SECTION 400520 MANUAL VALVES

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of manually operated valves including gate and butterfly valves.

B. Related Work Specified Elsewhere

1. Painting and Coating: 099000.

2. Cold-Applied Wax Tape Coating: 099752.

3. Polyethylene Sheet Encasement: 099754.

4. Fusion-Bonded Epoxy Linings and Coatings: 099761.

5. General Piping Requirements: 400500.

6. Pressure Testing of Piping: 400515.

7. Combination Air-Release Valves: 400560.

8. Globe Pattern Control Valves (AWWA C530): 400570.

C. Submittals

1. Submit shop drawings in accordance with the General Conditions and Section 013300.

2. Submit manufacturer's catalog data and detail construction sheets showing all valve parts. Describe each part by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type.

3. Show valve dimensions including laying lengths. Show port sizes. Show dimensions and orientation of valve actuators, as installed on the valves. Show location of internal stops for gear actuators. State differential pressure and fluid velocity used to size actuators. For worm-gear actuators, state the radius of the gear sector in contact with the worm and state the handwheel diameter.

4. Show valve linings and coatings. Submit manufacturer's catalog data and descriptive literature.

5. Submit six copies of a report verifying that the valve interior linings and exterior coatings have been tested for holidays and lining thickness. Describe test results and repair procedures for each valve. Do not ship valves to project site until the reports have been returned by the Owner's Representative and marked "Resubmittal not required."

6. For butterfly and eccentric plug valves, show the clear diameter or size of the port. Show the actual area of the port as a percentage of the area as calculated for the nominal valve size.

## PART 2 - MATERIALS

### A. General

1. Install valves complete with operating handwheels or levers, chainwheels, extension stems, floor stands, gear actuators, operating nuts, chains, and wrenches required for operation.

2. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached plate.

3. For buried locations, valves with mechanical joint ends may be substituted for the flanged ends specified provided the mechanical joint ends are compatible with the pipe ends.

### B. Valve Actuators

1. Provide lever or wrench actuators for exposed valves 6 inches and smaller. For larger valves, provide handwheels.

2. Provide 2-inch AWWA operating nuts for buried valves.

3. Provide enclosed gear actuators on butterfly valves 6 inches and larger, unless electric motorized valve actuators are shown in the drawings. Gear actuators for valves 6 inches and larger shall be of the worm and gear type.

4. Provide gear actuators on gate valves 14 inches and larger, unless electric motorized valve actuators are shown in the drawings. Gear actuators shall be of the bevel or spur gear type. Provide grease case. Gearing shall comply with AWWA C500.

5. Design gear actuators assuming that the differential pressure across the gate or disc is equal to the pressure rating of the valve and assuming a fluid velocity of 16 fps for valves in liquid service and a line fluid temperature range of 33°F to 125°F unless otherwise required in the detailed valve

specifications. Size actuators using a minimum safety factor of 1.5 for valves in open/close service and 2.0 in modulating service.

6. Gear actuators shall be enclosed, oil lubricated, with seals provided on shafts to prevent entry of dirt and water into the actuator. Gear actuators for valves located above ground or in vaults and structures shall have handwheels. The actuators for valves in exposed service shall contain a dial indicating the position of the valve disc or plug. Gear actuators for buried or submerged valves shall have 2-inch-square AWWA operating nuts.

7. For buried service, provide watertight shaft seals and watertight valve and actuator cover gaskets. Provide totally enclosed actuators designed for buried or submerged service.

8. Worm and gear actuators shall be of the totally enclosed design so proportioned as to permit operation of the valve under full differential pressure rating of the valve with a maximum pull of 50 pounds on the handwheel or crank. Provide stop limiting devices in the actuators in the open and closed positions. Actuators shall be of the self-locking type to prevent the disc or plug from creeping. Design actuator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel or chainwheel actuators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.

9. Self-locking worm gear shall be a one-piece design of gear bronze material (ASTM B427; or ASTM B84, Alloy C86200), accurately machine cut. Actuators for eccentric and lubricated plug valves may use ductile-iron gears provided the gearing is totally enclosed with spring-loaded rubber lip seals on the shafts. The worm shall be hardened alloy steel (ASTM A322, Grade G41500 or G41400; or ASTM A148, Grade 105-85), with thread ground and polished. Support worm-gear shaft at each end by ball or tapered roller bearings. The reduction gearing shall run in a proper lubricant. The handwheel diameter shall be no more than twice the radius of the gear sector in contact with the worm. Worm-gear actuators shall be Limitorque Model HBC, EIM Series W, or equal.

10. Design actuators on buried valves to produce the required torque on the operating nut with a maximum input of 150 foot-pounds.

11. Valve actuators, handwheels, or levers shall open by turning counterclockwise.

C. <u>Extension Stems for Buried and Submerged Valve Actuators</u>

1. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Where

the valve is submerged, provide operating extension stems to bring the operating nut to 6 inches above the water surface. Extension stems shall be steel, solid core, and shall be complete with 2-inch-square operating nut. The connections of the extension stems to the operating nuts and to the valves shall withstand without damage a torque of 300 foot-pounds.

2. Extension stem diameters shall be as tabulated below:

| **Valve Size (inches)** | **Minimum Extension Stem Diameter (inches)** |
|---|---|
| 2 | 3/4 |
| 3, 4 | 7/8 |
| 6 | 1 |
| 8 | 1 1/8 |
| 10, 12 | 1 1/4 |
| 14 | 1 3/8 |
| 16, 18 | 1 1/2 |
| 20, 24, 30, 36 | 1 3/4 |
| 42, 48, 54 | 2 |

D. Floor Stands, Extension Stems, and Extension Stem Support Brackets

1. When required by the installations, provide floor stands and extension stems for operation of valves. Floor stands shall be of the nonrising stem, indicating type, complete with steel extension stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Floor stands shall be cast-iron base type: Clow, Figure F-5515; Bingham and Taylor; Stockham; or equal. Handwheels shall turn counterclockwise to open the valves.

2. Provide Type 316 stainless steel anchor bolts.

3. Provide steel extension stems.

4. Provide adjustable stem guide brackets for extension stems. The bracket shall allow valve stems to be set over a range of 2 to 36 inches from walls. Provide bushings drilled to accept up to 2-inch-diameter stems. Base, arm, and clamp shall be Type 316 stainless steel. Bushing shall be bronze (ASTM B584, Alloy C86400 or C83600). Bolts, nuts, screws, and washers (including wall anchor bolts) shall be Type 316 stainless steel. Provide slots in the bracket to accept 3/4-inch bolts for mounting the bracket to the wall. Products: Trumbull Industries, Inc., Adjustable Stem Guide or equal.

E. Bolts and Nuts for Flanged Valves

Bolts and nuts for flanged valves shall be as described in Section 400500.

F. Gaskets for Flanges

Gaskets for flanged end valves shall be as described in Section 400500.

G. Painting and Coating

1. Coat metal valves located above ground or in vaults and structures in accordance with Section 099000, System No. 10. Apply the specified prime and intermediate and finish coat at the place of manufacture. Finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.

2. Coat buried metal valves at the place of manufacture per Section 099000, System No. 21.

3. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless steel pieces, per Section 099000, System No. 7. Apply lining at the place of manufacture.

4. Alternatively, line and coat valves with fusion-bonded epoxy per Section 099761.

5. Coat floor stands per Section 099000, System No. 10.

6. Test the valve interior linings and exterior coatings at the factory with a low-voltage (22.5 to 80 volts, with approximately 80,000-ohm resistance) holiday detector, using a sponge saturated with a 0.5% sodium chloride solution. The lining shall be holiday free.

7. Measure the thickness of the valve interior linings per Section 099000. Repair areas having insufficient film thickness per Section 099000.

H. Packing, O-Rings, and Gaskets

Unless otherwise stated in the detailed valve specifications, packing, O-rings, and gaskets shall be one of the following nonasbestos materials:

1. Teflon.

2. Kevlar aramid fiber.

3. Acrylic or aramid fiber bound by nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal.

4. Buna-N (nitrile).

I. Rubber Seats

Rubber seats shall be made of a rubber compound that is resistant to free chlorine and monochloramine concentrations up to 10 mg/L in the fluid conveyed.

J. Valves

1. Gate Valves:

a. Ductile-Iron Resilient Wedge Gate Valves 4 Through 36 Inches (AWWA C515):

Valves shall comply with AWWA C515 and the following. Valves shall be of the bolted-bonnet type with nonrising stems. Valve stems shall be Type 304 or 316 stainless steel or cast, forged, or rolled bronze. Provide operating nut for buried valves. Provide handwheel for exposed valves. Stem nuts shall be made of solid bronze. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum or more than 7% zinc. Bronze shall conform to ASTM B62 or ASTM B584 (Alloy C83600), except the stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 10% elongation in 2 inches (ASTM B584 or B763, Alloy C87600 or C99500). Body bolts shall be Type 316 stainless steel. End connections for shall as shown on drawings.

Provide reduction thrust bearings above the stem collar. Stuffing boxes shall be O-ring seal type with two rings located in stem above thrust collar. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.

Valves shall be lined and coated at the place of manufacture with either fusion-bonded epoxy or heat-cured liquid epoxy. Minimum epoxy thickness shall be 8 mils.

Manufacturers: Clow, AVK, American Flow Control, Waterous, Kennedy, or equal.

2. Butterfly Valves:

a. Thrust Bearings for Butterfly Valves:

Provide thrust bearings to hold the valve disc in the center of the valve seat. No bearings shall be mounted inside the valve body within the waterway. Do not use thrust bearings in which a metal bearing surface on the disc rubs in contact with an opposing metal surface on the inside of the body.

b. Bronze Components in Butterfly Valves:

Bronze components in contact with water shall comply with the following requirements:

| Constituent | Content |
|---|---|
| Zinc | 7% maximum |
| Aluminum | 2% maximum |
| Lead | 8% maximum |
| Copper + Nickel + Silicon | 83% minimum |

c. Port Sizes for Butterfly Valves:

For valves 24 inches and smaller, the actual port diameter shall be at least 93% of the nominal valve size. For valves larger than 24 inches, the port diameter shall not be more than 1.25 inches smaller than the nominal valve size. The dimension of the port diameter shall be the clear waterway diameter plus the thickness of the rubber seat.

d. Corrosion-Resistant Materials in Butterfly Valves:

Where AWWA C504 requires “corrosion resistant” material, such material shall be one of the following:

(1) Bronze as described above.

(2) Type 304 or 316 stainless steel.

(3) Monel (UNS N04400).

(4) Synthetic nonmetallic material.

e. Seating Surfaces in Butterfly Valves:

Seating surfaces shall be stainless steel or nickel-copper per AWWA C504 or nickel-chromium alloy containing a minimum of 72% nickel and a minimum of 14% chromium.

f. Factory Leakage Testing:

Perform factory leakage tests per AWWA C504 on both sides of the seat.

g. Flanged, Rubber-Seated Butterfly Valves 4 Through 72 Inches, Class 150B:

Butterfly valves shall be short body, flanged type for exposed valves and valves in vaults or structures, and either flanged or mechanical joint for buried valves. Valve shall conform to AWWA C504, Class

150B. Minimum working differential pressure across the valve disc shall be 150 psi. Flanged ends shall be Class 125, ASME B16.1. Valve shafts shall be stub shaft or one-piece units extending completely through the valve disc. Materials of construction shall be as follows:

| Component | Material | Specification |
|---|---|---|
| Body | Cast iron | AWWA C504 |
| Exposed body cap screws and bolts and nuts | Stainless steel | ASTM A276, Type 304 |
| Discs | Cast iron, or ductile iron | AWWA C504 |
| Shafts, disc fasteners, seat retention segments, and seat fastening devices | Stainless steel | ASTM A276, Type 304 |
| Seat material | Buna-N | -- |

Where the rubber seat is applied to the disc, it shall be bonded to a stainless steel seat retaining ring which is clamped to the disc by Type 304 or 316 stainless steel screw fasteners or secured to a stainless steel seat by a combination of cap screws, a serrated disc retaining ring, and molded shoulders in the seat mating with machined registers in the disc. Valves shall be Pratt, DeZurik Series BAW, or equal.

## PART 3 - EXECUTION

### A. Joints

1. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

2. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.

3. Install lug-type valves with separate hex head machine bolts at each bolt hole and each flange (two bolts per valve bolt hole).

B. Installing Exposed Valves

1. Unless otherwise indicated in the drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating stems vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the floor with their operating stems horizontal.

2. Install valves on vertical runs of pipe that are next to walls with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.

C. Installing Buried Valves

1. Connect the valve, coat the flanges, apply tape wrapping or polyethylene encasement, and place and compact the backfill to the height of the valve stem.

2. Place block pads under the extension pipe to maintain the valve box vertical during backfilling and repaving and to prevent the extension pipe from contacting the valve bonnet.

3. Mount the upper slip pipe of the extension in midposition and secure with backfill around the extension pipe. Pour the concrete ring allowing a depression so the valve box cap will be flush with the pavement surface.

4. In streets without concrete curbs and in open areas, install the valve box as for a paved area with concrete curb except include a marker post. Cut the marker post from 4-inch by 4-inch dense structural grade Douglas fir No. 2 surfaced on four sides to a length of 5 feet. Chamfer the top. Set the post in concrete, 2 feet into the ground, away from traffic, and to the side of the pipeline. Coat with a seal and finish coat of white alkyd exterior paint. On the side facing the valve, letter in black the word "VALVE" and the distance in feet from the marker post to the valve box cap.

D. Field Coating Buried Valves

1. Coat flanges of buried valves and the flanges of the adjacent piping, and the bolts and nuts of flanges and mechanical joints, per Section 099000, System No. 24.

2. Wrap buried metal valves with polyethylene sheet per Section 099754.

E. Installing Extension Stem Guide Brackets

Install at 6- to 8-foot centers. Provide at least two support brackets for stems longer than 10 feet, with one support near the bottom of the stem and one near the top.

F. Mounting Gear Actuators

The valve manufacturer shall select and mount the gear actuator and accessories on each valve and stroke the valve from fully open to fully closed prior to shipment.

G. Field Installation of Gear Actuator

Provide the actuator manufacturer's recommended lubricating oil in each actuator before commencing the field testing.

H. Valve Leakage Testing

Test valves for leakage at the same time that the connecting pipelines are tested. See Section 400515 for pressure testing requirements. Protect or isolate any parts of valves, actuators, or control and instrumentation systems whose pressure rating is less than the pressure test. Valves shall show zero leakage. Repair or replace any leaking valves and retest.

I. Valve Field Testing

1. Operate manual valves through three full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. Do not backfill buried valves until after verifying that valves operate from full open to full closed. If valves stick or bind, or do not operate from full open to full closed, repair or replace the valve and repeat the tests.

2. Gear actuators shall operate valves from full open to full close through three cycles without binding or sticking. The pull required to operate handwheel- or chainwheel-operated valves shall not exceed 80 pounds. The torque required to operate valves having 2-inch AWWA nuts shall not exceed 150 ft-lbs. If actuators stick or bind or if pulling forces and torques exceed the values stated previously, repair or replace the actuators and repeat the tests. Operators shall be fully lubricated in accordance with the manufacturer's recommendations prior to operating.

END OF SECTION