

ITEM 27

VALVES

1.0 DESCRIPTION. This Item includes the furnishing and installation of check, eccentric plug valves, air release and vacuum and other valves per project drawings; and all pertinent accessories, complete and in place, ready for service as shown in the contract drawings and described under this Item.

Each valve unit shall be furnished complete with valve; and, where appropriate, floor stand, gears, operator, hand wheel, crank, extension stem, guide bearing and support, brackets, gaskets, bolts, nuts, and all appurtenances necessary for the completion of this work.

2.0 SUBMITTALS. The following submittals shall be required;

A. Reference Standards. All valves under this item shall conform to the following referenced Standards (Latest revision):

1. American Water Works Association (AWWA)
 - a. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Pressure Pipe and Fittings.
 - b. AWWA C500 - Metal-Seated Gate Valves.
 - c. AWWA C509 - Resilient-Seated Gate Valves.
 - d. AWWA C515 - Reduced Wall, Resilient-Seated Gate Valves
 - e. AWWA C517 - Resilient-Seated Cast Iron Eccentric Plug Valves
 - f. AWWA C520 - Knife Gate Valves
 - g. AWWA C800 - Underground Service Lines and Fittings
2. American National Standards Institute (ANSI)
 - a. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
3. ASTM International
 - a. ASTM A48 - Standard Specification for Gray Iron Castings.
 - b. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
 - c. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - d. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
 - e. ASTM A536 - Standard Specification for Ductile Iron Castings.
4. The Society for Protective Coatings (SSPC)
 - a. SSPC SP-6 - Joint Surface Standard Commercial Blast Cleaning

B. Shop drawings.

1. Showing the principal dimensions, general construction of, and materials used in, all parts of the valves and operating mechanism.
2. Manufacturer's parts schedule in sufficient detail to serve as a guide in assembly and disassembly of the valve and in ordering repair parts.

3. The Contractor submittals shall include the statement that the submittals have been reviewed and the materials meet the contract specifications and/or standard details.
4. No fabrication shall take place until the final shop drawings are reviewed by the Engineer.

C. Calculations. This section is not applicable.

D. Certifications.

1. Manufacturer's certification of compliance with all applicable provisions of AWWA Standards and with the supplementary specifications included herein.
2. A certified report of shop operation and leakage tests.

E. Operation and Maintenance Manuals. With the delivery of equipment and valves specified herein, the manufacturer shall provide two hard copies and an electronic copy of an operation and maintenance manual including storage, installation, start-up, operating and maintaining instructions, and a complete parts and recommended spare parts list.

3.0 MATERIALS.

A. General. All valves and appurtenances shall be of standard make approved by the Engineer and shall have the name, monogram, or initials of the manufacturer cast thereon. They shall be built and equipped for the type of operation shown on the Drawings, specified herein, or as directed by the Engineer.

B. Bolts and Nuts.

1. Within a valve vault bolts/nuts shall be CORTEN, without the zinc anode cap or stainless steel, unless otherwise shown or specified.
2. All bolts and nuts utilized for underground valves and or piping shall be CORTEN with 6 oz. Sacrificial zinc anode nuts at each bolt affixed after the CORTEN nuts have been installed and tightened to the proper torque.

C. Protection. All valves shall be protected at all times from rust or damage, both before and after erection, until the completion of the Contract.

D. Operation. Unless otherwise specified, valves shall open by turning counter-clockwise, the direction being indicated by an arrow cast where easily visible to the operator.

1. Manual operation.
 - a. Valves shall be equipped with nut, hand wheel, crank, chain, gears, floor stand, and other appurtenances as required for manual operation as specified or scheduled.
 - b. Operation shall be designed so that the effort required to operate the handwheel, lever, or chain shall not exceed 25 lbs. applied at the extremity of the wheel or lever. The hand wheels valves 4 in. and larger shall not be less than 12 inches diameter.

- c. All valves 6 inches and larger, and all buried, submerged, or chain operated valves shall be gear operated. Gears for valve operation shall be sized for the working pressure and installed in such a manner that the stuffing box will be accessible for packing.
2. Hydraulic operation.
 - a. Valves for hydraulic operation shall be equipped with cylinders in accordance with AWWA C504, mounted on the valve bonnet. The size of the cylinder shall be determined by the valve manufacturer to be adequate for specified pressure and operating conditions in each instance where a hydraulically operated valve is specified in the specifications of this Item. Unless otherwise specified, cylinders above 12 inches, or where the cylinder pressure exceeds 100 lbs., shall be cast iron bronze-lined type.
 - b. Each operator shall be equipped with adjustable torque switches for overload protection in both opening and closing directions with torque switch bypass for unseating.
 - c. Each operator shall be equipped with four adjustable train gear limit switches. Each limit switch shall include a switch and counter gear. The setting accuracy shall be less than 1/10 turn of the operator output shaft. Two gear limit switches are for remote indication of end positions and shall be in accord with electrical requirements below
- E. Connections.** Valves shall be provided with hubs, spigots, flanges, mechanical groove-type, screw, or other connections compatible with pipe in which they are installed or scheduled.
- F. Seal System.** Unless otherwise specified, a stuffing box packed with O-ring seals shall be used to seal the stem of the valve. The seal system used shall be replaceable without removing bonnet or rotating element. Gaskets shall be of rubber composition or as specified in the drawings or specific valve specification.
- G. Check Valves.**
1. Check valves shall be all iron body, bronze mounted/seating or resilient-to-metal seating per AWWA C508 4.4.8, full opening swing type. Valve clapper shall swing completely clear of the waterway when valve is full open, permitting a "full flow" through the valve equal to the nominal pipe diameter. Check valves shall comply with AWWA Standard C-508, latest revision.
 2. Check valves shall be furnished with type of end connection as follows: 125# ANSI flanged ends.
 3. Check Valves shall be rated at 175 psi water working pressure, 350 psi hydrostatic test for structural soundness (3" through 12") and 150 psi water working pressure, 300 psi hydrostatic test (sizes 14" through 30"). Seat tightness at rated working pressure shall be in accordance with values shown in AWWA Standard C-500 for gate valves and fully conform to AWWA C508.
 4. All cast iron shall conform to ASTM-A-126 Class B. Ductile iron shall conform to ASTM-A-536. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed.

5. Hinged discs and seating materials shall conform to AWWA C508. When specified, neoprene bronze lacing shall be furnished in place of rubber facing. 14" and larger shall have rubber faced clapper. Hinge pins shall be 18-8 Stainless Steel rotating bronze plugs.
6. Bolts shall be stainless steel with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.
7. Check valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line. Glands shall be O-rings in 2" to 12" sizes and conventional in 14" to 30" sizes.
8. When specified, for application conditions of rapid flow reversal or vertical installation, check valves shall be equipped with adjustable outside lever & spring or lever & weight to accomplish faster closing and to minimize slamming effect.
9. Bosses shall be provided on check valves which may be tapped for draining or used for by-pass. When tapping is required, boss designation and size of tap should be stated. All valves 14" and larger shall have extended hinge pins for future addition of levers and springs if required.
10. Valves shall be suitable for installation in either horizontal or vertical position.
11. The inside and outside of all valves, together with the working parts except bronze and machined surfaces, shall be coated in accordance with AWWA standards.
12. Marking shall be in accordance with AWWA C-508 and shall include size, working pressure, and cast arrow to indicate direction of flow, name of manufacturer, and year of manufacture.
13. All check valves shall be AWWA C508 flanged cushion Style 206 as manufactured by M&H Valve Co., Anniston, Alabama, Dezurik, Inc., or approved equivalent.

H. Plug Valves - Eccentric plug valves shall meet or exceed the standards and specifications herein.

1. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanges shall be per the ANSI B16.1 125 lb. standard. End-to-end length of flanged valves shall be per AWWA C517, Table 1.
2. Bodies shall be of ASTM A126 Class B cast iron. Port shall be rectangular. Port area shall be 100% of standard pipe area regardless of published C_v factors.
3. Seats shall be 1/8" thick welded overlay of not less than 95% pure nickel. Seat area shall be at least 1/2" wide and raised, with the raised surface completely covered with weld to ensure that the plug face contacts only nickel.
4. Plugs shall be solid one-piece castings of ASTM A536 ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be Chloroprene (CR), or other resilient facing suitable for the application.
5. Bearings shall have sleeve type metal bearings and shall be of sintered, oil-impregnated permanently lubricated type 316 ASTM A743 Grade CF8M. Non-metallic bearings shall not be acceptable.

6. Grit Excluders at the upper and lower journals shall be provided to prevent entry of grit and foreign solids into the bearing areas.
7. Shaft seals shall be of the multiple V-ring type. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable. Shaft seals shall be accessible for inspection, external adjustment or replacement under pressure, without removing the actuator or bonnet from the valve.
8. Pressure ratings shall be 175 psi (1,207 kPa) on sizes 3"-12" (80-300mm) and 150 psi (1,034 kPa) for 14"-36" (350-900mm).
9. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc., as shown on the drawings. Valves 6" and larger shall be equipped with worm gear actuators. Non-buried actuators shall clearly indicate valve position.
10. Worm Gears shall be constructed in accordance to AWWA C517. Actuators shall be enclosed in a cast iron housing, with outboard seals to protect the bearings and other internal components. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Input shaft and fasteners shall be made of stainless steel.
11. Externally adjustable open and closed position stops shall be provided. The closed position stop shall be used to set closing torque and provide adjustment to compensate for change in pressure differential or flow direction.
12. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuators shall be 90% grease filled. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals.
13. Valves and actuators shall be model PEF as manufactured by DeZURIK Water Controls, , or approved equivalent.

I. Gate Valves - The operating pressure for all sizes shall be a minimum of 150 psi gage or of the adjacent piping whichever is greater. Buried valves with diameters of two inches (2") to twelve inches (12") shall be installed vertically on horizontal pipelines without gearing, bypasses, rollers, or tracks.

1. All gate valves in applications shall be provided with a fully enclosed, permanently lubricated actuator of the traveling nut or worm gear design. The actuator shall be connected to the valve shaft by means of a key and keyway connection. All actuators shall have adjustable, mechanical stop limits in accordance with AWWA C-504. All valve actuators shall be capable of withstanding 450 ft-lbs. of input torque against the open or closed stops without damage.
2. Gate valves shall be used on all potable and reclaimed water mains for all sizes. Gate valves sixteen inches (16") and larger shall be side actuated.
3. Valves three inches (3") through 36" shall be non-rising stem type and manufactured in accordance with AWWA C509 and as specified herein. Cut-in gate valves shall be resilient full seat and capable of handling working pressures up +250 psi. The cut-in valve shall be capable of installation and placing into operation in active potable and reclaimed water mains and active force mains without spillage or stopping the flow by isolating the inserting valve during installation.

4. Insert Valves, Ductile Iron 250 psig, shall be a Resilient Wedge Gate Valve including ductile iron body, bonnet and wedge shall provide strength and a pressure rating that meets or exceeds the requirements of AWWA C-515. The insert valves shall be designed for use in potable water, raw water, reclaimed water, sewage, irrigation and backflow control systems.
5. The design shall allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service as usual. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results.
6. The resilient wedge shall be totally independent of the carrier pipe. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal.
7. All interior and exterior ferrous surfaces of the valve, including the disc, shall be coated with fusion bonded epoxy, NSF 61 certified when in contact with potable water. The epoxy shall be fusion bonded and have a nominal thickness of eight (8) mils and be in accordance with AWWA C550.
8. All exposed bolts, nuts, fasteners, and washers shall be Type 316 stainless steel and all buried bolts, nuts, fasteners, and washers shall be 316 Stainless Steel.
 - a. Mechanical joints bolts shall not protrude more than one-half inch ($\frac{1}{2}$ ") through the nut after joints are assembled.
 - b. Accessories for the mechanical joint consisting of the gasket, gland and fasteners shall be furnished and packaged separately from the valves.
 - c. Each package shall be labeled in such a manner as to provide for proper identification and number of units per package or bundle.
 - d. All stainless-steel fastener threads shall be coated with an anti-seize compound. Valves shall be Mueller, Clow/Kennedy, American, or an approved equal.
9. Valve body shall be ASTM A536 ductile iron with fusion bonded epoxy coating. Valves shall be provided with a minimum of two O-ring stem seals.
10. Bonnet and gland bolts and nuts shall be either ASTM A 126, Class B. All ferrous surface inside and out shall have a fusion-bonded epoxy coating. The hot-dip process in accordance with ASTM A153 is not acceptable.
11. Allen-wrench type bonnet and gland fastening shall not be acceptable and will be rejected. Wedges shall be constructed of ASTM A536 ductile iron and totally encapsulated in vulcanized EPDM (ethylene propylene diene monomer).
12. The word "OPEN" and an arrow indicating direction to open shall be cast on each valve body or operator. Operating nut for all gate valves shall be two inches (2") square.
13. Extension stems shall be fabricated from Type 304 solid stainless steel. Stems shall not be smaller in diameter than the valve stem. Equip stem with wrench nut. Ensure all stem connections are pinned.
14. Thrust collars and stems shall be integrally cast (not pinned on) and shall feature brass valve stems. Buried valves shall have mechanical joint ends compliant with AWWA C111 unless otherwise noted on the Drawings.

J. Combination Air Release and Vacuum Valves. Combination air release and vacuum valves shall be ARI D-020 Combination Air Valve or approved equivalent. The valve

shall have a 2" flanged connection and shall be constructed at locations indicated on the contract drawings.

1. The valve provided under this item shall have stainless steel or reinforced nylon body, stainless steel inner metal parts (float, stem, washers, springs, bolts, nuts), and Buna-N type rubber seats.
2. The combination air valve shall have the following features:
3. Working pressure range: 3-250 psi.
4. The valve's design shall prevent any contact between sewage and the sealing mechanism by creating an air gap at the top of the valve. The design shall include a Rolling Seal Mechanism which is less sensitive to pressure differentials than a direct float seal.
5. The lower body of the valve shall be funnel-shaped to ensure that residual sewage matter will fall back into the system and be carried away by the main pipe.
6. A 1½" threaded outlet shall be provided to enable removal of excess fluids.
7. Each air release, vacuum or combination air release and vacuum valve shall be installed inside a chamber vault as indicated on the plans. All excavation, backfill, materials, equipment, labor, etc., necessary to provide the completed chamber in accordance with these specifications and with the contract plans shall be considered essential to the completion by the Contractor of all Item 27 work.

K. Knife Gate Valves.

1. Knife Gate Valves. shall meet the following:
2. Sized in accordance with all detail drawings.
3. One-piece Cast Corrosion Resistant 316 Stainless Steel.
4. Bi Directional, Full port design.
5. PTFE Square Braided Packing.
6. EPDM Resilient Seated.
7. ASME B16.5 150 lb.
8. 316 Precision Ground Beveled Gate.
9. Stainless Steel Stem and Superstructure.
10. Rated to 150 psig cold working pressure.
11. Valve shall be manufactured by DeZurik or engineering approved equal.

L. Extension Stems and Stem Guides. Each valve shall be provided with extension stem, when required for ease of operation. Unless otherwise specified, each extension stem shall be made of cold-rolled steel material and the same size as the valve stem of the valve it operates.

1. If the extension is more than 8 ft. long, intermediate stem guides shall be installed and supported from the wall by suitable brackets at a maximum spacing of 8 ft. Brackets and stem guides shall be made of cast iron and fully adjustable. The guide block shall be bronze bushed where it contacts the extension stem.
2. Stem guides shall be as manufactured by the Clow Valve Co., Rodney Hunt, or equal. Secure stem guides to walls with stainless steel 5/8 expansion bolts.
4. All valves which are to be operated by T-wrench shall have 2 in. square operating nut at the top of the extension stem.

5. Tee wrenches shall be supplied as required or specified, for each valve. Handle shall extend to 3 ft. - 0 in. above finish grade.
6. Stems for operation of plug valves shall not be less than 7/8 in. diameter solid steel pipe, ASTM A36 with intermediate steady guides. Weld socket for 2 in. valve nuts to bottom of extension stems and pin sockets to nut with cadmium plated 3/8 in. bolts. Provide a permanent lever or a 2 in. square operating nut at top of stems.

M. Shop Painting. All iron parts shall be painted before leaving the shop.

1. Unless otherwise specified, all internal ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of an asphalt varnish.
2. Unless otherwise specified, all exterior ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of a universally compatible primer or in the case of valves buried or submerged, with two coats of an asphalt varnish.

4.0 EXECUTION. The Contractor shall provide all labor, materials, equipment, and tools necessary to provide and install the valves as shown on all detailed drawings and as specified herein.

A. Installation.

1. All valves shall be carefully installed in their respective, designed and manufacturer recommended positions free from distortion and stress.
2. Connecting joints and fittings shall be in conformance to the applicable SCMSD specifications.
3. Stem guides shall be true and accurately aligned.

5.0 ELECTRICAL. Electric valve operator operations.

A. Valve Operators. Power actuated valves shall be furnished with electric motor actuators. Actuators shall be installed by the valve manufacturer and tested as a complete assembly.

1. The operator shall be the helical and worm gear type driven by an electric motor.
2. All power gearing shall be grease lubricated.
3. The actuator shall be in conformance with AWWA C504. The valve manufacturer shall furnish the valve of the maximum operating torque required to operate the valve as defined in the Appendix to AWWA C504.
4. Unless otherwise noted, the operator shall be geared to operate the valve from the fully open position to the fully closed position or vice versa in approximately 60 seconds. It shall be possible to change this cycle time by substituting suitable gear trains. The operator shall be equipped with a declutchable hand wheel for manual operation. The operator shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
5. Suitable reduction gearing shall be provided off the main shaft of the gearing, turning approximately 270 degrees while the valve performs full travel.

6. The reduction gearing shall be equipped with the following position indicating devices for each operator:
 - a. A mechanical position indicator dial;
 - b. The output signal shall be 4-20; a standard potentiometer, 1000 ohms with linearity of +/- 3% for indication in the remote controller;
7. Each motor shall be 480 volts, 60 Hz, three phase induction type as recommended by the operator manufacturer.
 - a. Three thermostats in series placed in the winding shall provide the motor with thermal protection. They shall interrupt the control circuit as soon as the temperature goes beyond the permissible winding temperature.
 - b. Each operator shall be equipped with a reversing magnetic starter. The starter shall be capable of receiving contact closures from remote sources to actuate the operator in either direction. Control voltage shall be 120 volts supplied by a transformer included in the control enclosure. Each operator shall include a local OPEN-STOP-CLOSE control switch and a pad lockable LOCAL-OFF-REMOTE selector switch.
 - c. All electrical components shall be integral with the operator, housed in a watertight NEMA 4X enclosure and complete wired.
 - d. A circuit-breaker disconnect shall be provided with the operator.
 - e. Easily identifiable terminal blocks shall be provided for all external power, control, and signal connections.
 - f. Operators, located outdoors, shall include thermostats & space heaters in motor & control compartments.
 - g. The operator shall be as manufactured by Limitorque, EIM (Emerson Process Management), or approved equal.

6.0 QUALITY ASSURANCE.

A. Testing.

1. All valves shall be tested in place by the Contractor as far as practicable under conditions for the pipelines, in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Engineer.
2. Source Quality Control. Each valve shall be submitted to operation and hydrostatic tests at the manufacturer's plant as specified in applicable AWWA Standards.
3. Every valve shall be given a hydrostatic and seat test, with test results being certified.

B. Observation.

1. SCMSD designated representative will visually observe the work performed. The representative will notify the Engineer of any discrepancies with the contract documents in the course of the contractor performing the work. The progress observations by the SCMSD do not waive any rights or remedies, nor divest the Contractor of any responsibility for contract compliance or liability for damage.

C. Warranty.

1. The contractor shall guarantee all materials and workmanship for one year per the contract requirements and also with the required two year project maintenance bond.

7.0 MEASUREMENT.

The unit of measurement shall be the actual number of each type and size of air release and vacuum valve. All other valves are paid under other Items.

8.0 PAYMENT.

All valves, with exception for air release and vacuum, that are required to be furnished and installed under this contract shall be included in the price bid for other items, and will not be measured or paid for under Item 27.

<u>Item</u>	<u>Unit</u>	<u>Description</u>
27	EA.	Air Release and Vacuum Valve

END OF SECTION