SECTION 40_05_60

VALVES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the supply, installation and testing of valves. Additional materials and performance requirements for valves are specified in Detailed Valve Specifications. Detailed Valve Specifications are provided in Division 40.

B. Determining Valve Type:
   1. Drawings specify valve types (gate, plug, butterfly, check, globe, etc.) used in each process pipe system. Process fluids that will be conveyed in pipelines are identified by the Process Service Identifiers shown on the Drawings.
   2. Piping System Schedules (Sections 40 05 02.23 and 40 05 02.43) specify piping system materials and components, including valve requirements, based on the Process Service Identifier specified on the Drawings for the pipeline or piping system. Piping System Schedules reference Detailed Valve Specifications that specify requirements for each valve type used in the pipeline or piping system.
   3. Provide valves conforming to the Detailed Valve Specifications listed in the Piping System Schedule for the valve/line size, process service, and valve type specified on the Drawings.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
   1. Section 01_33_00 – Submittal Procedures
   2. Section 01_75_17 – Commissioning
   3. Section 01_75_18 – Disinfection
   4. Section 01_77_00 – Closeout Procedures
   5. Section 01_78_24 – Operation and Maintenance Manuals

B. Valves shall be furnished compliant with Section 01_60_00 – Product Requirements.

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI 16.10	Face-to-Face and End-to-End Dimensions of Valves
ANSI B1.20.1	Pipe Threads, General Purpose
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.34	Valves—Flanged, Threaded, and Welding End
API 607	Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats
ASTM A48	Gray Iron Castings
ASTM A108	Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A216/A216M	Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
ASTM A276	Stainless and Heat Resisting Steel Bars and Shapes
ASTM A351	Castings, Austenitic, for Pressure-Containing Parts
ASTM A516	Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A536	Ductile Iron Castings
ASTM A571	Austenitic Ductile Iron Castings
ASTM A995/A995M-13	Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts
ASTM B124	Copper and Copper Alloy Forging Rod, Bar, and Shapes
ASTM B148	Aluminum-Bronze Sand Castings
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D5162	Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
AWWA C500	Metal-Seated Gate Valves for Water Supply Service
AWWA C504	Rubber-Seated Butterfly Valves
AWWA C507	Standard for Ball Valves
AWWA C509	Resilient Seated Gate Valves
AWWA C515	Reduced-Wall, Resilient Seated Gate Valves
AWWA C550	Protective Interior Coatings for Valves and Hydrants

Reference	Title
MSS SP-70	Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	Bronze Gate, Globe, Angle and Check Valves
MSS SP-81	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
MSS SP-110	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
NSF 61	Drinking Water System Components - Health Effects
UL 429	Electrically Operated Valves
UL 1002	Electrically Operated Valves for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G

1.04 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01_33_00
   2. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from specification requirements. Check-marks (✓) denote full compliance with a paragraph as a whole. Underline deviations and denote with a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal will be sufficient cause for rejection of the entire submittal with no further consideration.
   3. Catalog cuts and/or shop drawings for each type of valve indicating the valve type (Detailed Valve Specification Section Number), materials of construction, dimensions, operating torque, valve end connection configuration, pressure rating, and operating temperature range.
   4. An amended Detailed Valve Specification for all valve types provided for this contract. Indicate with check marks where the valve supplied meets the requirements specified and with written amendments where the product differs from the specification.
   5. Factory Acceptance Test results and/or Certified Statement of Proof-of-Design testing results when specified in Detailed Valve Specifications.
   6. Action Submittal Items listed on Detailed Valve Specifications

B. Informational Submittals:
   1. Affidavits and registration numbers as specified.
   2. Operating and Maintenance data for incorporation in operation and maintenance manual, as specified in Section 01_78_24. Include complete description of operation together with detailed drawings, a complete list of replacement and repair parts, and parts manufacturer's identifying numbers.
   3. Informational Submittal Items listed on Detailed Valve Specifications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01_60_00 – Product Requirements.

B. Deliver valves to site in accordance with Section 01_60_00 and using loading methods which do not damage any valve components or coatings.

C. Tag loose valves as specified in Section 01_60_00, stating size, type, coatings and mating parts shipped loose or separate.

D. Store on site until ready for incorporation in the work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

1.06 WARRANTY

A. A warranty for the equipment specified under this Section shall be provided in accordance with the Section 01_78_36 – Warranties and Bonds.

B. Where a warranty duration is specified by the Detailed Valve Specification, provide a special warranty valid for the specified duration.

PART 2 PRODUCTS

2.01 VALVE CONFIGURATION REQUIREMENTS

A. General
1. Provide valves of the same type, size range and service from a single manufacturer.
2. Provide new, unused valves for the work.
3. Provide valve materials free from defects or flaws, with true alignment and bores.
4. Provide valves that open by turning the valve shaft to rotate counter-clockwise unless otherwise specified in the Detailed Valve Specification Section.
5. Verify and coordinate flange type and mating surfaces (flat / raised) face prior to submittal of proposed valves. Coordinate with pipe submittals.
6. Furnish valves with working pressure rating equal to or greater than the process piping system within which it is to be installed.

B. Provide padlockable lockout feature on all valves.

C. Manual Operators
1. Provide valves with manual operators as specified in the Detailed Valve Specification. Unless otherwise noted, gear actuators shall be provided for all valves:
   a. Larger than 8-inch diameter.
   b. Operating shafts mounted horizontally.
   c. As specified and/o indicated on the Drawings/
   d. Where manual operating effort is greater than 65 ft-lbs.
2. For hand wheels, clearly show the direction of opening in raised lettering and symbols.
3. The maximum rim pull on a hand wheel is not to exceed 40 lb. when one side of the valve is at test pressure and the other side is at atmospheric pressure. Where a shaft mounted hand wheel would require greater force to operate, provide a torque reduction gearbox operator. Unless different operators are

scheduled or specified on the Drawings, conform to the following minimum requirements.

4. Provide an eight-point operating wrenches for each valve with square nut operators.
5. Quarter turn lever operators are to be perpendicular to the pipe runs when the valves are closed.
6. Provide butterfly valves with 10 position latching levers except where used to balance air flows. Where used to balance air flows provide infinite position, screw down levers.
7. The maximum pull at the end of the lever arm is not to exceed 65 lb. when one side of the valve is at test pressure and other side is at atmospheric pressure. Where greater force would be required to operate the valve with a lever, provide a torque reduction gearbox operator.
8. Provide grease lubricated, worm gear type operators for torque reduction gearbox operators. Gearbox operators equipped with a hand wheel and a visual indicator of the valve position. Provide gear operators with adjustable mechanical stop-limiting devices to prevent over travel of the disc/ball/plug in the open and closed positions and which are self-locking and designed to hold the valve in any intermediate position between full open and full closed. Where gearbox operators are intended for direct bury or submergence, seal units with long life lubricant.
9. For manual valves on lines 3 inches and greater, mounted over 7.0 feet above the operating floor, provide chain wheel gear operators. Design chain wheel operators so that a force of 30 lb. is sufficient to open the valve when one side of the valve is at test pressure and the other side is at atmospheric pressure. Provide chain pulley that positively engages the chain links. The chain will extend from the valve operator to an operating height of 4 feet above the floor or as directed by the Owner. The exact dimensions will be field determined. Provide approved chain hooks where required to prevent chain from hanging within traffic paths.
10. Where manual operators are installed over 7.0 feet above the operating floor and the Drawings specify a vertical valve shaft, revise the gear operator and/or chain wheel position to provide a horizontal chain wheel shaft. Retain the valve orientation specified on the Drawings.
11. Provide ductile iron chain wheels. Provide stainless steel operating chains.

D. Valve Stem Extensions and Wrench Nuts
   1. Provide valve stem extensions where additional clearance is required for pipe insulation or where valve operation without the extension is difficult; and in manholes.
   2. Where angle valve stem extensions are employed, they will be angle geared. Universal joint types are not permitted.
   3. Wrench nuts shall comply with AWWA C500. A minimum of two operating keys, but no less than one key per every ten valves, shall be provided for operation of wrench nut operated valves.

E. Operator Appurtenances
   1. Valve Boxes: Valve boxes shall be cast iron and shall have suitable base castings to fit properly over the bonnets of their respective valves and heavy top sections with stay-put covers. Covers shall be hot-dip galvanized. Valve boxes extending to finished surfaces shall be provided for buried valves.

2. Floor Boxes: Floor boxes shall be hot-dip galvanized. Where the operating nut is in the concrete slab, the floor box shall be bronze bushed. Where the operating nut is below slab, the opening in the bottom of the box shall be sufficient for passage of the operating key. Floor boxes shall be provided for wrench operation of valves located below concrete slabs. Each floor box and cover shall be of the depth required for installation in the slab.
3. Adjustable Shaft Valve Boxes: Adjustable shaft valve boxes shall be concrete or cast iron Brooks No. 3RT, Christie G5, Empire 7-1/2 valve extension box, or equal. Box covers on water lines shall be impressed with the letter "W." Gas line covers shall be impressed with the letter "G."

2.02 VALVE IDENTIFICATION TAGS

A. Provide valve identification tags for all valves with an identification tag number on the drawings (Mechanical and PI&D drawings).

B. Match tag numbers shown on the drawings.

C. Type 316 stainless steel tags, minimum 2.5-inches x 0.75 inches, with 0.1875 inch numbers and letters. Complete tag number shall be embossed on the tag. Tags shall be attached using stainless steel wire.

2.03 SPARE PARTS

A. Provide one set of special tools and manufacturer's recommended spare parts required for installation and regular servicing of all supplied valves, inclusive of actuators and other integral appurtenances, and furnish in accordance with requirements of Section 01_60_00.

PART 3 EXECUTION

3.01 PREPARATION

A. The valve and piping arrangement indicated on the Drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in the piping to allow for discrepancies between the valve dimensions shown and those supplied for the Work.

B. Prior to installation of valves, field measure and check all equipment locations, pipe alignments, and structural installations. Ensure that the valve location and orientation provides suitable access to manual operators and that sufficient space and accessibility is available for hydraulic, pneumatic, and electric power actuators.

C. Where conflicts are identified, inform the Owner.

3.02 INSTALLATION

A. Install valves in conjunction with the piping specified in the Piping System Schedules (Sections 40_05_02.23 through 40_05_02.43), and with control valves and their appurtenances specified in Section 40_05_63.23.

B. In horizontal pipe runs, other than in locations where space does not permit, install all valves (except for butterfly valves, eccentric plug valves, and trunnion ball valves) with a vertical operating shaft with the actuator at the top. In no case install a valve with the operator below the valve.

C. Unless otherwise specified on the drawings, install butterfly valves, eccentric plug valves, and trunnion ball valves with the shaft in a horizontal orientation. Install eccentric plug valves with the plug above the valve shaft centreline when the valve is full open.

D. When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.

E. Support valves in position using temporary supports until valves are fixed in place.

F. Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.

G. Where valves are installed in plastic pipelines (PVC, CPVC, HDPE, polypropylene etc.) greater than 4-inch diameter, support valves independent of the piping and brace valves against operating loads and torque to prevent transmission of stresses to the adjacent pipework.

H. Install gate valves in the closed position.

I. Install valves which are bubble tight in one direction to provide bubble tight seal of flow in normal direction of flow unless otherwise noted or directed by the Owner.

J. Unless otherwise specified, install single seated valves with the seat downstream. Install valves at tank connections with seat away from tank. Install valves on pump discharge and suction lines with seat end towards the pump.

K. Install all valves in accordance with the manufacturer's recommendations.

L. Protect valves installed below grade with a shrink sleeve or polyethylene sheath attached to the pipe with tape wrap.

M. Wrench nuts shall be provided on buried valves, on valves which are to be operated through floor boxes, and where specified. Extended wrench nuts shall be provided if necessary so that the nut will be within 6 inches of the valve box cover.

N. Furnish and install valves complete with insulating flange kits when connecting to dissimilar metals unless otherwise noted on the Drawings.

O. Refer to Section 01_75_17 – Commissioning for applicable requirements related to testing and system start-up for individual valves and overall systems (process and controls) in which they are installed.

P. Refer to Section 01_75_18 – Disinfection for applicable requirements and procedures related to valve installation and piping system disinfection. Verify with

valve supplier if specific procedures are recommended for valve disinfection and exposure to Contactor proposed disinfecting solution and concentration.

3.03 FIELD QUALITY CONTROL

A. Field or Site Tests and Inspections per Detailed Valve Specifications.

B. Pressure test all valves in conjunction with the pipes in which the valves are installed at test pressures specified in the applicable Piping System Schedule.

END OF SECTION