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USACE / NAVFAC / AFCEA / NASA UFGS-23 09 13.33 40 (June 2006)  
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Preparing Activity: NASA Superseding  
UFGS-23 09 13.33 40 (April 2006)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2008

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#### SECTION 23 09 13.33 40

#### CONTROL VALVES

06/06

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### SECTION 23 09 13.33 40

#### CONTROL VALVES 06/06

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NOTE: This specification covers the requirements  
for valves for steam and condensate systems.

Standard valves for steam, water, etc., operating at  
178 degrees C and 900 kilopascal 353 degrees F and  
125-pounds per square inch gage working steam  
pressure are covered in Section 23 05 00.00 40  
COMMON WORK RESULTS FOR HVAC.

Edit this guide specification for project specific  
requirements by adding, deleting, or revising text.  
For bracketed items, choose applicable items(s) or  
insert appropriate information.

Remove information and requirements not required in  
respective project, whether or not brackets are  
present.

Comments and suggestions on this guide specification  
are welcome and should be directed to the technical  
proponent of the specification. A listing of  
technical proponents, including their organization  
designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as  
a Criteria Change Request (CCR).

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: This paragraph is used to list the  
publications cited in the text of the guide  
specification. The publications are referred to in  
the text by basic designation only and listed in  
this paragraph by organization, designation, date,  
and title.

Use the Reference Wizard's Check Reference feature

when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

NSF/ANSI 14 (2007) Plastics Piping System Components and Related Materials

AMERICAN WELDING SOCIETY (AWS)

AWS A5.13 (2000) Specification for Surfacing Electrodes for Shielded Metal Arc Welding

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B1.20.1M (1983; R 2001) Pipe Threads, General Purpose (Metric)

ASME B16.1 (2005) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

ASME B16.34 (2004) Valves - Flanged, Threaded and Welding End

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M (2005) Standard Specification for Carbon Steel Forgings for Piping Applications

ASTM A 106/A 106M (2006a) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A 126/A 126M (2004) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A 182/A 182M (2007a) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

ASTM A 216/A 216M (2007) Standard Specification for Steel

Castings, Carbon, Suitable for Fusion  
Welding, for High-Temperature Service

ASTM A 395/A 395M (1999; R 2004) Standard Specification for  
Ferritic Ductile Iron Pressure-Retaining  
Castings for Use at Elevated Temperatures

ASTM A 436 (1984; R 2006) Standard Specification for  
Austenitic Gray Iron Castings

ASTM B 148 (1997; R 2003e1) Standard Specification  
for Aluminum-Bronze Sand Castings

ASTM B 164 (2003) Standard Specification for  
Nickel-Copper Alloy Rod, Bar, and Wire

ASTM B 584 (2006a) Standard Specification for Copper  
Alloy Sand Castings for General  
Applications

ASTM B 61 (2002) Standard Specification for Steam or  
Valve Bronze Castings

ASTM B 62 (2002) Standard Specification for  
Composition Bronze or Ounce Metal Castings

ASTM D 1784 (2006a) Standard Specification for Rigid  
Poly(Vinyl Chloride) (PVC) Compounds and  
Chlorinated Poly(Vinyl Chloride) (CPVC)  
Compounds

ISA - THE INSTRUMENTATION, SYSTEMS AND AUTOMATION SOCIETY (ISA)

ISA RP60.9 (1981) Piping Guide for Control Centers

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-67 (2002a; R 2004) Standard for Butterfly  
Valves

MSS SP-70 (2006) Standard for Cast Iron Gate Valves,  
Flanged and Threaded Ends

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check  
Valves

MSS SP-86 (2002) Guidelines for Metric Data in  
Standards for Valves, Flanges, Fittings  
and Actuators

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-50457 (2001a) Valves Radiator, Heating Packless  
Bonnett, Class 125 PSIG

FS WW-V-35 (Rev C) Valve, Ball

## 1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

[Fabrication Drawings](#) shall be submitted for the following in accordance with paragraph entitled, "General Requirements," of this section.

[Valves](#)  
[Accessories](#)

Installation drawings for valves shall be in accordance with the paragraph entitled, "Installation," of this section.

### SD-07 Certificates

[Listing of Product Installation](#) shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Certificates shall be submitted for the following items showing conformance to the referenced standards contained in this section.

Gate Valves  
Globe and Angle Valves  
Check Valves  
Cone-Plug Balancing Valve  
Eccentric Plug Valves  
Ball Valves  
Dial Cocks  
Diaphragm Control and Instrument Valves

### 1.3 GENERAL REQUIREMENTS

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NOTE: If Section 23 00 00.00 40 HEATING, VENTILATING, AND AIR-CONDITIONING is not included in the project specification, applicable requirements therefrom should be inserted and the first paragraph deleted. If Section 23 31 13.20 40 WELDING METAL DUCTWORK is not included in the project specification, applicable requirements therefrom should be inserted and the second paragraph deleted.  
\*\*\*\*\*

[Section 23 00 00.00 40 HEATING, VENTILATING, AND AIR-CONDITIONING applies to work specified in this section.]

[Section 23 31 13.20 40 WELDING METAL DUCTWORK applies to work specified in this section.]

Fabrication Drawings shall be submitted for each type of Valves and Accessories used, meeting referenced standards contained within this section.

Listing of Product Installation shall be submitted for valve assemblies indicating at least five installed units, similar to those proposed for use, that have been in successful service for a minimum of five years.

## PART 2 PRODUCTS

### 2.1 COMPONENTS

#### 2.1.1 Dial Cocks

Dial cocks in sizes DN65 2-1/2-inch ips and smaller with pointer and etched position dial shall be rated 1100 kilopascal 150-psi working steam pressure (wsp) and shall be of manufacturer's standard all-brass construction.

#### 2.1.2 Diaphragm Control and Instrument Valves (DCIV)

Diaphragm control and instrument valves in sizes DN8 and DN10 1/4 and 3/8 inch shall have a forged-brass body with reinforced tetrafluoroethylene diaphragm, and an AISI 300 series corrosion-resistant steel spring with round phenolic handle. Handle shall be fitted with disks color-coded in accordance with ISA RP60.9.

## 2.2 FABRICATION

### 2.2.1 Gate Valves

\*\*\*\*\*  
NOTE: These valves are recommended for steam and condensate service.  
\*\*\*\*\*

#### 2.2.1.1 2500 kPa350 psi

Valves shall be rated 2100 kilopascal 300 pounds per square inch (psi) working steam pressure (wsp) and shall conform to ASME B16.34.

Body end connections shall be flanged for all valves larger than DN50 2 inches, unless butt weld ends are specified. [Screwed] [Socket] weld shall be used for sizes DN50 2 inches and under to suit specified piping system end connection and maintenance requirements, or be welded. Flange faces shall have concentric serrated finish.

Body to bonnet connection shall be [union] [gasketed-bolted] type for valves DN50 2 inches and under and gasketed-bolted type for valves larger than DN50 2 inches. Bonnet shall be outside screw and yoke (OS&Y) type, rising stem.

Body and bonnet assembly shall be [cast steel] [forged carbon steel]. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

\*\*\*\*\*  
NOTE: Select the following paragraph only after checking flow coefficients.  
\*\*\*\*\*

[Valves shall have a full port.]

Trim shall include [hard-surfaced solid] [one-piece flexible] wedge disc and hard-surfaced seats. Stem shall be rising and backseating type.

Trim materials and hard-surfaced substrates shall [conform to ASTM A 182/A 182M, Grade F6] [shall be manufacturer's standard metallurgical equivalents for the specified service].

Hard surfacing alloy shall conform to AWS A5.13, [Class RNiCr-B] [Class RCoCr-B].

Packing shall be wire-reinforced, fiber braid impregnated with [30 percent tetrafluoroethylene] [a corrosion-inhibiting lubricant specifically suitable for service with stem material provided].

Valve wheels shall be [cast iron] [malleable iron] [wrought steel].

\*\*\*\*\*  
NOTE: Drawings shall note all locations where an integral bypass valve is required. Integral bypass valves are used for valves larger than 6 inches DN150 and for smaller sizes where unusual warmup operations will occur.  
\*\*\*\*\*



Integral bypass globe valves shall be provided around valves larger than DN150 6 inches. Bypass valves shall be factory installed and shall be [butt] [socket] welded end, conforming to the same requirements as the main valve, except that in all cases valve seat and plug disk shall be hard surfaced and seat shall be removable, replaceable type. Piping connections shall be pressure tubing, conforming to Schedule 80 ASTM A 106/A 106M, Grade [B] [C], and without change of direction fittings, i.e., bent. Connection shall be to valve bosses located to perform specified function. Valves with integral bypass shall be shipped bolted to crates in a manner that will preclude damage to bypass assembly.

\*\*\*\*\*

NOTE: Drawings shall note all locations where integral drain valve is required. Integral drain valves are particularly useful in tall risers and shall be noted in all cases where required except where valve size is less than 2 inches DN50, in which case an independent drain shall be provided immediately above the valve. Note pitch of horizontal lines.

\*\*\*\*\*

Integral drain valve assembly shall be [factory] [field] installed. Connection to main valve body shall be welded. Drain valve shall be trimmed with manufacturer's standard hardened corrosion-resistant steel. Piping shall be pressure tubing conforming to ASTM A 106/A 106M, Grade [B] [C]. Drain discharge shall be [capped] [plugged]; threaded closure assembly shall be made with tetrafluoroethylene tape.

#### 2.2.1.2 1100 kPa150 psi

Valves shall be rated 1100 kilopascal 150-psi (wsp) and shall conform to ASME B16.34.

Body end connections shall be flanged for all valves larger than DN50 2 inches unless butt weld ends are specified. [Screwed] [Socket] weld shall be used for sizes DN50 2 inches and under to suit specified piping system end connection and maintenance requirements. Flange faces shall have concentric serrated finish.

Body to bonnet connection shall be [union] [gasketed-bolted] type for valves DN50 2 inches and under and gasketed-bolted type for valves larger than DN50 2 inches. Bonnet shall be OS&Y type, rising stem.

Body and bonnet assembly shall be [cast steel] [forged carbon steel]. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

\*\*\*\*\*

NOTE: Select the following paragraph only after checking flow coefficients.

\*\*\*\*\*

[Valves shall have a full port.]

Trim for valves larger than DN50 2 inches shall include [hard surfaced solid] [one-piece flexible-wedge] disk and hard-surfaced seats. Trim for valves DN50 2 inches and under shall include [hard-surfaced]

[hardened-solid] [one-piece flexible wedge disk] and [hard-surfaced] [hardened seats]. Hardened components shall have Brinell hardness of not less than 500. Stem shall be rising and backseating type.

Trim materials and hard-surfaced substrates [shall conform to ASTM A 182/A 182M, Grade F6] [shall be manufacturer's standard metallurgical equivalents for the specified service].

Hard-surfacing alloy shall conform to AWS A5.13, [Class RNiCr-B] [Class RCoCr-B].

Packing shall be wire reinforced, fiber braid impregnated with [30 percent tetrafluoroethylene] [a corrosion-inhibiting lubricant specifically suitable for service with stem material provided].

Valve wheels shall be [cast iron] [malleable iron] [wrought steel].

\*\*\*\*\*  
NOTE: Drawings shall note all locations where an integral bypass valve is required. Integral bypass valves are used for valves larger than 6 inches DN150 and for smaller valves where unusual warmup operations will occur.  
\*\*\*\*\*

Integral bypass globe valves shall be provided around valves larger than DN150 6 inches. Bypass valves shall be factory installed and shall be [butt] [socket] welded end, conforming to the same requirements as the main valve except that in all cases, valve seat and disk shall be hard-surfaced and seat shall be removable, replaceable type. Piping connections shall be pressure tubing, conforming to Schedule 80 ASTM A 106/A 106M, Grade [B] [C], and without change of direction fittings; i.e., bent. Connection shall be to valve bosses located to perform specified function. Valves with integral bypass shall be shipped bolted to crates in a manner that will preclude damage to bypass assembly.

\*\*\*\*\*  
NOTE: Drawings shall note all locations where integral drain valve is required. Integral drain valves are particularly useful in tall risers and shall be noted in all cases where required except where valve size is less than DN50 2 inches, in which case an independent drain shall be provided immediately above the valve. Note pitch of horizontal lines.  
\*\*\*\*\*

Integral drain valve assembly shall be [factory] [field installed]. Main valve boss shall be factory drilled. Connection to main valve body shall be welded. Drain valve shall be trimmed with manufacturer's standard hardened corrosion-resistant steel. Piping shall be pressure tubing conforming to ASTM A 106/A 106M, Grade [B] [C]. Drain discharge shall be [capped] [plugged], and threaded closure assembly shall be made with tetrafluoroethylene tape. All necessary handling and shipping care shall be provided.

#### 2.2.1.3 900 kPa125 psi

Valves shall be rated 900 kilopascal 125-psi (wsp) and shall conform to

MSS SP-80 and MSS SP-86 wedge disc, rising stem, inside screw, 900 kilopascal 125-pound for sizes DN50 2 inches and under and to MSS SP-70 for sizes over DN50 2 inches.

Body end connections shall be flanged for all valves larger than DN50 2 inches and shall be screwed in sizes DN50 2 inches and under to suit specified piping system end connection and maintenance requirements.

Valves, in sizes DN50 2 inches and under, shall be union-bonnet type. Cast iron shall conform to ASTM A 126/A 126M, Class B.

Stem shall be rising and backseating type.

Packing shall be fiber braid impregnated with 30 percent tetrafluoroethylene.

Valve wheels shall be [cast iron] [malleable iron] [wrought steel].

\*\*\*\*\*

NOTE: The following materials selection may be desirable as a means of eliminating dissimilar metal couples in a corrosive condensate. Forged steel valve cost premium on per-unit basis is approximately 100 percent.

Coordinate the following selection with appropriate selections for 1100 150 service valves.

\*\*\*\*\*

For condensate service, screwed-end gate valves shall be 1100 kilopascal 150-psi, wsp-rated, forged steel, conforming to ASME B16.34, except that trim shall be manufacturer's standard corrosion-resistant steel.

\*\*\*\*\*

NOTE: Drawings shall note all locations where an integral bypass valve is required. Integral bypass valves are used for valves larger than 6 inches DN150 and where warmup operations will occur.

\*\*\*\*\*

Integral bypass globe valves shall be provided around valves larger than DN150 6 inches. Main valve body taps shall be factory installed. Bypass valves shall be globe type, [factory] [field] installed, and shall be socket welded end conforming to ASME B16.34, except that in all cases, valve seat and plug disk shall be hard-surfaced and seats shall be removable replaceable type. Piping connections shall be pressure tubing, conforming to Schedule 80 ASTM A 106/A 106M, Grade [B] [C], and without change of direction fittings; i.e., bent, and shall include a socket welded end 20700 kilopascal 3,000-psi-rated, forged steel union with corrosion-resistant steel insert. Connection shall be to valve bosses located to perform specified function. Valves with integral bypass shall be shipped bolted to crates in a manner that will preclude damage to bypass assembly.

\*\*\*\*\*

NOTE: Drawings shall note all locations where integral drain valve is required. Integral drain valves are particularly useful in tall risers and shall be noted in all cases where required except

where valve size is less than 2 inches DN50, in which case an independent drain shall be provided immediately above the valve. Note pitch of horizontal lines.

\*\*\*\*\*

Integral drain valves shall be provided. Main valve boss penetration shall be factory finished, and drain assembly shall be [factory] [field] installed. Drain valve shall be gate type. Piping shall be pressure tubing conforming to ASTM A 106/A 106M, Grade [B] [C]. Drain discharge shall be [capped] [plugged], and threaded closure assembly shall be made with tetrafluoroethylene tape.

## 2.2.2 Globe and Angle Valves

\*\*\*\*\*

**NOTE: These valves are recommended for steam and condensate service.**

\*\*\*\*\*

### 2.2.2.1 2500 kPa350 psi

Valves shall be rated 2100 kilopascal 300-psi (wsp) and shall conform to ASME B16.34.

Body end connections shall be flanged for all valves larger than DN50 2 inches, unless butt weld ends are specified. [Screwed] [Socket] weld shall be used for sizes DN50 2 inches and under to suit specified piping system end connection and maintenance requirements. Flange faces shall have concentric serrated finish.

Body to bonnet connection shall be [union] [gasketed-bolted] type for valves DN50 2 inches and under; gasketed-bolted type for valves larger than DN50; 2 inches; and for valves DN10 3/8 inch and under, assembly shall be screwed type. Bonnet shall be OS&Y type, except that valves DN10 3/8 inch and under shall be inside screw type.

Body and bonnet assembly shall be [cast steel] [forged carbon steel]. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

Trim shall include hard-surfaced plug disk and hard-surfaced seats. Stem shall be rising and backseating type.

Trim materials and hard surface substrates shall [conform to ASTM A 182/A 182M, Grade F6] [be manufacturer's standard metallurgical equivalents for the specified service].

Hard-surfacing alloy shall conform to AWS A5.13, [Class RNiCr-B] [Class RCoCr-B].

Packing shall be wire reinforced, fiber braid impregnated with [30 percent tetrafluoroethylene] [a corrosion-inhibiting lubricant specifically suitable for service with stem material provided].

Valve wheels shall be [cast iron] [malleable iron] [wrought steel].

\*\*\*\*\*

**NOTE: Drawings shall note all locations where**

integral drain valve is required. Integral drain valves are particularly useful in risers and shall be noted in all cases where required except where valve size is less than DN50 2 inches, in which case an independent drain shall be provided immediately above the valve. Note pitch of horizontal lines.

\*\*\*\*\*

Integral drain valves shall be provided. Main valve boss penetration shall be factory finished and drain assembly shall be [factory] [field] installed. Connection to main valve body shall be welded. Drain valve shall be trimmed with manufacturer's standard hardened corrosion-resistant steel. Piping shall be pressure tubing, conforming to ASTM A 106/A 106M, Grade [B] [C]. Drain discharge shall be [capped] [plugged], and threaded closure assembly shall be made with tetrafluoroethylene tape.

#### 2.2.2.2 1100 kPa150 psi

Valves shall be rated 1100 kilopascal 150-psi working steam pressure (wsp) and shall conform to ASME B16.34.

Body end connections shall be flanged for all valves larger than DN50 2 inches, unless butt weld ends are indicated. [Screwed] [Socket] weld shall be used for sizes DN50 2 inches and under to suit specified piping system end connection and maintenance requirements. Flange faces shall have concentric serrated finish.

Body to bonnet connection shall be [union] [gasketed-bolted] type for valves DN50 2 inches and under; gasketed-bolted type for valves larger than DN50 2 inches; and for valves DN10 3/8 inch and under, assembly shall be screwed type. Bonnet shall be OS&Y type, except that valves DN10 3/8 inch and under shall be inside screw type.

Body and bonnet assembly shall be [cast steel] [forged carbon steel]. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

Trim for valves larger than DN50 2 inches and for all sizes of valves in bypass service shall include hard-surfaced, solid plug disk and hard-surfaced seats. Plug material in valves DN50 2 inches and under shall be [as specified for valves larger than DN50 2 inches] [in accordance with AISI 400 series corrosion-resistant steel hardened to not less than 500 Brinell]. Stem shall be rising and backseating type.

Trim materials and hard surface substrates [shall conform to ASTM A 182/A 182M, Grade F6] [shall be manufacturer's standard metallurgical equivalents for the specified service].

Hard-surfacing alloy shall conform to AWS A5.13, [Class RNiCr-B] [Class RCoCr-B].

Packing shall be wire reinforced, fiber braid impregnated with [30 percent tetrafluoroethylene] [a corrosion-inhibiting lubricant specifically suitable for service with stem material provided].

Valve wheels shall be [cast iron] [malleable iron] [wrought steel].

\*\*\*\*\*

**NOTE: Drawings shall note all locations where**

integral drain valve is required. Integral drain valves are particularly useful in tall risers and shall be noted in all cases where required except where valve size is less than DN50, 2 inches, in which case an independent drain shall be provided immediately above the valve. Note pitch of horizontal lines.

\*\*\*\*\*

Integral, drain-valves assembly shall be [factory] [field] installed. Main valve boss shall be factory drilled. Connection to main valve body shall be welded. Drain valve shall be trimmed with manufacturer's standard hardened corrosion-resistant steel. Piping shall be pressure tubing conforming to ASTM A 106/A 106M, Grade [B] [C]. Drain discharge shall be [capped] [plugged]. Threaded closure assembly shall be made with tetrafluoroethylene tape.

#### 2.2.2.3 900 kPa125 psi

Valves shall be rated 900 kilopascal 125-psi (wsp) and shall conform to MSS SP-80, MSS SP-86, [globe] [angle], [900] [1100] kilopascal. [125] [150]-pound.

Body end connections shall be flanged for all valves larger than DN50 2 inches and shall be screwed for sizes DN50 2 inches and under.

Valves DN50 2 inches and under in size shall be union bonnet type.

Cast iron shall conform to ASTM A 126/A 126M, Class B.

Stem shall be rising and backseating type.

Composition seating surface disc construction may be substituted for metal plug disc connection.

\*\*\*\*\*

NOTE: Select the following paragraph for large pressure regulating stations.

\*\*\*\*\*

[Pressure regulating station bypass valves shall be 1100 kilopascal 150 psi.]

\*\*\*\*\*

NOTE: Select the following paragraph for miscellaneous high-pressure drop throttling.

\*\*\*\*\*

[Plug material for throttling valves DN50 2 inches and under shall be AISI 400 series corrosion-resistant steel hardened to not less than 500 Brinell.]

Packing shall be fiber braid impregnated with 30 percent tetrafluoroethylene.

Valve wheels shall be [cast iron] [malleable iron] [wrought steel].

\*\*\*\*\*

NOTE: Drawings shall note all locations where integral drain valve is required. Integral drain valves are particularly useful in tall risers and

shall be noted in all cases where required, except where valve size is less than DN50 2 inches in which case an independent drain shall be provided immediately above the valve. Note pitch of horizontal lines.

\*\*\*\*\*

Integral drain valves shall be provided. Main valve boss penetration shall be factory finished and drain assembly shall be [factory] [field] installed. Drain valve shall be gate type. Piping shall be pressure tubing conforming to ASTM A 106/A 106M, Grade [B] [C]. Drain discharge shall be [capped] [plugged], and threaded closure assembly shall be made with tetrafluoroethylene tape. All necessary handling and shipping care shall be provided.

#### 2.2.2.4 Type A Rated 41400 kPa 6000 psi WOG

Valves shall be Y-body globe type rated 17300 kilopascal wsp and 41400 kilopascal 2,500-psi wsp and 6,000-psi wog with seal-guided disc, [hard-surfaced integral] [inserted and welded seats] hard-surfaced body backseating, loose backseat, swing-eye gland bolts, and malleable-iron, impact-type, valve wheels and handles.

Body and bonnet assembly shall be forged corrosion-resistant steel conforming to ASTM A 182/A 182M, Grade F 316.

Trim shall conform to ASTM A 182/A 182M, Grade F 316.

Bronze stem bushing shall conform to ASTM B 148, C95300, heat treated or as approved.

\*\*\*\*\*

**NOTE: Select one of the following two paragraphs after checking flow coefficient.**

\*\*\*\*\*

[Valves shall have a full port.]

[Valves shall have [full] [reduced] ports.]

Valve body shall have butt weld ends except that valves DN40 1-1/2-inch iron pipe size (ips) and smaller shall be socket weld end type.

#### 2.2.2.5 Type B Rated 41400 kPa 6000 psi WOG

Valves shall be Y-body type, piston check, rated 17300 kilopascal wsp and 41400 kilopascal wog 2,500-psi wsp and 6,000-psi wog; [seal welded] [pressure seal bonnet], hard-surfaced, spring-loaded, body guided disk; and [hard-surfaced integral] [inserted and welded seat].

Body and bonnet assembly shall be forged corrosion-resistant steel conforming to ASTM A 182/A 182M, Grade F 316.

Trim shall conform to ASTM A 182/A 182M, Grade F 316.

Spring shall be corrosion-resistant steel.

Valve body shall have butt weld ends, except that valves DN40 1-1/2 inch ips and smaller shall be socket-weld end type.

#### 2.2.2.6 Type A 13800 kPa 2000 psi WOG

Valves shall be globe type rated 4200 kilopascal wsp and 13800 kilopascal wog 600-psi wsp and 2,000-psi wog, with union, [seal welded] [pressure sealed bonnet] OS&Y, hard-surfaced, loose disc, hard surfaced seat, minimum 375 Brinell backseating, loose backseat where required for access, and a malleable iron [hand wheel] [handle]. Body and bonnet assembly shall be forged corrosion-resistant steel conforming to ASTM A 182/A 182M, Grade F 316.

Trim shall [conform to ASTM A 182/A 182M, Grade F 316] [be manufacturer's standard equivalent materials for the specified service].

Valve body shall have butt weld ends, except that valves DN40 1-1/2 inch ips and smaller may be socket-weld end type.

#### 2.2.3 Check Valves

\*\*\*\*\*  
NOTE: These valves are recommended for steam and condensate service.  
\*\*\*\*\*

##### 2.2.3.1 2500 kPa350 psi

Valves shall be rated 2100 kilopascal 300-psi wsp and shall conform to applicable portions of ASME B16.34.

Valves shall be horizontal swing-check type.

Body end connections shall be flanged for all valves larger than DN50 2 inches unless butt weld ends are specified. [Screwed] [Socket] weld shall be used for sizes DN50 2 inches and under to suit specified piping system end connection and maintenance requirements. Flange faces shall have concentric serrated finish.

Body to cover connection shall be [union] [gasketed-bolted] type.

Body and bonnet assembly shall be [cast steel] [forged carbon steel]. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

Trim materials, including hinge pin, shall be manufacturer's standard corrosion-resistant alloys for the specified service.

##### 2.2.3.2 900 kPa125 psi

Valves shall be rated 900 kilopascal 125-psi wsp and standard horizontal swing type shall conform to MSS SP-80, MSS SP-86, swing check, 900 kilopascal. 125-pound.

Body end connections shall be flanged for all valves larger than DN50 2 inches and screwed in sizes DN50 2 inches and under.

Body to cover connection in sizes larger than DN50 2 inches shall be gasketed-bolted type, and valve body shall be [cast iron, conforming to ASTM A 126/A 126M, Class B] [Class 1 [ Class 1, at 178 degrees C; 1379 kilopascal125-psig, wsp at 353 degrees F; 200-psig water, oil and gas



(wog), nonshock] valves conforming to MSS SP-70]. Flanges shall conform to ASME B16.1.

Swing-check pin shall be corrosion-resistant [steel] [bronze] [brass]. Swing check angle of closure shall be manufacturer's standard, unless a specific angle is indicated.

Valve disk shall be [regrindable metal] [renewable composition] type.

#### 2.2.3.3 Manual Radiator Valves

\*\*\*\*\*  
NOTE: The following paragraph applies to steam and  
hot water systems.  
\*\*\*\*\*

Valves to control heating using medium heating element shall be packless type, metallic diaphragm seal, using MSS SP-86 (FS A-A-50457, Type II, Style D) conforming to FS A-A-50457, Type II, Style D metallic diaphragm seal.

#### 2.2.4 CONE-PLUG BALANCING VALVE (CPBV)

Cone-plug balancing valves in sizes through DN32 1-1/4 inches shall be thread end, conforming to ASME B1.20.1 and ASME B1.20.1M, and shall be rated for service at not less than 1207 kilopascal at 121 degrees C 175 psi at 250 degrees F. Valve body and components shall be [ASTM B 61 bronze] [manufacturer's equal-strength brass materials]. Valve plug shall be swivel-type contoured cone and shall not rattle or make noise in service at any balancing position. Valve shall have high temperature, service-rated packing, with bushing in bottom of gland and gland adjustment. Valves shall be fitted with a memory device which shall permit a valve set at a balance point to be opened or closed but not opened beyond the balance point. Valve shall be nonrising stem type. Where used for combination shutoff and balancing service, valve shall be furnished with insulating composition handle.

#### 2.2.5 Eccentric Plug Valves (EPV)

\*\*\*\*\*  
NOTE: Review service temperature range of dual  
temperature systems prior to making selection and  
restrict to temperatures and materials to ensure  
long elastomer life.  
\*\*\*\*\*

[Eccentric plug valves in sizes DN50 2 inches and smaller shall be constructed of manufacturer's standard [brass] [bronze] materials conforming to [ASTM B 61] [ASTM B 62]. Valves shall be rated for service at 1207 kilopascal 175-psi maximum nonshock pressure at 121 degrees C 250 degrees F. Valve body shall have screwed ends. Eccentric plug surfaces in contact with flow shall be coated with a 60 to 70 Shore A durometer hardness elastomer, resistant to treated water. Valves used for combination shutoff and balancing service shall be fitted with a memory device or mechanism which shall permit a valve set at a balance point to be operated to the closed position.]

[Reopening, limited to eccentric plug valves in sizes DN65 2-1/2 inches and larger, shall be constructed of Type 2 nickel-alloy iron conforming to

ASTM A 436. Valves shall be rated for service at 1207 kilopascal 175-psi maximum nonshock pressure at 121 degrees C. 250 degrees F. Valve body shall have screwed ends. Eccentric plug surfaces shall be coated with a 60 to 70 Shore A durometer hardness elastomer, resistant to treated water. Valves used for combination shutoff and balancing service shall be fitted with a memory device. Memory device or mechanism shall permit a valve set at a balance point to be operated to the closed position, but with reopening limited to the balance point. Valves up to DN150 6-inch ips shall be fitted with removable lever operator.]

\*\*\*\*\*  
NOTE: Normally delete the following paragraphs.  
Limit to DN125 5-inch valves. Cross sectional area  
of valve bore, when open, shall equal pipe inlet  
area.  
\*\*\*\*\*

[Valves, DN150 6-inch ips and larger, shall be fitted with totally enclosed, flood-lubricated, worm-gear drive; operating torque shall not exceed 68 newton meter 50 foot-pounds.]

#### 2.2.6 Ball Valves (BAV)

Ball valves shall conform to FS WW-V-35. Valves shall be [Style 1 (removal not required for inspection and repair)] [Style 3 (removal required for inspection and repair)].

\*\*\*\*\*  
NOTE: Due to the generalized approach of FS WW-V-35 and to the fact that there are more than 50 manufacturing sources of varied quality ball valves, it is suggested that the manufacturer's list of typical sources and model numbers be published as part of the specification. Typical source list should be checked for each project application.  
  
If the following paragraph is changed, check manufacturing sources.  
\*\*\*\*\*

[Valves shall be rated for service at not less than 1207 kilopascal at 93 degrees C 175 psi at 200 degrees F.]

Valve bodies in sizes DN50 2-inch ips and smaller shall be screwed-end-connection type, constructed of Class A copper alloy.

Valve bodies in sizes DN50 2-1/2-inch ips and larger shall be flanged-end connection type, constructed of Class [D] [E] [F] material.

Balls and stems of valves DN50 2-inch ips and smaller shall be [manufacturer's standard Class A copper alloy with 900 Brinell hard-chrome plate finish] [Class C corrosion-resistant steel alloy with hard-chrome plate.] Electroless nickel plating is acceptable.

Balls and stems of valves DN65 2-1/2-inch ips and larger shall be manufacturer's standard Class C, corrosion-resistant steel alloy with hard-chrome plate. In valves DN150 6-inch ips and larger, balls shall be Class D with 900 Brinell hard-chrome plate. Electroless nickel-plating is acceptable.

Valves shall be suitable for flow from either direction and shall seal equally tight in either direction.

Valves shall have full-pipe-size flow areas.

Valves with ball seals kept in place by spring washers are not acceptable. Valves shall have adjustable packing glands. Seats and seals shall be tetrafluoroethylene.

Valve body construction shall be such that:

Torque from a pipe with a valve installed shall not tend to disassemble the valve by stripping setscrews or loosening body-end inserts or coupling nuts.

Torque from a pipe shall be resisted [by a one-piece body between end connections] [by bolts in shear] where body is of [mating-flange] [surface-bolted construction].

#### 2.2.6.1 Plastic, PVC

\*\*\*\*\*  
NOTE: Valves shall be used in industrial pressure piping service where resistance to corrosion is of prime importance and service temperature does not exceed 60 degrees C 140 degrees F.  
\*\*\*\*\*

Ball valves shall be manufactured from a PVC compound that meets the requirements of Type 1, Grade 1 PVC as outlined in ASTM D 1784. Valves shall also conform to NSF/ANSI 14 and MSS SP-86.

Valves shall have Teflon ball seals and Viton stem and body seals. Ball valves shall carry a pressure rating of 1100 kilopascal 150-psi circulating water pressure (cwp) at 24 degrees C 75 degrees F.

#### 2.2.6.2 Plastic, CPVC

\*\*\*\*\*  
NOTE: Valves shall be used in industrial pressure piping service where resistance to corrosion is of prime importance and service temperature does not exceed 60 degrees C at 455 kilopascal. 200 degrees F at 66 psi.  
\*\*\*\*\*

Ball valves shall be manufactured from a compound which meets or exceeds the requirements for Class 23447-B CPVC in ASTM D 1784. Valves shall also conform to NSF/ANSI 14 and MSS SP-86.

Valves shall have Teflon ball seals and Viton stem and body seals. Ball valves shall carry a pressure rating of 1100 kilopascal cwp at 24 degrees C 150-psi cwp at 75 degrees F.

## 2.2.7 Butterfly Valves (BUV)

### 2.2.7.1 Metal

\*\*\*\*\*

NOTE: Review service temperature of systems prior to selection and restrict temperatures or materials as necessary to ensure long elastomer life.

The following is limited to valve sizes through DN500 20 inches. Economical selection point is 100 millimeter 4 inches and up.

\*\*\*\*\*

Butterfly valves shall conform to MSS SP-67.

Butterfly valves shall be wafer type for mounting between specified flanges and shall be rated for 1100 kilopascal 150-psig shutoff and nonshock working pressure. Body shall be cast-ferrous metal, conforming to requirements of ASTM A 126/A 126M, Class B, and to ASME B16.1 for body wall thickness.

Face-to-face dimensions shall conform to MSS SP-67.

\*\*\*\*\*

NOTE: Henry Pratt valves cannot conform to the following paragraph.

\*\*\*\*\*

Valves installed in insulated piping systems shall be provided with extended bonnets placing the operator beyond the specified insulation.

Disk shall be free of external ribs and shall be streamlined. Disk shall be fabricated from [cast ferrous] [nonferrous] alloys conforming to [ASTM A 126/A 126M, Class B (cast iron)] [ASTM A 436, Type [1] [2] (austenitic cast iron)] [ASTM A 216/A 216M, Grade WCB (cast steel)] [ASTM A 395/A 395M (ductile iron)] [ASTM B 62; bronze] [ASTM B 584; bronze] [ASTM B 148; bronze].

Use of taper pins to secure the valve disc to the shaft is prohibited.

Shafts shall be fabricated from [AISI Type-00 series] [17-4 PH corrosion-resistant steel] [nickel-copper alloy] conforming to ASTM B 164, and shall be [one-piece] [stub-shaft] type. Stub shafts shall extend into the disk hub at least 1-1/2 shaft diameters except for angle disk construction. Connection between the valve shaft and disk shall be designed to transmit shaft torque equivalent to not less than 75 percent of the torsional strength of the minimum required shaft diameter. Minimum shaft diameter for all valves shall be in accordance with the following:

<u>DN-VALVE SIZE</u> <u>(MILLIMETER)</u>	<u>SHAFT DIAMETER</u> <u>(MILLIMETER)</u>	<u>DN-VALVE SIZE</u> <u>(MILLIMETER)</u>	<u>SHAFT DIAMETER</u> <u>(MILLIMETER)</u>
65	11	250	28
80	15	300	32
100	18	350	40

<u>DN-VALVE SIZE</u> <u>(MILLIMETER)</u>	<u>SHAFT DIAMETER</u> <u>(MILLIMETER)</u>	<u>DN-VALVE SIZE</u> <u>(MILLIMETER)</u>	<u>SHAFT DIAMETER</u> <u>(MILLIMETER)</u>
125	19	400	41
150	20	450	47
200	22	500	53

\*\*\*\*\*

**NOTE: Henry Pratt and other manufacturers are limited to 93 degrees C 200 degrees F service by their elastomer.**

\*\*\*\*\*

<u>VALVE SIZE</u> <u>(INCH)</u>	<u>SHAFT DIAMETER</u> <u>(INCH)</u>	<u>VALVE SIZE</u> <u>(INCH)</u>	<u>SHAFT DIAMETER</u> <u>(INCH)</u>
2-1/2	7/16	10	1-1/8
3	1/2	12	1-1/4
4	5/8	14	1-1/2
5	11/16	16	1-5/8
6	3/4	18	1-7/8
8	7/8	20	2-1/8

Seats and seals shall be resilient-elastomer type designed for field removal and replacement. Elastomers shall be [Buna-N] [ethylene propylene terpolymer] [chloroprene], formulated for continuous immersion service at 121 degrees C 250 degrees F, minimum, and shall be applied at least 10 percent below maximum continuous service temperature. Bonding adhesives shall comply with elastomer temperature requirements and shall have an effective life equal to or greater than the elastomer.

Seals on DN500 20-inch and smaller valves shall be designed [to use standard split-V packing, dual O-rings, and quad rings] [to be the adjustable pull-down type].

Seats may be installed in the [valve body] [on the disk] except that circular cross section O-ring construction is not acceptable.

Seat or disk matting surfaces shall be corrosion-resistant material such as austenitic gray cast iron and bronzes specified for the disk or the materials specified for stems. These materials shall be [welded to substrate and ground] [mechanically retained]. Plated or similarly applied surfacing materials are not acceptable.

\*\*\*\*\*

**NOTE: Norris will modify valve to include bearings.**

\*\*\*\*\*

Bearings shall be permanently lubricated sleeve type of manufacturer's standard corrosion-resistant [steel] [bronze] [nickel-copper alloy] [nylon] [filled tetrafluoroethylene]. Bearings shall be designed for [a pressure not exceeding the published design load for the bearing material]

[one-fifth of the compressive strength of the [bearing] [shaft] material]. Operating end of the shaft shall be provided with [dual inboard bearings] [a single inboard and an outboard bearing] in or beyond the operator.

Padlocking feature shall be provided to make valve tamperproof.

For balancing service, valve operators shall have provision for infinite position locking.

Manual nonchain-operated valves through DN150 6 inches shall be provided with not less than nine-position, lever-lock handles not exceeding 450 millimeter 18 inches in length.

Manual valves DN200 8 inches and larger, or smaller if the application torque exceeds a pull of 356 newtons 80 pounds, shall be provided with gear operators.

Where valves are indicated to be chain operated, all sizes shall be equipped with gear operators, and chain length shall be suitable for proper storage and operation.

Gear operators shall be worm-gear type. Operator shall be totally enclosed in a cast-iron housing, suitable for grease or oil lubrication. Gears shall be hobcut. Cast-iron-housed traveling-nut operators are acceptable MSS SP-67. Maximum manual pull on the handwheel or chain wheel shall be 356 newtons 80 pounds.

[Modulating or remotely actuated two-position service valves, shall be provided with pneumatic operators, pilot positioners, valve position indicators, boosters, and relays. Operating air supply pressure shall be per manufacturer's instructions.]

[Pneumatic operator and adjustable stroke crosslink system shall be provided for bypass operation where indicated.]

[Maximum load on a pneumatic operator shall not exceed 85 percent of rated operator capacity.]

#### 2.2.7.2 Plastic, PVC

\*\*\*\*\*  
NOTE: Valves shall be used in industrial pressure piping service where resistance to corrosion is of prime importance and service temperature does not exceed 60 degrees C 140 degrees F.  
\*\*\*\*\*

Body and disk shall be manufactured of a PVC compound that meets the requirements of Type IO (PVC) as outlined in ASTM D 1784. Valves shall be rated bubble-tight, 1100 kilopascal for DN100, DN150, DN200 150 psi for 4-, 6-, and 8-inch valves, and 310 kilopascal for DN250 45 psi for 10-inch valves at 23 degrees C 73 degrees F water.

[Shaft shall be Type 316 corrosion-resistant steel.]

[Shaft shall be Type 304 corrosion-resistant steel with Penton coating.]

Seat material shall be [Buna-N] [ethylene] [propylene] [Hypalon] [Viton].

Valve body shall be of the wafer design and shall be compatible with 1100 kilopascal 150-psi ANSI flanges. Shaft shall be square in the area of the disk to allow maximum torque-carrying capacities and round in bearing and sealing areas for minimum wear. Seal shall be designed to be reversible and easily removable from the body.

Bearings shall be manufactured of polytetrafluoroethylene 25-percent glass-filled and shall be replaceable. Shaft shall have a Viton secondary seal to ensure maximum sealing characteristics. Disc shall not have holes for pins or bolts to fasten to shaft.

Valve, as supplied by the manufacturer, shall include a [lever handle with index plate] [worm-gear operator].

Valves shall carry an identification plate, securely fastened to the body, that legibly identifies the manufacturer, valve size, manufacturer's serial number, and seat and shaft material.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Valves shall be installed in accordance with the manufacturer's recommendations and in accordance with the applicable requirements of Section 23 05 00.00 40 COMMON WORK RESULTS FOR HVAC.

-- End of Section --