SECTION 40 27 02
PROCESS VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Gas Association (AGA): 3, Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids.
2. American National Standards Institute (ANSI): Z21.15, Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
3. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   b. B16.44, Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi.
4. American Society of Sanitary Engineers (ASSE): 1011, Performance Requirements for Hose Connection Vacuum Breakers.
5. American Water Works Association (AWWA):
   a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   b. C500, Metal-Seated Gate Valves for Water Supply Service.
   c. C504, Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
   d. C508, Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
   e. C509, Resilient-Seated Gate Valves for Water Supply Service.
   f. C510, Double Check Valve Backflow Prevention Assembly.
   g. C511, Reduced-Pressure Principle Backflow Prevention Assembly.
   h. C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
   i. C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
   j. C517, Resilient-Seated Cast-Iron Eccentric Plug Valve.
   k. C541, Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
   l. C542, Electric Motor Actuators for Valves and Slide Gates.
   m. C550, Protective Interior Coatings for Valves and Hydrants.

n. C606, Grooved and Shouldered Joints.
o. C800, Underground Service Line Valves and Fittings.

6. ASTM International (ASTM):
   a. A276, Standard Specification for Stainless Steel Bars and Shapes.
   b. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
   c. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   d. A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
   e. B61, Standard Specification for Steam or Valve Bronze Castings.
   f. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
   g. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
   h. B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
   i. B139/B139, Standard Specification for Phosphor Bronze Rod, Bar and Shapes.
   j. B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
   k. B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar.
   l. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
   m. D429, Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
   n. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
7. Canadian Standards Association, Inc. (CSA): 9.1, Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
8. Chlorine Institute (CI): Pamphlet 6, Piping Systems for Dry Chlorine.
9. FM Global (FM).
10. Food and Drug Administration (FDA).
11. International Association of Plumbing and Mechanical Officials (IAPMO).
12. Manufacturers Standardization Society (MSS):
   a. SP-80, Bronze Gate, Globe, Angle, and Check Valves.
   b. SP-81, Stainless Steel, Bonnetless, Flanged Knife Gate Valves.
   c. SP-85, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.
   d. SP-88, Diaphragm Valves.

e. SP-108, Resilient-Seated Cast-Iron Eccentric Plug Valves.
f. SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

13. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
14. NSF International (NSF):
    a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
    b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
15. UL.
16. USC Foundation for Cross-Connection Control and Hydraulic Research.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
    a. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.
    b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
    c. Certification for compliance to NSF/ANSI 61 for valves used for drinking water service.
    d. Power and control wiring diagrams, including terminals and numbers.
    e. For each power actuator provided, manufacturer's standard data sheet, with application specific features and options clearly identified.
    f. Sizing calculations for open-close/throttle and modulating valves.
    g. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services, for the following:
    a. Electric actuators; full compliance with AWWA C542.
    b. Butterfly valves; full compliance with AWWA C504.
3. Tests and inspection data.

4. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
5. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves to include operator, actuator, handwheel, chain wheel, extension stem, floor stand, operating nut, chain, wrench, and accessories to allow a complete operation from the intended operating level.

B. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.

C. Valve same size as adjoining pipe, unless otherwise called out on Drawings or in Supplements.

D. Valve ends to suit adjacent piping.

E. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure, unless otherwise allowed for in this section or in stated valve standard.

F. Size operators and actuators to operate valve for full range of pressures and velocities.

G. Valve to open by turning counterclockwise, unless otherwise specified.

H. Factory mount operator, actuator, and accessories.

I. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2. For this Project, valves specified in this section used for the following fluid services shall meet the requirements of this paragraph:
   a. BWS, CW, FE, FI, FW, HW, OS, OZW, PW, RCY, RW, and TW.

J. Cleaning for Instrument Air, Oxygen, Ozone or Chlorine Service:

1. Valves used for instrument air, oxygen or ozone services (AI, LOX, GOX, GOD, O3, OG) shall be cleaned by an experienced subcontractor for commercial grade oxygen service in accordance with the latest addition of the Compressed Gas Association (CGA) Pamphlet 4.1. Cleaning of AI piping applies only to AI piping at the Ozone Facility.
2. Valves used for dry chlorine services (CL2L. CL2, CL2V and NCL2) shall be cleaned by an experienced subcontractor for chlorine service in accordance with the latest addition of the Chlorine Institute Pamphlet 6, 16th Edition, Piping Systems for Dry Chlorine.
3. Valves cleaned prior to shipment or prior to use shall be sealed and packaged for protection from contamination and tagged as cleaned for oxygen/ozone/chlorine service as applicable. Precleaned items shall not require further cleaning if their handling and installation meets the requirements of the CGA and the Chlorine Institute.
4. For any lubricant used in assembling valves for the above listed services, such lubricant shall be completely oxidation resistant, Dupont Krytox, "or-equal."

2.02 SCHEDULE

A. Additional requirements relative to this section are shown on Electric Actuated Valve Schedule, Electro-Hydraulic Actuated Valve Schedule, Pneumatic Actuated Valve Schedule, Solenoid Valve schedule, Self-Regulated Automatic Valve Schedule, Air Release/Combination Valve Schedule and Manual Valve Schedule, located on Drawings.

2.03 TAGGING

A. Valves shall be tagged. All actuated, solenoid, self-regulated, or manual valves shall be tagged with 316 SST tags showing the full valve tag number listed in the Valve schedules as shown on Drawings. Full valve tag number includes the "WA3260" prefix. Buried valves to have tag numbers attached to the valve cover boxes.

2.04 MATERIALS

A. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

1. Approved alloys are of the following ASTM designations:
   a. B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139/B139M (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
2. Stainless steel Alloy 18-8 may be substituted for bronze.

B. Valve materials in contact with or intended for drinking water service to meet the following requirements:

1. Materials to comply with requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements.
2. Coatings materials to be formulated from materials deemed acceptable to NSF/ANSI 61.
3. Supply certification product is certified as suitable for contact with drinking water by an accredited certification organization in accordance with NSF/ANSI 61. Provide certification for each valve type used for drinking water service.

2.05 FACTORY FINISHING

A. General:

1. Interior coatings for valves and hydrants shall be in accordance with AWWA C550, unless otherwise specified.
2. Exterior coating for valves and hydrants shall be in accordance with Section 09 90 00, Painting and Coating.
3. Material in contact with potable water shall conform to NSF/ANSI 61.
4. Exposed safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be "safety yellow."

B. Where epoxy lining and coating are specified, factory finishing shall be as follows:

1. In accordance with AWWA C550.
2. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as "fusion" or "fusion bonded" epoxy.
3. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

2.06 VALVES

A. Gate Valves:

1. General:
   a. AWWA gate valves to be in full compliance with stated AWWA standard and the following requirements:
      1) Provide 2-inch operating nut and handwheel for AWWA gate valves 12 inches and smaller.
      2) Provide totally enclosed spur or bevel gear operator with indicator for AWWA gate valves 14 inches and larger.
      3) Provide Affidavit of Compliance per the applicable AWWA standard for AWWA gate valves.
      4) Mark AWWA gate valves with manufacturer's name or mark, year of valve casting, valve size, and working water pressure.
      5) Repaired AWWA gate valves shall not be submitted or supplied.
      6) Supply AWWA gate valves with stainless steel bolting.
      7) AWWA C509 and AWWA C515 valves may be substituted for each other.
2. Type V132 Resilient Seated Gate Valve 3 Inches to 12 Inches, for Buried Service:
   a. Iron body, resilient seat, bronze stem and stem nut, mechanical joint ends, nonrising stem, in accordance with AWWA C509, 2-inch operating nut, minimum design working water pressure 200 psig, full port, fusion epoxy coated inside and outside per AWWA C550, NSF/ANSI 61 certified.
   b. Manufacturers and Products:
      1) M&H Valve; AWWA C509.
      2) U.S. Pipe; A-USPO.

B. Globe Valves:

1. Type V200 Globe Valve 3 Inches and Smaller:
   a. All-bronze, union bonnet, packed gland, inside screw, rising stem, TFE disc, Class 150 rated 150 psi SWP/300 psi CWP, complies with MSS SP-80 Type 2.
   b. Manufacturers and Products:
      1) Stockham; Figure B-22T, NPT threaded end.
      2) Crane Co.; Figure 7TF, NPT threaded end.
      3) Milwaukee; Model 1590T, soldered ends.
      4) NIBCO; Figure S-235-Y, soldered ends.

2. Type V234 Angle Type Hose Valve 1/2-Inch to 3/4-Inch:
   a. Bronze or manufacturer's standard brass, angle sillcock type body, threaded or solder inlet as applicable, pressure rating 125 psi cold water.
   b. Manufacturer and Product:
      1) Nibco; QTX Series.
      2) "Or-equal."
3. Type V235 Angle Type Hose Valve 3/4-Inch:
   a. 3/4-inch NPT female inlet, 3/4-inch male hose thread outlet, heavy rough brass body rated 125 psi, lockshield bonnet, removable handle, atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code.
   b. Manufacturer and Products:
      1) Acorn; 8126, surface pipe mount valve, bent nose without flange.
      2) Acorn; 8121, surface mount through wall valve, bent nose with flange.
      3) Acorn; 8131, pipe and pedestal mounted valve located above 6 inches, straightnose.
      4) Acorn; 8136, pedestal mounted valve located lower than 6 inches, inverted nose.
4. Type V236 Globe Style Hose Valve 1-Inch to 3-Inch:
   a. All-bronze, NPT threaded ends, inside screw-type rising stem, TFE disc, cast brass male NPT by male NHT adapter with hexagonal center wrench nut, brass cap with chain, complies with MSS SP-80, rated 300 WOG.
   b. Manufacturers and Products:
      1) Stockham; Figure B-22T.
      2) Crane Co.; Cat. No. 7TF.
      3) Nibco; Figure T-235-Y.

C. Ball Valves:

1. Type V300 Ball Valve 3 Inches and Smaller for General Water and Air Service:
   a. Two-piece, standard port, NPT threaded ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, zinc-coated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Threaded:
         a) Conbraco Apollo; 70-100.
         b) Nibco; T-580-70.

2) Soldered:
   a) Conbraco Apollo; 70-200.
   b) Nibco; S-580-70.

2. Type V301 Ball Valve 2 Inches and Smaller for General Water and Air Service:
   a. Two-piece, full port, NPT threaded ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, zinc-coated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Threaded:
         a) Conbraco Apollo; 77-100.
         b) Nibco; T-585-70.
      2) Soldered:
         a) Conbraco Apollo; 77-200.
         b) Nibco; S-585-70.
3. Type V304 Ball Valve 2 Inches and Smaller for General Water and Air Service:
   a. Three-piece, full port, NPT threaded ends, bronze body and end pieces, hard chrome plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, zinc-plated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150 psi SWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Threaded Ends:
         a) Conbraco Apollo; 82-100.
         b) Nibco; T-595-Y.
         c) Stockham; T-395 Series.
      2) Solder Ends:
         a) Conbraco Apollo; 82-200.
         b) Nibco; S-595-Y.
         c) Stockham; S-395 Series.
4. Type V306 Stainless Steel Ball Valve 2 Inches and Smaller:
   a. Two-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end piece, NPT threaded ends, ASTM A276 Type 316 stainless steel ball, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout proof stainless steel stem, stainless steel lever operator with vinyl grip or tee handle for buried service, rated 1,000 psig CWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Conbraco Apollo; 76F-100 Series.
      2) Nibco; T-585-S6-R-66-LL.

5. Type V307 Stainless Steel Ball Valve 2 Inches and Smaller:
   a. Three-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end pieces, Type 316 stainless steel ball, NPT threaded ends, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout-proof stainless steel stem, stainless steel lever operator with vinyl grip, rated 800 psig to 1,000 psig CWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Conbraco Apollo; 86R-100/86-500 Series.
      2) Nibco; T-595-S6-R-66-LL.
6. Type V310 Ball Valve for Chlorine Liquid and Gas:
   a. Three-piece, full port, ANSI Class 800-pound WOG, ASTM A216 WCB carbon steel body, Hastelloy C ball and stem, Xtreme fire tight seats, TFM and graphite seals, double stem seal, lever operator, screwed or socket welded ends, nonlubricated, and comply with the requirements of Chlorine Institute Pamphlet 6.
   b. Prepare, clean, package and tag valve in accordance with Chlorine Institute Pamphlet 6.
   c. Manufacturers and Products:
      1) Jamesbury; 4000 Eliminator Series.
      2) Threaded Ends: 4BBC-2273-XTB1.
      3) Socket Welded Ends: 4DBC-2273-XTB1.
7. Type V311 Ball Valve for Oxygen and Ozone Service 2 Inches and Smaller:
   a. Three-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end pieces, Type 316 stainless steel ball, NPT threaded ends, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout-proof stainless steel stem, stem grounding washer, stainless steel lever operator with vinyl grip, rated 800 psig to 1,000 psig CWP, complies with MSS SP-110.
   b. Cleaned and bagged for commercial grade oxygen service.
   c. Manufacturers and Products:
      1) McCanna Marpac; E525 Series.
      2) Apollo; Series 86B-100.
8. Type V312 Stainless Steel Ball Valve 2-1/2 Inches to 8 Inches:
   a. Two-piece, full port, Type 316 stainless steel body, ball, and end pieces, 150-pound flanged ends, RTFE seats, PTFE or graphite seals and packing, adjustable packing gland, blowout-proof Type 316 stainless steel stem, stainless steel lever operator, rated 200 psig CWP.

b. Manufacturers and Products:
   1) Nibco; F-515 Series.
   2) Apollo; Series 87A-200.

9. Type V315 Flanged Ductile Iron Ball Valve 2-1/2 Inches to 6 Inches:
   a. Two-piece, full port, ductile iron body, stainless steel ball and stem, 150-pound flanged ends, RTFE seats, PTFE seals and packing, adjustable packing gland, lever operator, rated 150 psig CWP.
   b. Manufacturers and Products:
      1) American Valve; Model 4000D.
      2) Apollo; Series 6Q.
10. Type V317 Alloy 20 Ball Valve 2 Inches and Smaller:
   a. Three-piece, standard port, Alloy 20 body, ball, and end pieces, NPT threaded ends, RTFE seats, seals, and packing, adjustable packing gland, blowout-proof Alloy 20 stem, stainless steel lever operator with vinyl grip, rated 600 psig to 800 psig CWP.
   b. Manufacturers and Products:
      1) Sharpe; Series 84.
      2) Apollo; Series 86C-100.
11. Type V318 Alloy 20 Ball Valve 2-1/2 Inches to 4 Inches:
   a. Two-piece, full port, Alloy 20 body, ball, and end pieces, 150-pound flanged ends, RTFE seats, PTFE seals and packing, adjustable packing gland, blowout-proof Alloy 20 stem, stainless steel lever operator, rated 200 psig CWP.
   b. Manufacturers and Products:
      1) Sharpe; Series 70.
      2) Apollo; Series 87A-500.
12. Type V330 PVC Ball Valve 4 Inches and Smaller:
   a. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, PTFE, Viton or Viton-backed PTFE elastomer seat, Viton or Teflon O-ring stem and body seals, to block flow in both directions.
   b. Manufacturers and Products:
      1) Nibco; Chemtrol Tru-Bloc.
      2) ASAHI/America; Type 21.
      3) Spears; True Union.
13. Type V333 PVC Ball Valve 4 Inches and Smaller:
   a. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, PTFE, EPDM or EPDM-backed PTFE elastomer seat, EPDM or Teflon O-ring stem and body seals, to block flow in both directions.

b. Manufacturers and Products:
   1) Nibco; Chemtrol Tru-Bloc.
   2) ASAHI/America; Type 21.
   3) Spears; True Union.

14. Type V335 CPVC Ball Valve 6 Inches and Smaller:
   a. Rated 150 psi at 100 degrees F, 80 psi at 140 degrees, with ASTM D1784, Type IV, Grade 1 chlorinated polyvinyl chloride (CPVC) body, ball, and stem, end entry, double union design, with solvent-weld socket, replaceable Teflon or Viton seat, Viton or Viton-backed PTFE O-ring stem and body seals, to block flow in both directions.
   b. Manufacturers and Products:
      1) Nibco; Chemtrol Tru-Bloc.
      2) ASAHI/America; Type 21.
      3) Spears; True Union (only Spears true 6-inch valve for 6-inch size).
15. Type V337 CPVC Vented Ball Valve 4 Inches and Smaller:
   a. Rated 150 psi at 100 degrees F, 80 psi at 140 degrees, with ASTM D1784, Type IV, Grade 1 chlorinated polyvinyl chloride (CPVC) body, ball, and stem, end entry, double union design, with solvent-weld socket, replaceable PTFE, Viton or Viton-backed PTFE seat, Viton or Teflon O-ring stem and body seals, to block flow in both directions, with vented ball to relieve pressure inside the ball of a closed valve.
   b. Manufacturers and Products:
      1) Nibco; Chemtrol Tru-Bloc.
      2) ASAHI/America; Type 21.
      3) Spears; True Union.
16. Type V338 CPVC Ball Valve 4 Inches and Smaller:
   a. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 chlorinated polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, EPDM or EPDM-backed PTFE elastomer seat, EPDM or Teflon O-ring stem and body seals, to block flow in both directions.
   b. Manufacturers and Products:
      1) Nibco; Chemtrol Tru-Bloc.
      2) ASAHI/America; Type 21.
      3) Spears; True Union.

D. Plug Valves:

1. Type V405 Eccentric Plug Valve 3 Inches to 12 Inches:
   a. Nonlubricated type rated 175 psig CWP, drip-tight shutoff with pressure from either direction, cast iron body, exposed service

flanged ends per ASME B16.1 or grooved ends in accordance with AWWA C606 for rigid joints, buried service mechanical joint ends, unless otherwise shown.

b. Plug cast iron with round port of no less than 100 percent of connecting pipe area and coated with Buna-N, seats welded nickel or Type 316 stainless steel machined to a smooth finish, stem bearings lubricated stainless steel or bronze, stem seal multiple V-rings, or U-cups with O-rings of nitrile rubber, grit seals on both upper and lower bearings.

c. For buried service, provide external epoxy coating.

d. Operators:
   1) 3-Inch to 4-Inch Valves: Wrench lever manual.
   2) 6-Inch to 12-Inch Valves: Totally enclosed, geared, manual operator with handwheel, 2-inch nut or chain wheel. Size operator for 1.5 times maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut. See Article Operators and Actuators, for acceptable manufacturers of direct buried operators.

e. Manufacturers and Products:
   1) Pratt; Ballcentric.
   2) Milliken; Millcentric Series 600.
   3) Val Matic Cam Centric.

2. Type V406 Eccentric Plug Valve 14-Inch to 20-Inch:
   a. Nonlubricated type rated 150 psig CWP, drip-tight shutoff with pressure from either direction, cast iron body, exposed service flanged ends per ASME B16.1 or grooved ends in accordance with AWWA C606 for rigid joints, buried service mechanical joints ends, unless otherwise shown, plug cast iron with round or rectangular port of no less than 100 percent of connecting pipe area and coated with Buna-N, seats welded nickel, stem bearings lubricated stainless steel or bronze, stem seal multiple V-rings or U-cups with O-rings of nitrile rubber, grit seals on both upper and lower bearings.
   b. Totally enclosed, geared, manual operator with handwheel, 2-inch nut or chain wheel. Size operator for 1.5 times maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut. See Article Operators and Actuators, for acceptable manufacturers of direct buried operators.
   c. For buried service, provide external epoxy coating.

d. Manufacturers and Products:
   1) Pratt; Ballcentric.
   2) DeZurik; Style PEF.
   3) Milliken; Millcentric Series 600.
   4) Val Matic Cam Centric.

3. Type V464 Curb Stop 1/2-Inch to 2-Inch:
   a. AWWA C800 ball type curb stop, bronze or brass no or low lead construction, EPDM or nitrile seals and O-rings, tee handle for use with T-handle operating wrench in buried installation, with female NPT inlet or outlet connections or other connection as required to suit the installation, rated 150 psi minimum.
   b. Manufacturers and Product:
      1) Ford Meter Box Co, Ball Valve Curb Stop B11 series.
      2) Mueller 20283N.
      3) "Or-equal."

E. Butterfly Valves:

1. General:
   a. In full compliance with AWWA C504, C516 or C519 as applicable to valve size and type, and following requirements:
      1) Suitable for throttling operations and infrequent operation after periods of inactivity.
      2) Elastomer seats which are bonded or vulcanized to the body shall have adhesive integrity of bond between seat and body assured by testing, with minimum 75-pound pull in accordance with ASTM D429, Method B. For valves 36-inch and larger, only mechanically retained seats are allowable. Mechanically retained shall mean seats retained by clamping rings held in place with bolts fastened to the valve body or disk.
      3) Bubble-tight with rated pressure applied from either side. Test valves with pressure applied in both directions.
      4) No travel stops for disc on interior of body.
      5) Self-adjusting V-type or O-ring shaft seals.
      6) Isolate metal-to-metal thrust bearing surfaces from flowstream.
      7) Provide traveling nut or worm gear actuator with handwheel. Valve actuators to meet the requirements of AWWA C504 or C516.
      8) Buried service operators shall withstand 450-foot-pounds of input torque at fully open and fully closed positions. See Article Operators and Actuators, for acceptable manufacturers of direct buried operators.

9) Provide linings and coatings per AWWA, unless otherwise indicated on Drawings or specified herein.
10) Valves to be in full compliance with NSF/ANSI 61. Provide NSF/ANSI 61 certificate for each valve.

b. Non-AWWA butterfly valves to meet the following actuator requirements:
1) For above ground installations, provide handle and notch plate for valves 6 inches and smaller and heavy-duty, totally enclosed gearbox type operators with handwheel, position indicator and travel stops for valves 8 inches and larger, unless otherwise indicated on Drawings or specified herein.

2. Type V500 Butterfly Valve Water Works Service 3 Inches to 96 Inches:
a. AWWA C504 or C516, Class 150B.
b. Short body type, flanged ends.
c. Cast iron body, cast or ductile iron disc, Type 304 stainless steel shafts, Buna-N rubber seat, and stainless steel seating surface.
d. Provide epoxy lining and coating in compliance with AWWA C550.
e. For valves 36 inches and larger, only mechanically retained seats are allowable. Mechanically retained shall mean seats retained by clamping rings held in place with bolts fastened to the valve body or disk.
f. See Article Operators and Actuators, for acceptable manufacturers of direct buried operators.
g. Manufacturers and Products:
1) Crispin.
2) Valmatic.
3) Pratt; Model 2FII or Triton XR-70.
4) DeZurik; AWWA Valve.

3. Type V501 Butterfly Valve Water Works Service 30 Inches to 96 Inches:
a. AWWA C504 or C516, Class 75B.
b. Short body type, flanged ends.
c. Cast iron body, ductile iron disc with Type 316 stainless steel seating edge, Type 304 stainless steel shafts, Buna-N rubber seat.
d. Provide epoxy lining and coating in compliance with AWWA C550.
e. For valves 36 inches and larger, only mechanically retained seats are allowable. Mechanically retained shall mean seats retained by clamping rings held in place with bolts fastened to the valve body or disk.
f. See Article Operators and Actuators, for acceptable manufacturers of direct buried operators.

g. Manufacturers and Products:
   1) Crispin.
   2) Valmatic.
   3) Pratt; Model Triton XR-70.
   4) DeZurik; AWWA Valve.
h. At the Contractor's option, V500 valves may be substituted for V501 valves.

4. Type V505 Double Offset Butterfly Valve Water Works Service, 24 inches to 96 inches.
   a. AWWA C504, C516, or C519 as applicable, Class 150B.
   b. Short body type, flanged ends.
   c. Cast iron body, cast or ductile iron disc, Type 304 stainless steel shafts, Buna-N rubber seat, and stainless steel seating surface.
   d. Double offset disc mounting so shaft does not penetrate seat and disc is not in contact with the seat when the valve is fully open.
   e. Provide epoxy lining and coating in compliance with AWWA C550.
   f. Valves shall have mechanically retained seats. Mechanically retained shall mean seats retained by clamping rings held in place with bolts fastened to the valve body or disk.
   g. See Article Operators and Actuators, for acceptable manufacturers of direct buried operators.
   h. Special Warranty for Double Offset Butterfly Valves:
      1) Manufacturer shall warrant the double offset butterfly valves furnished under this section against defects in material and workmanship and operational failure for a period of 5 years from the date of project substantial completion.
      2) In the event of failure of any part or parts of the valves during the warranty period, provided the equipment has been operated in accordance with good practice, the Manufacturer shall furnish and deliver a replacement for the defective part or parts ay the Manufacturer's expense. Manufacturer shall also be responsible for freight for the replacement parts.
      3) This special warranty shall not apply to electric, pneumatic or electro-hydraulic actuators furnished with the double offset valves, which shall have the standard warranty proscribed by the Contract Documents.
   i. Manufacturers and Products:
      1) VAG.
      2) Av-Tek.
      3) Pratt.
      4) Val Matic.

5. Type V510 Lug Style Butterfly Valve, Resilient Seated, 2 Inches to 20 Inches for Low Pressure Process Air Service:
   a. Lug style cast iron body, aluminum bronze discs, Type 316 stainless steel one-piece stem, self-lubricating sleeve type bushings, EPDM replaceable resilient seat suitable for operating temperatures up to 250 degrees F, 150 psi working pressure rating, bubble-tight at 50 psi differential pressure, valve body to fit between ASME B16.1 Class 125/150 flanges.
   b. Manufacturers and Products:
      1) Av-Tek; Series 140.
      2) Tyco/Keystone; Model GRL.
6. Type V513 Butterfly Valve 2 Inches to 20 Inches:
   a. Lug style, ductile iron body, Type 316 stainless disc, Type 316 or Type 431 stainless steel stem, EPDM replaceable resilient seat, heavy-duty self-lubricating sleeve type bushings, NBR stem seal, 150 psi working pressure rating, valve body to fit between ASME B16.1 Class 125/150 flanges.
   b. Manufacturers and Products:
      1) Pratt BF Series.
      2) Dezurik BOS-US.
      3) Av-Tek; Series 140.
      4) Tyco/Keystone; Model GRL.
      5) Crane/Centerline; Series 200.
7. Type V514 Butterfly Valve 2 Inches to 20 Inches for Ozonated Water Service:
   a. Lug style, one-piece, ductile iron body, Type 316 stainless disc, Type 316 or Type 431 stainless steel stem, FKM replaceable resilient seat, heavy-duty self-lubricating sleeve type bushings, NBR stem seal, 150 psi working pressure rating, valve body to fit between ASME B16.1 Class 125/150 flanges.
   b. Manufacturers and Products:
      1) Pratt BF Series.
      2) Av-Tek; Series 140.
      3) Tyco/Keystone; Model GRL.
8. Type V520 Solid Polyvinyl Chloride (PVC) Butterfly Valve 1-1/2 Inches to 8 Inches:
   a. Wafer body type, pressure rated 150 psi at 70 degrees F CWP, solid ASTM D1784, Type I, Grade 1, PVC body and contoured PVC valve disc, Type 316 stainless steel nonwetted valve stem, EPDM seat except for valves used in sulfuric acid (SA) and chlorine solution (CS) service shall have Viton seats, lever operator. Seat shall seal against mating pipe flanges and body shall be nonwetted.

b. Manufacturers and Products:
   1) ASAHI/America; Type 57.
   2) Spears.

F. Check and Flap Valves:

1. Type V600 Check Valve 2 Inches and Smaller:
   a. All bronze, threaded cap, threaded or soldered ends, swing type replaceable bronze disc, rated 125-pound SWP, 200-pound WOG.
   b. Manufacturers and Products:
      1) Stockham; Figure B-319, threaded ends.
      2) Milwaukee; Figure 509, threaded ends.
      3) Stockham; Figure B-309, soldered ends.
      4) Milwaukee; Figure 1509, soldered ends.
2. Type V602 Check Valve 2 Inches and Smaller:
   a. All bronze, threaded cap, threaded ends, swing type replaceable Teflon disc and bronze disc holder, rated 150-pound SWP, 300-pound WOG.
   b. Manufacturers and Products:
      1) Walworth; Figure 3412.
      2) Milwaukee; Figure 510.
3. Type V606 Check Valve 2 Inches to 12 Inches:
   a. Flanged end, cast iron body, bronze mounted swing type, solid bronze or cast iron disc, bronze seat ring, outside lever and weight, rated 125-pound SWP, 200-pound WOG.
   b. Manufacturers and Products:
      1) Stockham; G-931.
      2) Crane Co.; Cat. No. 383.
4. Type V608 Swing Check Valve 2 Inches to 36 Inches:
   a. AWWA C508, 125-pound flanged ends, cast or ductile iron body, bronze body seat, bronze mounted cast iron clapper with bronze seat, stainless steel hinge shaft.
   b. Valves, 2 inches through 12 inches rated 175-pound WWP and 14 inches through 36 inches rated 150-pound WWP. Valves to be fitted with adjustable outside lever and weight. Increasing-pattern body valve may be used where increased outlet piping size is shown.
   c. Manufacturers and Products:
      1) M&H Valve; Style 159.
      2) Mueller Co.; No. A-2600/8001 Series.
5. Type V612 Double Disc Swing Check Valve 2 Inches to 48 Inches:
   a. Wafer style, spring loaded, cast-iron body, aluminum-bronze or ductile iron discs, Buna-N resilient seats, and Type 316 stainless steel spring, hinge pin, and stop pin.

b. Valves 2 inches through 12 inches rated 200 psi nonshock working pressure and valves 14 inches through 48 inches rated 150 psi nonshock working pressure.
c. Manufacturers and Products:
1) APCO; Series 9000.
2) Val-Matic; Dual Disc.
3) Crane/Stockham; WG-970.

6. Type V614 Stainless Steel Swing Check Valve 2-1/2 Inches to 8 Inches:
a. Flanged end, Type 316 stainless steel body, swing type, Type 316 stainless steel disc, Type 316 stainless steel hinge shaft, stainless steel seat ring, rated 250-pound WOG. Any elastomers used in the valve shall be EPDM or PTFE.
b. Manufacturers and Products:
1) Sharpe; Series 25116.
2) Crane; Aloyco Figure 377.

7. Type V620 Silent Check Valve 2 Inches to 10 Inches:
a. Wafer style, iron body, center guided valve, bronze trim, Buna-N seat, stainless steel springs, rated 150-pound WOG.
b. Manufacturers and Products:
1) Mueller; Steam Specialty 91AP.
2) APCO; Series 300.

8. Type V625 Check Valve 3/8 Inches to 4 Inches:
a. Spring-loaded, in-line poppet valve, Alloy 20 body and disc, Viton seat, threaded ends, Hastelloy C-276 spring, 1 psi to 2 psi opening pressure, rated 1,500-pound nonshock, CWP.
b. Manufacturer and Product:
1) Check; All Style U3.
2) "Or-equal."

9. Type V626 Check Valve 3/8 Inches to 4 Inches:
a. Spring-loaded, in-line poppet valve, Type 316 stainless steel body and disc, EPDM seat, threaded ends, Type 316 stainless steel spring, 1 psi to 2 psi opening pressure, rated 1,500-pound nonshock, CWP.
b. Manufacturer and Product:
1) Check; All Style U3.
2) "Or-equal."

10. Type V628 Flanged Ductile Iron Check Valve 2-1/2 Inches to 8 Inches:
a. Flanged end, ductile iron body, swing type, stainless steel or stainless steel faced ductile iron disc, steel or stainless steel hinge shaft, stainless steel seat ring, rated 250-pound WOG. Any elastomers used in the valve shall be EPDM.
b. Manufacturers and Products:
1) Nibco; Series F-938.
2) Dezurik; Apco CVS 6000.

11. Type V630 PVC Ball Check Valve 4 Inches and Smaller:
    a. ASTM D1784, Type I, Grade 1 polyvinyl chloride body, dual union socket weld ends, rated 150 psi at 73 degrees F, and Viton seat and seal.
    b. Manufacturers and Products:
        1) Nibco; Chemtrol Tru Union.
        2) ASAHI/America.
        3) Spears; True Union.
12. Type V631 CPVC Ball Check Valve 4 Inches and Smaller:
    a. ASTM D1784 Cell Class 23477B CPVC body, single or dual union socket weld ends, rated 150 psi at 73 degrees F, 110 psi at 140 degrees F, Viton seat and seal.
    b. Manufacturers and Products:
        1) Nibco; Chemtrol Tru Union.
        2) ASAHI/America.
        3) Spears; True Union.
13. Type V632 PVC Ball Check Valve 4 Inches and Smaller:
    a. ASTM D1784, Type I, Grade 1 polyvinyl chloride body, dual union socket weld ends, rated 150 psi at 73 degrees F, and EPDM seat and seal.
    b. Manufacturers and Products:
        1) Nibco; Chemtrol Tru Union.
        2) ASAHI/America.
        3) Spears; True Union.
14. Type V633 CPVC Ball Check Valve 4 Inches and Smaller:
    a. ASTM D1784 Cell Class 23477B CPVC body, single or dual union socket weld ends, rated 150 psi at 73 degrees F, 110 psi at 140 degrees F, EPDM seat and seal.
    b. Manufacturers and Products:
        1) Nibco; Chemtrol Tru Union.
        2) ASAHI/America.
        3) Spears; True Union.
15. Type V634 Rubber Flapper Check Valve 2 Inches to 24 Inches:
    a. Iron body, ASME B16.1, Class 125 flanges, steel-reinforced Buna-N flapper raised seating ring, rated 150-pound CWP.
    b. Manufacturers and Products:
        1) APCO; Series 100.
        2) Val-Matic; "Swingflex."
16. Type V660 Check Valve 2 Inches and Smaller for Compressed Air Service:
    a. Cast brass spring-loaded lift check valve, screwed ends, RTFE seats, stainless steel spring, plugged unloading port, rated 250-pound WOG.

b. Manufacturer and Product:
   1) CDI; Model CB.
   2) "Or-equal."

17. Type V692 Flexible Rubber Flap Gate:
   a. Flexible rubber flap gate with a one-piece reinforced neoprene rubber flap with Type 304 stainless steel angle iron stiffeners through bolted with a Type 304 stainless backing bar and stainless steel nuts and bolts caulked to prevent leakage, a Type 304 stainless steel frame for concrete wall mounting with anchor bolts and a grout pad, neoprene J-bulb or lip-style side and bottom seals and flap lifting eye and gate lifting eye. Gate shall be suitable for a width of 20 feet as a single gate. Gate will not see any backpressure and is intended to close off the opening over a weir to prevent birds from entering through the space.
   b. Manufacturer:
      1) Hydro Gate.
      2) "Or-equal."
18. Type V693 Flexible Rubber Flap Gate:
   a. High density polyethylene flap gate with hinged flap to mount on flanged wall pipe. Hinge axles shall be Type 316 stainless steel solid bar. In CLOSED position, the weight of gate flap shall provide a tight seal of opening at a 10-degree angle from vertical. The gate installed at the outside wall of a basin will not see backpressure and is intended to close off the overflow pipe openings to prevent insects and birds from entering the covered basin. During a basin overflow, the flap shall open at a low head unseating head, not to exceed 1 psi differential pressure. All required fasteners and hardware shall be Type 316 stainless steel.
   b. Manufacturer:
      1) Westatlantic Tech Corp.
      2) "Or-equal."
19. Type V694 Check Valve 1-Inch to 48-Inch:
   a. Elastomer type flanged or slip-on as shown on Drawings, round entry area to match pipe, contoured duckbilled shaped exit, flat bottom and off-set bill design, curved bill for 18 inches and larger, valve to open with approximately 2 inches of line pressure and return to CLOSED position under zero flow condition, rated for 50 psi minimum operating pressure; flanges steel backing flange type, drilled to ASME B16.1, Class 125, plain-end valve attached with two Type 316 stainless steel adjustable bands, elastomer nylon-reinforced neoprene.
   b. Manufacturers and Products:
      1) Cla Val; Series DB.
      2) Red Valve Co.; Tideflex Check Valve Series TF-1 or 35-1.

20. Type V695 Check Valve 1-Inch to 48-Inch:
    a. Elastomer type flanged, slip-on or insertion style as shown on Drawings or as required, round entry area to match pipe, contoured duckbilled shaped exit, flat bottom and off-set bill design, curved bill for 18 inches and larger, valve to open with approximately 2 inches of line pressure and return to CLOSED position under zero flow condition, rated for 50 psi minimum operating pressure; flanges CPVC backing flange type, drilled to ASME B16.1, Class 125, plain-end valve attached with two Type 316 stainless steel adjustable bands, elastomer nylon-reinforced FKM. Type 316 stainless steel bolts for flanged or insertion style.
    b. Manufacturers and Products:
        1) Cla Val; Series DB.
        2) Red Valve Co.; Tideflex Check Valve Series TF-1 or 35-1.
21. Type V696 Check Valve 1-Inch to 48-Inch:
    a. Elastomer type flanged, slip-on or insertion style as shown on Drawings or as required, round entry area to match pipe, contoured duckbilled shaped exit, flat bottom and off-set bill design, curved bill for 18 inches and larger, valve to open with approximately 2 inches of line pressure and return to CLOSED position under zero flow condition, rated for 50 psi minimum operating pressure; flanges CPVC backing flange type, drilled to ASME B16.1, Class 125, plain-end valve attached with two Type 316 stainless steel adjustable bands, elastomer nylon-reinforced EPDM. Type 316 stainless steel bolts for flanged or insertion style.
    b. Manufacturers and Products:
        1) Cla Val; Series DB.
        2) Red Valve Co.; Tideflex Check Valve Series TF-1 or 35-1.

G. Self-Regulated Automatic Valves:

1. Type V710 Pressure-Reducing Valve 2-1/2 Inches and Smaller:
    a. Direct diaphragm operated, spring controlled, bronze body, NPT threaded ends, 200 psig rated minimum.
    b. Size/Rating: As shown in Self-Regulated Automatic Valve Schedule as shown on Drawings.
    c. Manufacturers and Products:
        1) Fisher; Type 75A.
        2) Watts; Series 223.

2. Type V711 Pressure-Reducing Valve 2 Inches and Smaller:
   a. Direct diaphragm, spring controlled, cast iron body, spring case, composition seat and diaphragm, stainless steel valve stem, NPT threaded ends, 250 psig rated.
   b. Size/Rating: As shown in Self-Regulated Automatic Valve Schedule as shown on Drawings.
   c. Manufacturer and Product:
      1) Fisher; 95 Series.
      2) "Or-equal."
3. Type V714 Pressure-Reducing Valve 2 Inches and Larger:
   a. Hydraulically operated, diaphragm actuated, pilot controlled globe valve, ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless steel trim, stainless steel stem, externally mounted strainers with cocks, maintains a constant downstream pressure regardless of fluctuations in flow or upstream pressure.
   b. FDA approved fusion bonded epoxy lining and coating installed in accordance with AWWA C550.
   c. Size/Rating: As shown in Self-Regulated Automatic Valve Schedule as shown on Drawings.
   d. Manufacturers and Products:
      1) Cla-Val; 90-01 Series.
      2) Singer; Model 106PR.
4. Type V716 Pressure-Reducing/Back-Pressure Sustaining Valve 3 Inches and Larger:
   a. Hydraulically operated, diaphragm actuated, pilot controlled globe valve, ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless steel trim, stainless steel stem, externally mounted strainers with cocks, maintains a constant downstream pressure while maintaining a minimum upstream pressure.
   b. FDA approved fusion bonded epoxy lining and coating installed in accordance with AWWA C550.
   c. Size/Rating: As shown in Self-Regulated Automatic Valve Schedule as shown on Drawings.
   d. Manufacturers and Products:
      1) Cla-Val; 92-01 Series.
      2) Singer; Model 106PR-R.
5. Type V720 PVC Pressure Relief, By-Pass Relief, Back-Pressure Regulator, Back-Pressure, Anti-Siphon Valve 1/2-Inch to 2-Inch:
   a. Direct acting diaphragm, spring controlled, in-line pattern, NPT threaded inlet and outlet, 150 psi design pressure.

b. PVC body, Teflon or Viton diaphragm, PVC or Teflon piston, high-density polyethylene or stainless steel adjusting bolt and locknut, stainless steel or coated steel spring, stainless steel fasteners.
c. Designed to open when upstream pressure reaches set point; set pressure adjustable from 10 psi to 100 psi, minimum. Factory set pressure setting at 25 psi for back-pressure and anti-siphon valves, 10 psi for pressure relief valves, 100 psi for bypass relief valves, and 50 psi for back-pressure regulator valves.
d. Manufacturers and Products:
   1) Plast-O-Matic; Series RVDT.
   2) Griffco; Series BPV.
   3) Primary Fluid Systems; TOP Valve.

6. Type V722 PVC Pressure Regulating Valve, 1/2-Inch to 1-1/2-Inch:
   a. Diaphragm operated assembly, spring controlled, in-line pattern, NPT threaded inlet and outlet, 150 psi design pressure.
   b. PVC body, Viton seals and diaphragm, coated stainless steel spring, stainless steel adjusting bolt, locknut, and fasteners.
   c. Designed to regulate downstream pressure closing when pressure reaches set point; set pressure adjustable from 5 psi to 50 psi. Factory set pressure setting as listed in Self-Regulated Automatic Valve Schedule as shown on Drawings.
   d. Manufacturers and Products:
      1) Plast-O-Matic, Series PR.
      2) Hayward; Pressure Regulator.
7. Type V723 PVC Back Pressure Regulating Valve, 1/2-Inch to 2-Inch:
   a. Diaphragm operated assembly, spring controlled, in-line pattern, NPT threaded inlet and outlet, 250 psi design pressure.
   b. PVC body, PTFE/EPDM seals and diaphragm, steel spring, stainless steel fasteners.
   c. Designed to regulate upstream pressure opening when pressure reaches set point; set pressure adjustable from 10 psi to 125 psi. Factory set pressure setting as listed in the Self-Regulated Automatic Valve Schedule as shown on Drawings.
   d. Manufacturers and Products:
      1) Plast-O-Matic; Series RVDT.
      2) Hayward; Series PBV.
8. Type V724 CPVC Back Pressure Regulating Valve, 1/2-Inch to 2-Inch:
   a. Diaphragm operated assembly, spring controlled, in-line pattern, NPT threaded inlet and outlet, 250 psi design pressure.
   b. PVC body, PTFE/Viton seals and diaphragm, steel spring, stainless steel fasteners.

c. Designed to regulate upstream pressure opening when pressure reaches set point; set pressure adjustable from 10 psi to 125 psi. Factory set pressure setting as listed in the Self-Regulated Automatic Valve Schedule as shown on Drawings.
d. Manufacturers and Products:
   1) Plast-O-Matic; Series RVDT.
   2) Hayward; Series PBV.

9. Type V725 Stainless Steel Back Pressure Regulating Valve, 1/2-Inch to 2-Inch:
   a. Diaphragm operated assembly, spring controlled, in-line pattern, NPT threaded inlet and outlet, 250 psi design pressure.
   b. Type 316 or duplex stainless body, stainless steel spring chamber, PTFE/EPDM seals and diaphragm, stainless steel spring, stainless steel fasteners.
   c. Designed to regulate upstream pressure opening when pressure reaches set point; set pressure adjustable from 10 psi to 30 psi. Factory set pressure setting as listed in the Self-Regulated Automatic Valve Schedule as shown on Drawings.
   d. Manufacturer and Product:
      1) Cashco; Model DA5.
      2) "Or-equal."
10. Type V726 Automatic Degassing Valve, 1/2-Inch to 3/4-Inch:
   a. PVC or CPVC construction with Viton seals, NPT threaded inlet and outlet, float designed to automatically vent gases, 150 psi design pressure.
   b. Manufacturer and Product:
      1) Primary Fluid Systems, Inc.; Accu-Vent.
      2) "Or-equal."
11. Type V730 Pressure-Relief Valve 2 Inches and Smaller:
   a. Direct diaphragm, spring controlled, cast iron body, spring case, nitrile seat neoprene diaphragm, stainless steel valve stem, NPT threaded ends, 200 psi rated.
   b. Opens when upstream pressure reaches a maximum set point.
   c. Size/Rating: As shown in Self-Regulated Automatic Valve Schedule as shown on Drawings.
   d. Manufacturer and Product:
      1) Fisher; 98 Series.
      2) "Or-equal."
12. Type V732 Pressure-Relief Valve 3 Inches and Larger:
   a. Hydraulically operated, diaphragm actuated, pilot controlled globe valve, ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless steel trim, stainless steel stem, externally mounted strainers with cocks, to open when upstream pressure reaches a maximum set point.

b. FDA approved fusion-bonded epoxy lining and coating installed in accordance with AWWA C550.
c. Size/Rating: As shown in Self-Regulated Automatic Valve Schedule as shown on Drawings.
d. Manufacturers and Products:
   1) Cla-Val; 50-01.
   2) Singer; Model 106-RPS.

13. Type V733 Chlorine Pressure Safety Valve 1-Inch by 2-Inch:
   a. The PSV shall be sized and selected to make Chlorine Storage Tanks compliant with ASME Section VIII.
   b. PSV shall be compliant with Chlorine Institute for Class V service.
   c. PSV shall be 1-inch Class 300 RF inlet flange by 2-inch Class 150 RF outlet flange.
   d. PSV shall be set to open at 300 psig and reclose when high pressure condition stops.
   e. The PSV shall be integral with rupture disc, designed for use with chlorine gas. See Section 44 44 16, Chlorine and Chlorine Dioxide Equipment, for Rupture Disc Specifications.
   f. A piping flanged spool piece shall be provided between the rupture disc and PSV with two 1/2-inch NPT connections for installation of a pressure gauge and pressure switch suitable for exposure to 300 psig chlorine gas meeting the requirements of Section 40 91 00, Instrumentation and Control Components.
   g. The PSV shall conform to the Chlorine Institute Pamphlet 5 and Pamphlet 6.
   h. Prepare, clean, package and tag valve in accordance with Chlorine Institute Pamphlet 6 and Section 40 27 02, Process Valves and Operators.
   i. Manufacturer and Product:
      1) Farris Engineering; Series 2600.
      2) See Valve Data Sheet at end of this section.

14. Type V734 Chlorine Three-Way Selector Valve 2-inch:
   a. 2-inch, Class 300 RF flanged inlet with integral 1-inch, Class 300 outlet capable of isolating either PSV for servicing.
   b. Hastelloy C-276 bellow sealed style valve with backup packing.
   c. Oil and grease free, designed for use with liquid and gaseous chlorine.
   d. Shall conform to Chlorine Institute Pamphlet 6 for Class V valves and Pamphlet 5.
   e. Prepare, clean, package and tag valve in accordance with Chlorine Institute Pamphlet 6 and Section 40 27 02, Process Valves and Operators.

f. Manufacturer and Product:
   1) Ferris Engineering; Model 370BH/A030062202.00x1.50/ RHHS-CHLORINE.
   2) "Or-equal."

15. Type V735 PVC Conservation Vent Valve 2-Inch to 8-Inch:
   a. PVC end-of-line pressure and vacuum breather vent, suitable for sulfuric acid service, combined pressure and vacuum release valve. Automatically exhaust air during filling of system and allow air to re-enter during draining or when vacuum occurs.
   b. Polyvinyl chloride (PVC) body, cover and hood; PVC pallet assembly components; FEP diaphragms; PVC hardware; Type 316 stainless steel weights, if required. For sulfuric acid tanks use Derakane 470 coated weights.
   c. Self-draining body design to condensate away from seating surface. ASME B16.1 Class 125 flanged inlet and cover outlet.
   d. Pressure Setting: 6 ounces per square inch.
   e. Vacuum Setting: 4 ounces per square inch.
   f. Manufacturers and Products:
      1) The Protectoseal Company; 8-inch Model PVC-8548B for Tanks TNK-9450-3, 4.
      2) The Protectoseal Company; 4-inch Model PVC-8544B for Tank TNK-9452-2.

16. Type V740 Air and Vacuum Valve 1/2-Inch to 16-Inch:
   a. 1/2-inch through 3-inch NPT inlets and outlets, 4-inch and larger ASME B16.1 Class 125 flanged inlet with plain outlet and protective hood.
   b. Rated 150 psi working pressure, cast iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
   c. Manufacturers and Products:
      1) APCO Valve and Primer Corp.; Series 140 or 150.
      2) Val-Matic Valve; Series 100.

17. Type V741 Air and Vacuum Valve 4 Inches to 16 Inches with Anti-Slam Device:
   a. Equipped with anti-slam device to throttle flow of water into air valve. Design anti-slam device to permit full, unrestricted flow of air into and out of air valve but reduce flow area for water to approximately 10 percent.
   b. Rated 150 psi working pressure, cast iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512, ASME B16.1 Class 125 flanged inlet and plain outlet with protective hood.

c. Manufacturers and Products:
   1) APCO Valve and Primer Corp.; Series 1900.
   2) Val-Matic Valve; Series 1200/100.

18. Type V744 Air Release Valve 1/2-Inch to 2-Inch:
   a. Suitable for water service, automatically exhaust small amounts of entrained air that accumulates in a system. In CLOSED position, seat against resilient seat to prevent water leakage.
   b. Rated 150 psi working pressure, cast iron or ductile iron body and cover, stainless steel float and trim, NPT threaded inlet and outlet, built and tested to AWWA C512.
   c. Manufacturers and Products:
      1) APCO Valve and Primer Corp.; Series 50, 200, and 200A.
      2) Val-Matic Valve; Series 15A to 45.6.
19. Type V746 Combination Air Release Valve 1-Inch to 16-Inch:
   a. Suitable for water service, combines operating features of air and vacuum valve and air release valve. Air and vacuum portion to automatically exhaust air during filling of system and allow air to re-enter during draining or when vacuum occurs. Air release portion to automatically exhaust entrained air that accumulates in system.
   b. Valve single body or dual body, air release valve mounted on air and vacuum valve, isolation valve mounted between the dual valves. 1-inch through 3-inch valves with NPT threaded inlet and outlet, 4-inch and larger valves with ASME B16.1 Class 125 flanged inlet and cover outlet.
   c. Rated 150 psi working pressure, cast iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
   d. Manufacturers and Products:
      1) APCO Valve and Primer Corp.; Series 143C to 149C or 1804 to 1816.
      2) Val-Matic Valve; Series 201C to 203C or 104/22 to 116/38.
20. Type V750 Sewage Air and Vacuum Valve 2 Inches to 14 Inches:
   a. Suitable for sewage service; automatically exhausts air during system filling and allows air to re-enter during draining or when vacuum occurs.
   b. Rated working pressure of 150 psi, 1-inch through 3-inch valves with NPT threaded inlet and outlet, 4-inch and larger valves with ASME B16.1 Class 125 flanged inlet and threaded cover outlet, built and tested to AWWA C512.
   c. Materials: Cast iron or ductile iron body and cover, concave or skirted stainless steel float and trim, Buna-N seat.
   d. Sewage air and vacuum valve fitted with blowoff valve, flushing valve with quick disconnect couplings, and a minimum 5 feet of

hose with quick disconnect couplings to permit backflushing after installation without dismantling valve.

e. Manufacturers and Products:
   1) APCO Valve and Primer Corp.; Series 401 SAVV to 414 SAVV.
   2) Val-Matic Valve; Series 301 to 306.

21. Type V752 Sewage Air Release Valve 2 Inches to 4 Inches:
   a. Suitable for sewage service; automatically exhausts entrained air that accumulates in a system.
   b. Rated working pressure of 150 psi, operating pressure of 20 psi, built and tested to AWWA C512.
   c. Materials: Cast iron or ductile iron body and cover with NPT threaded inlet and 1-inch NPT threaded outlet, concave or skirted stainless steel float and trim; Buna-N resilient seat.
   d. Sewage air release valve fitted with blowoff valve, flushing valve with quick disconnect couplings, and a minimum 5 feet of hose with quick disconnect couplings to permit backflushing after installation without dismantling valve.
   e. Manufacturers and Products:
      1) APCO Valve and Primer Corp.; Series 400 SARV or 450 SARV.
      2) Val-Matic Valve; Series 48 or 49.

22. Type V754 Sewage Combination Air Valve 2 Inches to 6 Inches:
   a. Suitable for sewage service; combines operating functions of air and vacuum valve and an air release valve. Air and vacuum portion shall automatically exhaust air during filling of a system and allow air to re-enter during draining or when a vacuum occurs. Air release portion to automatically exhaust entrained air that accumulates in system. Single body unit with air and vacuum valve and an air release valve in a single housing.
   b. Rated working pressure of 150 psi; built and tested to AWWA C512.
   c. Materials: Cast iron or ductile iron body and covers, NTP threaded inlet and outlet, with concave or skirted stainless steel float and trim.
   d. Sewage air release valve fitted with blowoff valve, flushing valve with quick disconnect couplings, and a minimum 5 feet of hose with quick disconnect couplings to permit backflushing after installation without dismantling valve.
   e. Manufacturers and Products:
      1) APCO Valve and Primer Corp.; Series 440 SCAV.
      2) Val-Matic Valve; Series 800.

23. Type V760 Air Release Valves for Chemical Service:
    a. Float-operated valve to provide the following functions:
        1) Air release on filling of line. Valve to close at 0 psi based on float rather than hydraulic force of escaping liquid.
        2) Release of accumulated air or gas while line is operating at pressure.
        3) Vacuum relief when line is drained.
    b. CPVC body with NPT connections and Viton seals (EPDM seals for sodium hydroxide service). Pipe outlet to floor with CPVC piping.
    c. Manufacturer and Product:
        1) Plast-O-Matic; CARD Series.
        2) "Or-equal."

H. Miscellaneous Valves:

1. Type V925 Sampling Valve:
    a. Type 316 stainless steel wetted parts, hand operated iron crank, piston to extend to inner surface of vessel or pipe, sealed by two compressible replaceable Teflon rings, one above discharge port and other below discharge port, 3/4-inch NPT inlet and 3/4-inch NPT outlet.
    b. Manufacturers and Products:
        1) Strahman Valves, Inc.; Piston Type Sampling Valve.
        2) Fetterolf Corporation; Rod-Seal Sampling Valve.
2. Type V940 Solenoid Valve 1/4-Inch to 2-Inch:
    a. Two-way internal pilot operated diaphragm type, brass body, resilient seat suitable for air or water, solenoid coil molded epoxy, NEMA insulation Class F, 120V ac, 60-Hz, unless otherwise indicated. Solenoid enclosure NEMA 250, Type 4 unless otherwise indicated. Size and normal position (when de-energized) as indicated on the P&ID or in the control description.
    b. Minimum operating pressure differential no greater than 5 psig, maximum operating pressure differential not less than 125 psig.
    c. Manufacturers:
        1) ASCO.
        2) Skinner.

2.07 OPERATORS AND ACTUATORS

A. Manual Operators:

1. General:
   a. For AWWA valves, operator force not to exceed requirements of applicable valve standard. Provide gear reduction operator when force exceeds requirements.
   b. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
   c. Operator self-locking type or equipped with self-locking device.
   d. Position indicator on quarter-turn valves.
   e. Worm and gear operators one-piece design, worm-gears of gear bronze material. Worm of hardened alloy steel with thread ground and polished. Traveling nut type operator's threaded steel reach rod with internally threaded bronze or ductile iron nut.
2. Exposed Operator:
   a. Galvanized and painted handwheel.
   b. Cranks on gear type operator.
   c. Chain wheel operator with tieback, extension stem, floor stand, and other accessories to permit operation from normal operation level.
   d. Valve handles to take a padlock, and wheels a chain and padlock.
3. Buried Operator:
   a. Buried service operators on valves larger than 2-1/2 inches shall have a 2-inch AWWA operating nut. Buried operators on valves 2 inches and smaller shall have cross handle for operation by forked key. Enclose moving parts of valve and operator in housing to prevent contact with the soil.
   b. Buried service operators to be grease packed and gasketed to withstand submersion in water to 20 feet minimum.
   c. Buried valves shall have extension stems, bonnets, and valve boxes. Provide stainless steel shaft extension and wrench nut. Minimum extension stem diameter shall be 1-inch or diameter of valve shaft, whichever is larger.
   d. Manufacturers and Products for Direct Buried Gear Operators:
      1) Auma; GS.
      2) Limitorque; HBC.

B. Electric Operators, 120 Volts:

1. General:
   a. Unit shall be low profile to reduce amount of required space and weigh 30 pounds or less.
   b. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of the valve.
   c. Provide operator mounting bracket to mount operator to valve providing minimal torque to piping system when operating.
2. Operator Operation, General:
   a. Suitable for full 90-degree rotation of quarter-turn valves.
   b. Manually override handwheel.
   c. Mechanical valve position indication.
3. Electronic Control:
   a. Torque Limiting Switches: Two single pole, double throw mechanical switches. Switches operate at any point in valve travel.
   b. Jammed-valve detection and protection.
   c. Motor over-temperature detection and protection.
   d. Travel limit switches, single pole double throw.
4. Open-Close (O/C) Service:
   a. Duty cycle for intermittent ON-OFF operation shall be 25 percent.
   b. Operator shall power to OPEN and power to CLOSE.
   c. Local Indication and Control:
      1) Integral mechanical valve POSITION indication, 0 percent to 100 percent OPENED.
      2) Integral OPENED and CLOSED indication lights.
      3) Integral LOCAL-OFF-REMOTE (L-O-R).
      4) Integral OPEN maintained switch which causes the valve to stroke full OPENED, even if OPEN switch is released, while L-O-R switch is in LOCAL.
      5) Integral CLOSE maintained switch which causes valve to stroke full CLOSED, even if CLOSED switch is released, while L-O-R switch is in LOCAL.
   d. Remote Indication and Control:
      1) Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
      2) Limit switch that closes when valve is fully OPENED for connection to and monitoring by plant control system.
      3) Limit switch that closes when valve is fully CLOSED for connection to and monitoring by plant control system.

5. Modulating (M) Service:
   a. Operator rated for continuous duty with servo shall be rated for 100 percent modulating operation.
   b. Operator shall modulate based on an externally applied 4 mA to 20 mA dc signal.
   c. Operator shall be equipped with an electronic servo module for valve modulation.
      1) Module shall provide serial communications with provided cable for setup of valve operation.
   d. Local Indication and Control:
      1) Integral mechanical valve POSITION indication, 0 percent to 100 percent OPENED.
      2) Integral OPENED and CLOSED indication lights.
      3) Integral LOCAL-OFF-REMOTE (L-O-R).
      4) Integral OPEN momentary switch which causes valve to stroke towards OPENED, as long as OPEN switch is held, while L-O-R switch is in LOCAL.
      5) Integral CLOSE momentary switch which causes valve to stroke towards CLOSED, as long as CLOSED switch is held, while L-O-R switch is in LOCAL.
      6) Position valve proportionally 0 percent to 100 percent OPEN with external 4 mA to 20 mA dc signal while in REMOTE.
   e. Remote Indication and Control:
      1) Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
      2) Current Position Transmitter, 4 mA to 20 mA dc signal in proportion to 0 percent to 100 percent OPENED, with 0.5 percent accuracy and 0.5 percent repeatability, capable of driving a 750-ohm load, for connection to and monitoring by Plant Control System.
6. Control Features: Electric motor actuators with features as noted above, and as modified/supplemented in Electric Actuated Valve Schedule as shown on Drawings.
7. Manufacturer and Product:
   a. Rotork Q-range with Q-Pak option.
   b. "Or-equal."

C. Electric Motor Actuators, 480 Volts:

1. General:
   a. Comply with latest version of AWWA C542.
   b. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.
   c. Controls integral with actuator and fully equipped as specified in AWWA C542.
   d. Stem protection for rising stem valves.
2. Actuator Operation—General:
   a. Suitable for full 90-degree rotation of quarter-turn valves or for use on multiturn valves, as applicable.
   b. Manual override handwheel.
   c. Valve position indication.
   d. Operate from FULL CLOSED to FULL OPEN positions or the reverse in the number of seconds given in Electric Actuated Valve Schedule as shown on Drawings.
   e. Nonintrusive Electronic Control: Local controls, diagnostics, and calibration, including limit and torque settings, shall be accomplished nonintrusively. Electronic valve position display with capability to show continuous torque output. If applicable, provide two hand-held configuration units for every 10 actuators provided, two minimum.
   f. Integral control power transformer or power supply for 120-volt or lower control circuits.
   g. Thermostatically controlled space heater.
   h. NEMA 250 Type 4 enclosure.
3. Open-Close(O/C)/Throttling(T) Service:
   a. Size motors for one complete OPEN-CLOSE-OPEN cycle no less than once every 10 minutes.
   b. Actuator suitable for throttling operation of valve at intermediate positions.
   c. LOCAL-OFF-REMOTE Selector Switch, Padlockable in Each Position:
      1) Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in LOCAL position.
      2) Remote OPEN-STOP-CLOSE momentary control dry contact inputs in REMOTE position. Integral seal-in circuits for remote OPEN and CLOSE commands; valve travel stops when remote STOP contact opens.
      3) Auxiliary contact that closes in REMOTE position.
   d. OPEN and CLOSED indicating lights.

e. Dry contacts for discrete output of valve OPEN and CLOSED position.
f. Integral reversing motor starter with built-in overload protection.

4. Modulating (M) Service:
   a. Size actuators for continuous modulating duty.
   b. Feedback potentiometer, or equivalent, and integral electronic positioner/comparator circuit to maintain valve position.
   c. HAND-OFF-AUTO (LOCAL-OFF-REMOTE) Selector Switch, Padlockable in Each Position:
      1) Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in HAND (LOCAL) position.
      2) 4 mA to 20 mA dc input signal to control valve in AUTO (REMOTE) position.
      3) Auxiliary contact that closes in AUTO (REMOTE) position.
   d. OPEN and CLOSED indicating lights.
   e. Dry contacts for discrete output of valve OPEN and CLOSED position.
   f. Ac motor with solid state reversing starter or dc motor with solid state reversing controller, and built-in overload protection. Controller capable of 1,200 starts per hour.
   g. Duty cycle limit timer and adjustable band width, or equivalent, to prevent actuator hunting.
   h. Valve position output converter that generates isolated 4 mA to 20 mA dc signal in proportion to valve position, and is capable of driving into loads of up to 500 ohms at 24V dc.
5. Limit Switch:
   a. Single-pole, double-throw (SPDT) type, field adjustable, with contacts rated for 5 amps at 120V ac.
   b. Each valve actuator to have a minimum of two auxiliary transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.
   c. Housed in actuator control enclosure.
6. Control Features: Electric motor actuators with features as noted above, and as modified/supplemented in Electric Actuated Valve Schedule as shown on Drawings.
7. Manufacturers and Products:
   a. Rotork Controls; IQ Range.
   b. Flowserve Limitorque; L120 MX.
   c. AUMA; SA/SAR Aumatic.

D. Pneumatic Actuators:

1. General:
   a. Actuator complete with air sets, exhaust mufflers, speed controls, pilot solenoids, safety vented isolation valves, and accessories.
   b. Suitable for full operation range of valve at air supply pressure indicated.
   c. Position indication and stop limiting devices on all actuators.
2. Vane Style Actuator:
   a. In compliance with AWWA C541.
   b. Air supply of 80 psig.
   c. Pressure die-cast aluminum housing with corrosion resistant fusion bonded epoxy finish, stainless steel bolting, stainless steel adjustable end stops.
   d. Electroless nickel-plated steel shaft and vane, single-component machined or cast part.
   e. Dual-opposed polyurethane lip seals with stainless steel expander.
   f. Double Acting:
      1) Complete with mounting hardware.
      2) Suitable for nonlubricated air.
   g. Spring Return:
      1) Wound stainless steel spring type in separate housing.
      2) Attached to pneumatic actuator housing.
      3) Only for fail-close valves as shown in the Pneumatic Actuated Valve Schedule as shown on Drawings.
   h. Visual Indicator: High visibility, OPEN-CLOSED indication, color coded, chemical resistant, clear polycarbonate cover.
   i. Manual override handwheel on modulating service actuators, with clutch to deactivate pneumatic drive in the handwheel mode.
   j. Actuator-mounted 120V ac solenoid valve. Solenoid fail position as required to achieve the valve deactivated (nonenergized) position shown in the Pneumatic Actuated Valve Schedule as shown on Drawings. Provide manual override on solenoid to allow it to be manually placed and maintained in the energized position without power.
   k. Manufacturers:
      1) K-Tork.
      2) Kinetrol.
3. Accessories:
   a. Air Set: Pressure regulator with internal relief, filter, outlet pressure gauge, and adjustable reduced pressure range as required by valve actuator.
      1) Aluminum body and handwheel.
      2) Safety vented lockout isolation valve.

3) Gauge range 1-1/3 to 2 times maximum operating pressure.
4) Manufacturers and Products:
   a) Fisher Controls; Type 67 AFR.
   b) Masoneilan; No. 77-4.

b. Air Exhaust Muffler:
   1) In the exhaust port of actuator pilot solenoid valves.
   2) Manufacturers:
      a) Barry Wright Corp.
      b) Allied Witan Co.

c. Limit Switch:
   1) Single-pole, double-throw (SPDT) type, rated 10 amps at 120V ac.
   2) Housed in NEMA 4X enclosure.
   3) Adjustable for OPEN and CLOSED valve positions.

d. Positioner:
   1) For modulating actuators, shall be pneumatic force balance instruments to control valve position as a function of input signal. Accomplish positive positioning of valve by a mechanical feedback connection from valve actuating mechanism. Position feedback through a characterized linear cam to allow adjustment of valve positioning and input signal. Positioner suitable for double acting or spring return actuator.
   2) Positioner to have zero and span adjustment and be field reversible for direct or reverse action.
   3) Gauges for supply and output pressure and for input signal pressure.
   4) Positioner for 4 mA to 20 mA dc input signal. Hold valve in last position on loss of input signal (below 3.8 mA).
   5) Positioner for dc input signal with transducers shall convert electrical signal to appropriate pneumatic signal. Transducer integral with positioner or separate component. If separate, factory mount transducer on pneumatic operator. Line electric power not required for transducer.
   6) Positioner to provide 4 mA to 20 mA dc isolated output valve position signal, capable of driving into loads of up to 500 ohms at 24V dc.
   7) Corrosion-resistant enclosures for positioners and transducers to be splash-proof and moisture-proof with gasketed covers.

e. Pilot Solenoid Valve:
   1) Solenoid valve shall pilot control actuator in appropriate configuration for type of open-close actuator being controlled. Double acting actuator shall have four-way solenoid valve, and spring return actuator shall have three-way solenoid valve. Dual coil solenoid valve for valves noted as "Fail Last Position" shall not change position unless one coil is energized while the other is de-energized.
   2) Pilot operated diaphragm type solenoid valve with brass body and resilient seat. Valve with minimum operating pressure differential no greater than 10 psig and maximum operating pressure differential no less than 150 psig. Internal parts corrosion-resistant. Solenoid valve to have Class F molded coils for operation on 120V ac, 60-Hz, unless otherwise indicated. Solenoid enclosure as defined in NEMA 250, Type 4X.
   3) Manufacturers:
      a) Asco Red Hat.
      b) C. A. Norgren Co.

4. Modulating Valve: Positioner with 4 mA to 20 mA input signal, unless otherwise indicated.
5. Control Features: Pneumatic actuators with features noted in the Pneumatic Actuated Valve Schedule as shown on Drawings.

E. Electric Hydraulic Actuator:

1. General:
   a. Quarter turn actuator consisting of a self-contained, electric motor driven positive displacement gear pump, a linear double-acting hydraulic cylinder and a rack and pinion gear drive.
   b. Motor shall be continuous duty without limitations on start and stop cycles.
   c. The pump shall operate only when valve movement is required, and flow control valves shall lock the valve in position and prevent movement when the valve is not operating.
   d. The actuator shall mount to the valve with a keyed shaft coupling and a bolted adapter.
   e. Actuators shall be modulating style capable of 100 percent duty cycle.
   f. Actuator shall be rated for operation over a range of 10 degrees F to 200 degrees F.
   g. Actuators shall be sized for a minimum of 125 percent of the valve's maximum torque requirement.

2. Controller:
   a. Actuators shall be controlled by a separately mounted, microprocessor based control panel (CPU) or remote hand station. The CPU shall have AUTOMATIC, SETUP and LOCAL modes.
      1) In the AUTOMATIC mode the actuator shall respond to a 4 mA to 20 mA valve position input signal from the plant control system.
      2) In LOCAL mode the valve position shall be input at the CPU using a keypad or via a remote hand station.
      3) In SETUP mode, a menu driven program shall allow setting of actuator speed, stroke, dead band, acceleration, control signal and gain via the keypad or a remote set up device. Access to the SETUP mode shall be able to be password protected.
      4) The CPU shall have a positioner function that compares valve position to the control signal and adjusts the valve position if the control signal and valve position differ by more than an operator adjustable dead band.
      5) CPU shall be housed in a NEMA 4 enclosure suitable for a nonhazardous location and rated for operation between minus 40 degrees F to 140 degrees F.
      6) CPU shall have transient surge protection, motor driver, integral fused power supply and terminal strips for external connections.
      7) CPU shall operate with a single 115V ac power supply or be powered from the actuator power supply.
      8) Operator interface shall be a membrane keypad with two-line text display. Interface to be mounted on outside face of indoor units, and inside the enclosure for outdoor mounted units. Alternately, a remote hand station and hand held remote control device may be used for the interface.
3. Inputs and Outputs:
   a. CPU shall have a two-wire 4 mA to 20 mA output signal that is proportional to valve position and selectable for direct or reverse action. This signal shall be powered from a dc power supply in the CPU, and suitable for a maximum external load of 700 ohms at 24V dc.
   b. The CPU shall have four output relays, two of which that can be configured as limit switches (valve full OPEN and valve full CLOSED) and two of which that can be figured as alarm or warning switches (one shall be a common FAULT alarm).
      1) LOCAL mode shall not be configured as an alarm output.

4. Fail Mode:
   a. Actuators shall fail in the position indicated in the Electro Hydraulic Actuated Valve Schedule as shown on Drawings.
   b. For actuators specified to fail open or closed, that operation shall be accomplished with a hydraulic accumulator and controls provided with the actuator and CPU or by a spring in the hydraulic cylinder.
5. Manual Override: An override handwheel or manual hydraulic pump shall be provided for each actuator for manual operation in the event of loss of power.
6. Manufacturers and Products:
   a. Rexa; X2R Series.
   b. Rotork Skilmatic SI.

2.08 ACCESSORIES

A. Tagging: 1-1/2-inch diameter heavy brass or stainless steel tag attached with No. 16 solid brass or stainless steel jack chain for each valve, bearing valve tag number shown on Electric Actuated Valve Schedule, Pneumatic Actuated Valve Schedule, Self-Regulated Automatic Valve Schedule, and Manual Valve List as shown on Drawings.

B. Limit Switch:

1. Factory installed NEMA 4X limit switch by actuator manufacturer.
2. SPST, rated at 5 amps, 120V ac.

C. T-Handled Operating Wrench:

1. Six each galvanized operating wrenches, 4 feet long.
2. Manufacturers and Products:
   a. Mueller; No. A-24610.
   b. Clow No.; F-2520.
3. Six each galvanized operating keys for cross handled valves.

D. Extension Bonnet for Valve Operator: Complete with enclosed stem, extension, support brackets, and accessories for valve and operator.

1. Manufacturers:
   a. Pratt.
   b. DeZurik.

E. Floor Stand:

1. Nonrising, heavy pattern, indicating type.
2. Complete with 1-inch minimum solid extension stem, coupling, handwheel, stem guide brackets, and yoke attachment. Stem length as required to connect valve operating nut and floor stand. End fittings of the extension rod shall be welded to the rod rather than bolted or clipped.
3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
4. Anchor Bolts: Type 304 stainless steel.
5. Manufacturers and Products:
   a. Clow; Figure F-5515.
   b. Mueller, Figure A-26426.

F. Floor Box:

1. Plain type, for support of nonrising type stem.
2. Complete with 1-inch minimum solid extension stem, operating nut, and stem guide brackets. Stem length as required to extend valve operating nut to within 3 inches of finish floor. End fittings of the extension rod shall be welded to the rod rather than bolted or clipped.
3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
4. Anchor Bolts: Type 304 stainless steel.
5. Manufacturers and Products:
   a. Neenah Foundry; R 7506.
   b. Clow; No. F5690.

G. Chain Wheel and Guide:

1. Handwheel direct-mount type.
2. Complete with chain.
3. Galvanized or cadmium-plated.
4. Manufacturers and Products:
   a. Clow Corp.; Figure F-5680.
   b. Walworth Co.; Figure 804.
   c. DeZurik Corp.; Series W or LWG.

H. Cast Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 5-1/4-inch ID shaft.

1. Box: Cast iron with minimum depth of 9 inches.
2. Lid: 3-1/2-inch domed bronze disc marker stamped "North Texas Municipal Water District" and the size and type of valve shall be marked in the concrete pad. Bernsten; C35DB, "or-equal."
3. Extensions: Cast iron.

4. Two-piece box and lid for valves 4 inches through 12 inches, three-piece box and lid for valves larger than 12 inches with base sized for valve.
5. Valve extension stem for valves with operating nuts 3 feet or greater below finish grade.
6. Manufacturers and Products:
   a. East Jordan Iron Works; Cast Iron Valve Boxes.
   b. Bingham & Taylor; Cast Iron Valve Boxes.

I. Indicator Post Assembly:

1. Cast or ductile iron post head, bell, and wrench with cast or ductile iron or steel barrel.
2. Plexiglas, "or-equal" protected window to indicate OPEN and CLOSED position.
3. Padlockable eye bolt for wrench.
4. Adjustable bury depth. Bury depth as required for valve installation.
5. UL listed and FM approved.
6. Access port for mounting a position switch and mechanical mechanism for triggering the switch within 1/4 turn of the valve stem from full open.
7. Manufacturers and Products:
   a. Clow; Style 2945.
   b. Mueller; A-20806.

PART 3 EXECUTION

3.01 INSTALLATION

A. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.
3. Use Type 316 stainless steel nuts, bolts and washers for buried flanged valves, as specified for buried flanges for the type of pipe in which the valve is installed.

B. Screwed Ends:

1. Clean threads by wire brushing or swabbing.
2. Apply joint compound.

C. PVC and CPVC Valves: Install using solvents approved for valve service conditions.

D. Valve Installation and Orientation:

1. General:
   a. Install valves so handles operate from fully open to fully closed without encountering obstructions.
   b. Install valves in location for easy access for routine operation and maintenance.
   c. Install valves per manufacturer's recommendations.
2. Gate, Globe, and Ball Valves:
   a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
   b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.
3. Eccentric Plug Valves:
   a. Unless otherwise restricted or shown on Drawings, install valve as follows:
      1) Liquids with Suspended Solids Service with Horizontal Flow: Install valve with stem in horizontal position with plug up when valve is open. Install valve with seat end upstream (flow to produce unseating pressure).
      2) Liquids with Suspended Solids Service with Vertical Flow: Install valve with seat in highest portion of valve (seat up).
      3) Clean Liquids and Gas Service: Install valve with seat end downstream of higher pressure when valve is closed (higher pressure forces plug into seat).
4. Butterfly Valves:
   a. Unless otherwise restricted or shown on Drawings, install valve a minimum of 8 diameters downstream of a horizontal elbow or branch tee with shaft in horizontal position.
   b. For vertical elbow or branch tee immediately upstream of valve, install valve with shaft in vertical position.
   c. For horizontal elbow or branch tee immediately upstream of valve, install valve with shaft in horizontal position.
   d. When installed immediately downstream of swing check, install valve with shaft perpendicular to swing check shaft.
   e. For free inlet or discharge into basins and tanks, install valve with shaft in vertical position.
5. Check Valves:
   a. Install valve in accordance with manufacturer's instructions and provide required distance from immediate upstream fitting.
   b. Install valve in vertical flow (up) piping only for gas services.

c. Install swing check valve with shaft in horizontal position.
d. Install double disc swing check valve to be perpendicular to flow pattern when discs are open.

6. Solenoid Valves: Install in accordance with manufacturer's instructions.

E. Install line size ball valve and union upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, excluding magnetic flowmeters, for isolation during maintenance.

F. Install safety isolation valves on compressed air.

G. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.

H. Extension Stem for Operator: Where depth of valve operating nut is 3 feet or greater below finish grade, furnish operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

I. Torque Tube: Where operator for quarter-turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of valve.

J. Floor Box and Stem: Steel extension stem length shall locate operating nut in floor box.

K. Chain Wheel and Guide: Install chain wheel and guide assemblies or chain lever assemblies on manually operated valves over 6 feet 9 inches above finish floor. Install chain to within 3 feet of finish floor. Where chains hang in normally traveled areas, use appropriate "L" type tie-back anchors. Install chains to within operator horizontal reach of 2 feet 6 inches maximum, measured from normal operator standing location or station.

3.02 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

C. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

D. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.

E. Set, verify, and record set pressures for relief and regulating valves.

F. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by Engineer.

G. Test hydrostatic relief valve seating; record leakage. Adjust and retest to maximum leakage of 0.1 gpm per foot of seat periphery.

3.03 MANUFACTURER'S SERVICES

A. Valve(s) as listed below require manufacturer's field services:

1. Valves larger than 30 inches size and all actuated valves.

B. Manufacturer's Representative:

1. Present at Site for minimum person-days listed below, travel time excluded:
   a. 1 person-day for inspection for each different valve type for valves greater than 30 inch or for different actuator manufacturer.
   b. 2 person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation for each different valve type for valves greater than 30 inches or for different actuator manufacturer.

C. See Section 01 43 33, Manufacturers' Field Services, and Section 01 91 14, Equipment Testing and Project Startup.

END OF SECTION