items in Sections 4.5.8.5.5, 4.5.8.5.8, and 5.2.1 through 5.2.4.3 of AWWA C504 for review.

- H. Submit data indicating maximum torque required to open valve, maximum torsional strength of shaft and torque output of actuator.
- I. Provide submittal information on CD-ROM in Adobe portable document format (*.PDF).
- J. Include number of turns to operate valves to fully open/closed.
- K. Submit Operation and Maintenance (O&M) Manuals to include special maintenance and adjustment instructions and expanded or detailed drawings with parts descriptions, numbers, and material specifications.

1.05 RELATED REQUIREMENTS

- A. Sizes, end connections, class, type operator, operating conditions, acceptable manufacturers, special features, and valve tag numbers where required are shown on Plans.
- B. Section 01270 – “Measurement and Payment”
- C. Section 01330 – “Submittal Procedures”
- D. Section 01782 – “Operations and Maintenance Data”
- E. Section 02082 – “Precast Concrete Manholes”
- F. Section 02085 – “Valve Boxes, Meter Boxes, and Meter Vaults”
- G. Section 02317 – “Excavation and Backfill for Utilities”
- H. Section 02514 – “Disinfection of Water Lines”
- I. Section 02515 – “Hydrostatic Testing of Pipelines”
- J. Section 09902–“Painting and Protective Coating”
- K. Other related Work as called for on Plans or specified elsewhere in this or other Specification Sections.

1.06 QUALITY ASSURANCE

- A. Valve, operator, and accessories to be furnished as a complete unit by valve manufacturer and conform fully to requirements of AWWA C504 with limitations included herein.
- B. Perform valve leakage tests in both directions at 150 psi in factory and field. Hydrostatic field tests of 150 psi shall be made against dished head plug or similar arrangement.

- C. For purposes of interpreting referenced AWWA tests, the following shall apply: Shutoff pressure is 150 psi; cycle consists of rotating disc from fully opened to fully closed position. When proof of design tests are performed on valve delivered to job site, replace disc, bushing, shaft and seals with new and unused items, and test and certify as described above.
- D. Hydrostatic Testing by Manufacturer:
1. Hydrostatic testing is to be performed prior to shipment of valves. Provide minimum 4 weeks' notice to the Project Manager for optional witness testing. When possible, maximize number of valves to be tested during a plant visit. Expenses for visits by the Project Manager for defective valves, improper scheduling, or valve failures are to be paid by Contractor. Witness of hydrostatic testing by the Project Manager will only be in regards to compliance with this specification and will not constitute approval by the Project Manager nor relieve Contractor of obligations to comply with contract documents.
 2. Document serial number on valve at time of testing and reflect in certified test records furnished to the Project Manager. Identification plate must be permanently affixed to valve and actuator prior to hydrostatic testing.
 3. Hydrostatic testing to conform to AWWA C504 except as modified below:
 - a. Install actuator prior to hydrostatic testing. Test actuator to verify actual number of turns match manufacturer's published number of turns. Verify valve stops are in correct positions.
 - b. Fully open and close valve prior to performing shell test and prior to each leakage test
 - c. Perform shell test first
 - d. When tested with water, adequately dry seat and disc
 - e. When tested with air, fill top of valve with water to aid in viewing possible leakage.
 - f. Pressure Gauges:
 - g. Calibrated within past 12 months; 0-500 psi range in increments of 5 psi, present calibration certificates prior to hydrostatic testing.
 - h. If seat adjustment is required during hydrostatic testing, perform valve leakage test again in both directions. Once seat adjustment is made, fully open and fully close valve three (3) times, and repeat leakage test.

4. Field Testing

- a. When valve arrives at the job site, Contractor is to operate valve fully open and closed twice in presence of the Project Manager. Document number of turns to open and close each time.
- b. Install operator nut plum
- c. After valve is installed, repeat the operation test and document number of turns in presence of the Project Manager
- d. Manufacturer's representative must be present to witness the operation test again at the substantial walk thru. Verify valve operate fully open/closed twice at the appropriate number of turns

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, unload, and store products on site in manner that prevents damage. Use special care to prevent damage from temperature and condensation.
- B. Protect electric operators in storage by weatherproofing for humidity control.
- C. Store butterfly valves out of direct sunlight.

1.09 - 1.13 (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

- A. DeZurik Co.
- B. Pratt
- C. Or Approved Equal

2.02 MATERIALS AND/OR EQUIPMENT

A. General

1. Butterfly Valves and Actuators:

Conform to AWWA C504, for 72-inch and smaller diameters. Conform to AWWA C516 for 78-inch and larger diameters. Compliance with NSF 61 is required for all parts in contact with finished water.

2. If type of valve is not indicated on Plans, use butterfly valves for line valve sizes 24-inch and larger. .
3. Butterfly valves shall be installed at locations as shown on Plans.
4. Direct-bury valves and valves in subsurface vaults shall open clockwise. Above-ground valves shall open counterclockwise.
5. Provide flanged joints when valve is connected to steel or PCCP. Provide ASTM A193 Grade B7 high strength steel stud bolts with ASTM A194 heavy hex nuts. Refer to flange bolting requirements in Section 02511 – “Water Lines”.
6. Butterfly Valves and Actuators (Additional Requirements for Large Diameter Water Lines):
 - a. Provide all valves for single project, from same manufacturer.
 - b. Valves larger than 72-inches in diameter design: Allowable stresses at rated pressure not to exceed one-third of yield strength or one-fifth of ultimate strength of material used.
 - c. Provide manual actuators for single project, from same manufacturer.
 - d. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension is to be fully enclosed and watertight.

B. Valves

Butterfly valves shall be constructed per the following requirements:

1. AWWA C504 or AWWA C516, Class 150B
2. Body Type:
 - a. Aboveground
 - 1) 20-inch and smaller
 - a) Wafer, unless otherwise designated
 - b) Flanged for valves with geared, cylinder, or electric motor operators
 - 2) 24-inch to 96-inch: Short-body flanged per ASME B16.1, Class 125.

- 3) For larger than 96-inch: AWWA C207, Class D with bolt holes ¼-inch larger than nominal bolt diameter for larger than 96-inch diameters
 - 4) Dead-end Service: Flanged
 - b. Buried: Push – on, mechanical joint or flanged, or as shown on Plans
3. Body:
 - a. 72-inches and smaller: Cast iron, ASTM A126, Class B or ASTM A48/A48M Class 40
 - b. 78-inches and larger diameters: ASTM A536 Grade 65-45-12
4. Flanges: ASME B16.1, Class 125 lb.
5. Discs:
 - a. Cast iron or ductile iron fastened to shaft with stainless steel pins or bolts.
 - b. For 24-inches in diameter and greater, valves require a minimum of two (2) taper pins used for attaching valve shaft to valve disc. Disc to shaft connection is to be with Type 316 stainless steel tapered pins secured with nuts or shrink fit stainless steel pins. Use of torque plug for purposes of attaching valve shaft to valve disc is not permitted.
 - c. Valves greater than 54-inches in diameter must utilize flow through disc
 - d. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position.
6. Bushings: Self - lubricating bronze, Grade A, D, or E; nylon; or reinforced Teflon
7. Seats:
 - a. Buna-N, neoprene or EPDM, and may be applied to disc or body
 - b. Seats shall be mechanically secured or may rely solely on adhesive properties of epoxy or similar bonding agent to attach seat to body
 - c. Seat may be bonded into valve body for valves 20-inch and smaller per the approval of the Project Manager and/or Engineer, or as shown on Plans

- d. Seats on disc shall be mechanically retained with corrosion resistant stainless steel (18-8) retaining ring held in place by stainless steel (18-8) cap screws that pass through rubber seat for added retention
 - e. When seat is on disc, seat shall be retained in position by shoulders located on both disc and stainless-steel retaining ring.
 - f. Mating surfaces for seats:

Type 304 or 316 stainless steel and secured to disc by mechanical means. Sprayed-on or plated mating surfaces will not be allowed.
 - g. For valves 24-inch and larger, use valves with 360 degree seating, whereby shaft does not pass through seat surface.
 - h. Seat must be replaceable in field for valves greater than 24-inches in diameter.
 - i. Valves with segmented retaining rings will not be accepted.
8. Retaining Hardware for Seats:
- a. Type 304 or 316 stainless steel
 - b. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitational effects.
9. Coat interior wetted ferrous surfaces of valve, including disc, with epoxy suitable for potable water conditions and NSF/ANSI 61 approved. Epoxy, surface preparation, and epoxy application: In accordance with AWWA C550 and coating manufacturer's recommendations. Provide three coats of two component, high-build epoxy with minimum dry film thickness of 12 mils. Provide approved epoxy coating. Coatings shall be holiday tested and measured for thickness.
10. Additional requirements of external coating system for valves installed aboveground and in exposed vaults shall be as follows:
- a. Surface preparation shall be in accordance with NAPF 500-03-05 Blast Clean method #1. Manufacturer's technical data sheet shall be consulted and should be followed if a recommendation is given for ductile iron surface preparation.
 - b. Exterior surfaces on non-buried valves shall be coated with a metal primer to a minimum dry film thickness of 3 mils or an epoxy conform to the requirements of AWWA C550 to a minimum dry film thickness of 8 mils. The primer shall be compatible with the anticipated field

- coating when the field coatings are identified in the purchase documents.
- c. Intermediate coat: Chemical resistant epoxy, or approved equal.
 - d. Finish coat: Polyurethane, or approved equal Barr blue color or other as approved by Project Manager.
 - e. Total allowable dry film thickness for system shall be as recommended by coating manufacturer.
 - f. Provide all coating materials from same manufacturer.
 - g. Total allowable dry film thickness for system as recommended by coating manufacturer.
11. Valve shaft and keys:
- a. Shaft Material:
 - 1) 72-inches and smaller: Type 304 stainless steel for treated (potable) water applications. Type 316 stainless steel for raw water applications.
 - 2) 78-inches and larger: ASTM A564, Type 630 (17-4 PH), Stainless Steel, Condition 1150.
 - b. For 24-inches in diameter and greater, valves require a minimum of two (2) taper pins used for attaching valve shaft to valve disc. See Paragraph 2.02.B.5.b for minimum requirements.
 - c. Shaft Bearings:

Stainless steel, bronze, nylon, or Teflon (supported by fiberglass mat or backing material with proven record of preventing Teflon flow under load) in accordance with AWWA C504 or C516. Sinter stainless steel bearing material.
 - d. Design valve shaft to withstand 3 times amount of torque necessary to open valve.
 - e. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow, except where shown otherwise on Plans.
12. Shaft Seals:

- a. Upper seal to consist of self - adjusting and wear compensating full or split “V” type packing or a stuffing box with pulldown packing and bronze gland
 - 1) Packing:
 - a) Material to be Buna - N or TFE impregnated Teflon
 - b) To be replaceable without removing actuator assembly
 - 2) Seals to be replaceable without removing valve shaft or operator
13. End Cover:

Cast iron, gasketed or with Buna-N O-ring
14. Cover Plate Cap Screws for Buried Service:

Stainless steel, AISI Type 316
15. For valves utilizing retaining rings, tighten bolts to a uniform torque. Measure torque prior to testing valve.

C. Valve Operators

1. Valve Operators shall conform to the requirements of AWWA C504 or AWWA C516 and be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators to be factory mounted and tested.
2. Provide actuators for valves with size based on line velocity of 12 feet per second and uni-directional service, and, unless otherwise shown on Plans, equip with geared manual actuators. For electric operators, see Paragraph 2.02.C.9. Provide fully enclosed and traveling-nut type, rack-and-pinion type, or worm-gear type for valves 20-inches and smaller. Provide worm-gear type for valves 24-inches and larger.
3. Provide actuator designed for installation with valve shaft horizontal unless otherwise indicated on Plans.
4. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements.
5. Provide oil-tight and watertight actuator housings for valves, specifically designed for buried service or submerged service when located in valve vaults, and factory packed with suitable grease.

6. Install valve position indicator on each actuator housing located above ground or in valve vaults. Valves shall be equipped with 2-inch actuator nut only.
7. Indicate direction of opening of valve on exposed visible part of assembly and cast direction of open on 2-inch nut on top of valve operator extension. Paint 2-inch actuator nut and extension shaft black when counter clockwise open and red when clockwise to open.
8. Design worm-gear or traveling-nut actuators to be self-locking and designed to transmit twice the required actuator torque without damage to faces of gear teeth or contact faces of screw or nut.
9. Electric Motor Operator
 - a. General
 - 1) Comply with AWWA C542
 - 2) Size to 1-1/2 times required operating torque starting with valve wide open at maximum port velocity and ending with a differential equal to the specified maximum shutoff pressure. Motor stall torque not to exceed torque capacity of valve.
 - 3) Controls integral with the actuator and fully equipped as specified in AWWA C542
 - 4) Stem protection for rising stem valves
 - 5) Complete with motor, gearing, handwheel, limit and torque switches, lubricants, space heaters, wiring, and terminals.
 - 6) Self-contained unit with cast iron weatherproof housing
 - 7) Integrally assembled on valve by valve Manufacturer
 - b. Open-Close Service
 - 1) Size motors for two complete "OPEN-CLOSE-OPEN" cycles that occur in immediate succession without overheating at full differential pressure.
 - 2) Integral "OPEN-STOP-CLOSE" pushbutton controls
 - 3) "OPEN" and "CLOSED" indicating lights
 - 4) Combination starter and circuit breaker type with reversing motor starter with built-in overload protection, three-pole heavy-duty F frame circuit breaker, and cover with quick release screws.

- 5) Opening and closing cycle time:
 - 6) 60 seconds minimum unless otherwise noted in Plans or the Attachment.
- c. Actuator Power Supply
- 1) 208-volt, three-phase unless otherwise indicated
 - 2) Control power transformer, 120-volt secondary
 - 3) Remotely located, externally operable power disconnect switch
- d. Enclosure
- 1) As defined in NEMA 250, Type 4
 - 2) Contain continually energized space heaters rated for 230-volts and connected to 120 volts
 - 3) Oversized to permit adequate and convenient clearance to all internally mounted devices
- e. Motors
- 1) Totally enclosed, high torque
 - 2) In accordance with NEMA standards
 - 3) Operate at any voltage within 10 percent above or below rated voltage
 - 4) Permanently lubricated motor bearing
- f. Gearing
- 1) Hardened steel spur or helical gears
 - 2) Alloy bronze or hardened steel worm gear
 - 3) Designed for 100 percent overload
 - 4) Hardened steel gears not less than 350 Brinell
 - 5) Sealed against entrance of foreign matter
 - 6) Self-locking so that actuation of a torque switch by a torque overload condition will not allow the operator to restart until the torque overload is eliminated

- 7) Planetary or cycloidal gearing; aluminum, mild steel, or nonmetallic gearing will not be acceptable
 - 8) Contain continually energized space heaters rated for 230 volts and connected to 120 volts
- g. Handwheel Mechanism
- 1) Prevent handwheel rotation during motor operation and prevent effect of motor rotation during handwheel operation.
 - 2) Geared so that force required to operate does not exceed 80 pounds.
- h. Torque Switches
- 1) Provide for torque and thrust loads in both opening and closing directions.
 - 2) Provide with micrometer adjustment and reference setting indicator.
 - 3) Adjustment with approximately 40 percent torque setting variation.
 - 4) Rated for not less than 6 amperes at 120 volts ac.
- i. Selector Switch, Pushbuttons, and Indicator Lights
- 1) Heavy duty, oil tight/watertight construction for outdoor use with NEMA A600 modular contact blocks.
 - 2) Two-stage, three-position maintenance contact selector switch.
 - 3) Momentary spring return, non-illuminated, recessed type, pushbuttons.
 - 4) "Push-To-Test" indicating lights, both lamps shall illuminate in intermediate valve position.
- j. Terminals
- 1) Provided in motor starter enclosure for all external control connections.
 - 2) Provide sufficient terminals so that no more than two conductors are connected to a single terminal.

- 3) Provide permanent designations which agree with wiring diagrams.
 - 4) Heavy duty, phenolic strap-screw type, 300-volt, 30-amp rating.
- k. Wiring
- 1) Flame retardant switchboard type
 - 2) Minimum No. 14 AWG, copper, stranded
- l. Limit Switch
- 1) Single-pole, double-throw (SPDT) type, field adjustable cam-operated, with contacts rated for 5 amps at 120 volts AC.
 - 2) Each valve actuator to have a minimum of two transfer contacts at end position, one for valve "FULL OPEN" and one for valve "FULL CLOSED."
 - 3) Housed in actuator control enclosure
- m. Control Features:
- n. Furnish electric actuators with features noted in the Electric Operator Schedule.
- o. Manufacturers and Products:
- 1) EIM Controls - Model 2000/MG
 - 2) AUMA - Models SA07.1 through SA48.1
 - 3) Limitorque - Models SMB or HBC with T-Series actuator
 - 4) Rotork Actuator
- D. Valve Boxes
- Provide Standard Type "A" valve boxes conforming to requirements of Section 02085 – "Valve Boxes, Meter Boxes, and Meter Vaults".
- E. Valve Service Manholes
- For large diameter water lines, provide manholes as shown, and to dimensions shown on Plans conforming to requirements of Section 02082 – "Precast Concrete Manholes."

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Earthwork

Conform to applicable provisions of Section 02317 – “Excavation and Backfill for Utilities.”

B. Setting Valves and Valve Boxes

1. Prior to Hydrostatic testing of water line and valve:
 - a. Test valve by opening and closing valve at a minimum of two times to verify valve seats properly.
 - b. Verify number of turns from fully open to fully closed position is same as identified in manufacturer’s submittal.
 - c. Adjust valve as required if number of turns do not match
 - d. Remove foreign matter from within valves
2. Install valves where shown on Plans or as located by the Project Manager. Use valve boxes for 16-inch and 24-inch valves. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Install for maximum operator access and convenience.
3. Avoid disturbing or overstressing valve body when installing valves. Perform field adjustment of valves under pressure to ensure shutoff occurs in number of rotations as described in valves operation and maintenance manual.
4. Attach two four (4) foot lengths of pipe to each side of valve prior to installation in line.
5. Submit certification that large diameter valve was installed, adjusted, and exercised in accordance with manufacturer’s instructions. Manufacturer’s certification shall state that all performance characteristics of large diameter valves, as installed, have been met. Adjustments made to valve, for any reason, must be made by manufacturer’s representative.

C. Above Ground Valves

Above ground installation of valves shall support the pipe on both lengths of pipe adjacent to the valve. Flanged joints shall be used for all above ground butterfly valve installations.

3.04 DEMONSTRATION / TESTING AND INSPECTION

A. Disinfection and Testing

1. Contractor to disinfect valves and appurtenances as required by Section 02514 – “Disinfection of Water Lines” and test as required by Section 02515 – “Hydrostatic Testing of Pipelines.” Do not use valves for throttling without prior approval of manufacturer. Operate satisfactorily through at least three cycles.
2. Furnish services of qualified factory trained technical representative to check installation and assist Contractor in making adjustments to mechanical stop - limiting devices.

END OF SECTION