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An American National Standard

Standard Specification for Pressure-Reducing Valves for Steam Service[1]

This standard is issued under the fixed designation F1565; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers self-contained, internally operated, globe style, pressure-reducing valves for use in steam service. In these valves, the downstream pressure feedback is sensed by a spring-loaded diaphragm to position a pilot valve—the pilot valve uses the inlet steam pressure to position the main valve plug via an operating piston.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A105/A105M Specification for Carbon Steel Forgings for Piping Applications

A182/A182M Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

A193/A193M Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

A194/A194M Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

A216/A216M Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A217/A217M Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service

A515/A515M Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

A516/A516M Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

A547 Specification for Steel Wire, Alloy, Cold-Heading Quality, for Hexagon-Head Bolts (Withdrawn 1989)[3]

2.2 *American Society of Mechanical Engineers (ASME) Standards:*[4]

B1.1 Unified Screw Threads

B16.5 Pipe Flanges and Flanged Fittings

B16.34 Valves—Flanged, Threaded, and Welding End

B18.2.1 Square and Hex bolts and Screws, Including Askew Head bolts, Hex Cap Screws, and Lag Screws

2.3 *Federal Specification:*[5]

FED-STD-H 28 Screw-Thread Standards for Federal Services

2.4 *Military Standards and Specifications:*[5]

MIL-V-3 Valves, Fittings, and Flanges (Except for Systems Indicated Herein); Packaging of

MIL-S-901 Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for

MIL-R-2765 Rubber Sheet Strip, Extruded, and Molded Shapes, Synthetic, Oil Resistant

MIL-P-15024 Plates, Tags and Bands for Identification of Equipment

MIL-P-15024/5 Plates, Identification

MIL-R-17131 Rods and Powders, Welding, Surfacing

MIL-G-24716 Gaskets, Metallic-Flexible Graphite, Spiral Wound

MIL-I-45208 Inspection Systems Requirements

MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment (Type I—Environmental and Type II—Internally Excited)

NAVSEA T9074–AQ-GIB-010/271 Nondestructive Testing Requirements for Metals

NAVSEA S9074–AR-GIB-010/278 Fabrication Welding and Inspections and Casting Inspection and Repair for Machinery, Piping and Pressure Vessels in Ships of the United States Navy

MIL-STD-798 Nondestructive Testing, Welding, Quality Control, Material Control and Identification and Hi-Shock Test Requirements for Piping System Components for Naval Shipboard Use

MS 16142 Boss, Gasket Seal Straight Thread Tube Fitting, Standard Dimensions for

[1] This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990.

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

3. Terminology

3.1 *accuracy of regulation*—the amount by which the downstream pressure may vary when the valve is set at any pressure within the required set pressure limit and is subjected to any combination of inlet pressure, flow demand, and ambient temperature variations, within the specified limits.

3.2 *design pressure and temperature*—the maximum pressure and temperature the valve should be subjected to under any condition. These are the pressure and temperature upon which the strength of the pressure-containing envelope is based.

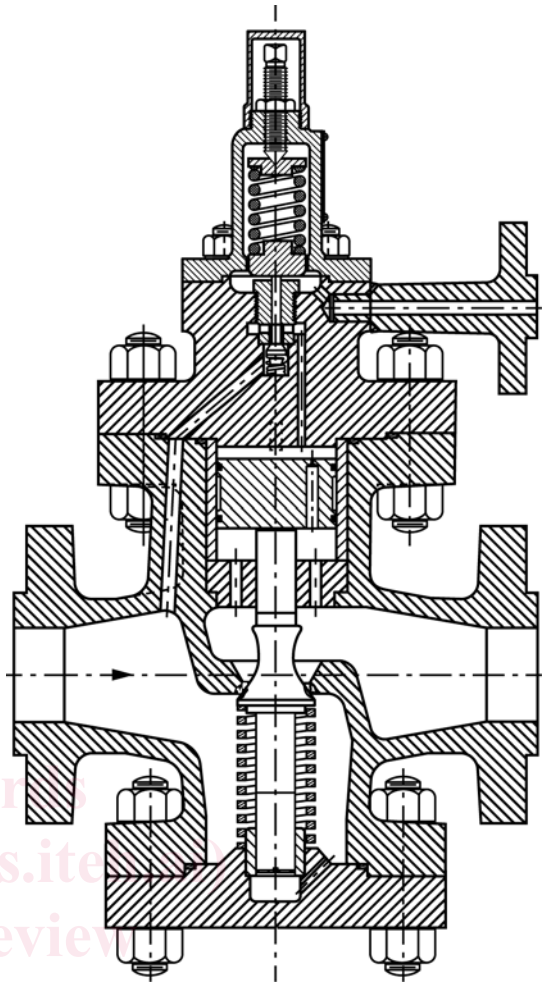
3.3 *hydrostatic test pressure*—the maximum test pressure that the valve is required to withstand without damage. Valve operation is not required during application of this test pressure, but after the pressure has been removed, the valve must meet all performance requirements.

3.4 *lockup pressure*—the outlet pressure delivered by a pressure-reducing valve under shutoff conditions (that is, when the flow demand is reduced to a point where it is equal to or less than the allowable leakage as defined in 8.3).

3.5 *nominal pressure*—the approximate maximum pressure to which the valve will be subjected in service under normal conditions.

3.6 *set pressure*—the downstream pressure which the valve is set to maintain under a given set of operating conditions (that is, inlet pressure and flow). Ideally, the valve should be set at downstream pressure approximately equal to the mid-point of the set pressure limits (defined in 3.7).

3.7 *set pressure limits (range of set pressure adjustment)*—the range of set pressure over which the valve can be adjusted while meeting the specified performance requirements.



NOTE 1—Pictorial representations are for illustrative purpose only and do not imply design.

FIG. 1 Pressure-Reducing Valve (External Pressure Sensing)

4. Classification

4.1 Valves shall be of the following compositions and pressure ratings, as specified (see Section 5 and 6.1.7). The pressure-temperature ratings shown below are applicable to the pressure-containing components of the valve. See Fig. 1 and Fig. 2.

4.1.1 *Composition B*—1¼ % chromium, ½ % molybdenum [maximum temperature 1000°F (see 6.1.7)].

4.2 *Composition D*—carbon steel [maximum temperature 775°F (see 6.1.7)].

4.3 *Pressure Ratings*—These shall conform to ASME Class 150, Class 300, Class 600, or Class 1500.

5. Ordering Information

5.1 Ordering documentation for valves under this specification shall include the following information, as required, to describe the equipment adequately.

5.1.1 ASTM designation and year of issue.

5.1.2 Valve specification code (see 6.1.14).

5.1.3 Composition and pressure rating required (see Section 4).

5.1.4 Trim materials where specific requirement is known (see Table 1, Footnote B, Note 2).

5.1.5 Whether internal or external reduced pressure sensing line is required (see 6.1.2.1).

5.1.6 Accuracy of regulation required if other than listed in 7.2.

5.1.7 Minimum and maximum inlet steam pressures (psig) (see 7.3 and S1.5).

5.1.8 Maximum inlet steam temperature (°F) (see S1.5).

5.1.9 Range of set pressure adjustment for valves, if other than listed in 7.4.

5.1.10 Maximum and minimum capacity required lb/hour.

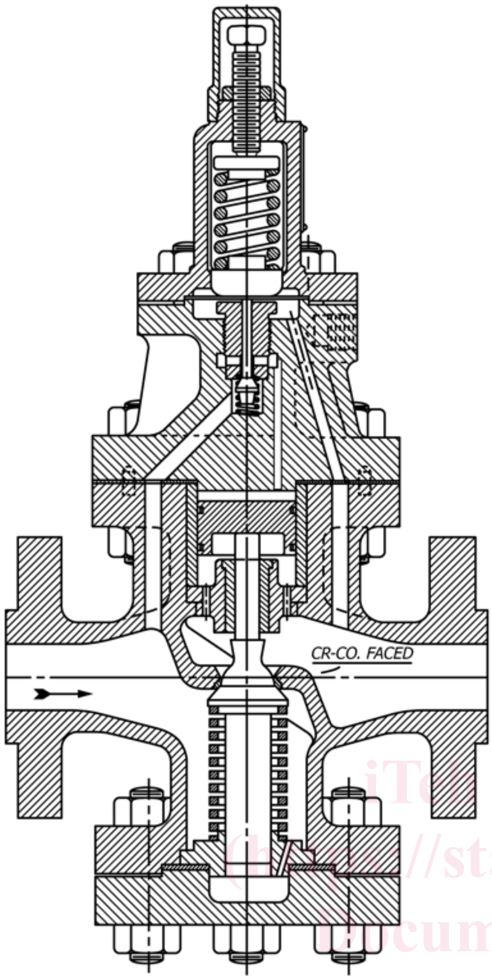
5.1.11 Special tools, if required (see 6.1.15).

5.1.12 Supplementary requirements, if any (see S1 through S4).

6. Valve Construction and Coding

6.1 Valves shall incorporate the design features specified in 6.1.1 – 6.1.14.

6.1.1 *Materials of Construction*—Materials shall be as specified in Table 1. All materials shall be selected to prevent corrosion, galling, seizing, and excessive wear or erosion where applicable. Clearances shall prevent interference as a result of the thermal expansion. Cadmium plating is prohibited.



NOTE 1—Pictorial representations are for illustrative purpose only and do not imply design.

FIG. 2 Pressure-Reducing Valve (Internal Pressure Sensing)

6.1.2 *General Requirements:*

6.1.2.1 Valves will be operated, maintained, and repaired on board ships and shall emphasize simplicity, maintainability, ruggedness, and reliability. Design shall permit access for adjustment and repair when working from either side of the valve and without requiring removal of the valve body from the line. Valves shall be of the self-contained, internal-operated type as described in 1.1.

6.1.2.2 The operating piston shall be separate from the main valve and fitted with one or more piston rings. The design shall prevent water buildup on the piston. The piston shall operate within a separate hardened steel cylinder liner located in the valve body so that removal of the valve bonnet provides access to the top of the piston assembly. The cylinder liner shall be held in place by way of the bonnet bolting or shall be permanently fabricated into the body. The requirement to locate the cylinder liner in the body may be waived where it is shown that an alternative location provides a satisfactory maintenance configuration. Pilot valve and diaphragm chambers shall be self-draining. The pilot valve shall be single seated with integral stem. The valve shall be controlled by a spring-referenced metal diaphragm and shall open against high pressure. A return spring shall keep the pilot valve in contact with the diaphragm at all times. The diaphragm shall not travel through center during any phase of operation. Edges contacting the diaphragm shall be rounded to prevent wear and damage. Condensate chamber or other suitable means shall be provided to preclude internal wetted springs from being exposed to temperatures exceeding their material limitations. The reduced pressure sensing line shall be internal or external as specified (see 5.1).

6.1.3 *Maintainability*—Internal parts shall permit easy disassembly and reassembly with standard tools and shall prevent, as far as practical, the incorrect reassembly of parts. Positioning and alignment of all parts in assembly shall use positive means so that correct reassembly is repeatedly assured. Parts for a given valve shall not be physically interchangeable or

TABLE 1 List of Material

Name of Parts	Composition B	Composition D
Body, bonnet, and bottom cover[A]	ASTM A182/A182M, Grade F11 ASTM A217/A217M, Grade WC6	ASTM A105/A105M, ASTM A216/A216M, Grade WCB, ASTM A515/A515M, A516/A516M, A547
Internal trim	[B]	[B]
Cylinder liner and piston	400 series CRES 500 Brinell min hard	400 series CRES 500 Brinell min hard
Gaskets	MIL-G-24716, Class B	MIL-G-24716, Class B
Diaphragm	Ni-Cr alloy 300 series CRES	Ni-Cr alloy 300 series CRES
Springs	[C]	[C]
Bolting[A]	ASTM A193/A193M, Grade B16 ASTM A194/A194M, Grade 2H	ASTM A193/A193M, Grade B7 ASTM A194/A194M, Grade 2H

[A]If desired by the manufacturer, the higher grade bolting materials may be used in lower temperature categories (for example, Specification A194/A194M, Grade 4 may be used for Composition B, and so forth) and also higher grade body materials for Composition B and D valves (for example, Specification A182/A182M, Grade F22 for Composition B, and so forth).

[B]*Trim materials*—Unless otherwise specified (see 5.1), the valve manufacturer shall select from the categories listed below the trim materials best suited to meet the requirements.

(*1*) Main valve trim materials. Main valve trim (defined as consisting of the seat or seat ring and plug and the guide posts and bushings) materials shall be selected from the following:

(*a*) Stellite—Trim to be Stellite.

(*b*) Hardened corrosion-resistant steel—Hardened corrosion-resistant steel plug (400 series or 17-4 PH) and Stellite seat or seat ring. Guiding surfaces to be hardened corrosion-resistant steel or Stellite.

Nongalling grades of materials shall be chosen to prevent galling between rubbing surfaces. A difference in hardness of at least 100 points Brinell shall be maintained between the rubbing guiding surfaces. This requirement does not apply if both the guide surfaces are Stellited or if the hardness of either exceeds 450 Brinell.

(*c*) Where Stellite is used, it shall consist of either wrought Stellite 6B, cast Stellite 6, or an inlay of Stellite (not less than 3⁄32-in. thickness for main seat and disk surfaces). Where inlays are used, welding rods shall be in accordance with Type MIL-RCoCr-A or MIL-R-17131.

(*2*) Pilot valve trim materials. Pilot valve trim (defined as consisting of the seat, valve, and guiding surfaces) shall be made from one or a combination of the following materials:

(*a*) 400 series or 17-4PH corrosion-resistant steel-hardened.

(*b*) Stellite.

[C] *Spring materials*—Where the working temperature of the spring will exceed 600°F, either Inconel X-750 or A-286 alloy steel shall be used. Where the working temperature of the spring exceeds 450°F, but not 600°F, Inconel 600 or tungsten tool steel may also be used. Where the working temperature of the spring will not exceed 450°F, 300 series corrosion-resistant steel may be used.

reversible, unless such parts are also interchangeable or reversible with regard to function, performance, and strength. Valve design shall permit accomplishment of the following maintenance actions within the time limits specified:

Action	Time Allowed
Disassemble, replace pilot assembly, reassemble	½ h
Renew pilot valve assembly trim	½ h
Renew main valve trim	¾ h

6.1.4 *Interchangeability*—Valve design shall permit interchangeability without individual modification of like parts between all valves. Each part shall have part number identity and shall be replaceable from stock or the manufacturer on a nonselective and random basis. With the exception of matched parts, parts having the same manufacturer's part number shall be directly interchangeable with each other with respect to installation (physical) and performance (function). Physically interchangeable assemblies, components, and parts are those that are capable of being readily installed, removed, or replaced without alteration, misalignment, or damage to parts being installed or to adjoining parts. Fabrication operations such as cutting, filing, drilling, reaming, hammering, bending, prying, or forcing shall not be required.

6.1.5 *Springs*—Springs shall not be fully compressed during any normal operation or adjustment of the valve. The working stress shall be such that relaxation shall not exceed 5 % over a 1000-h period at the nominal operating temperature. Spring ends shall be squared and ground.

6.1.6 *Threads*—Threads shall conform to ASME B1.1. Where necessary, provisions shall be incorporated to prevent accidental loosening of threaded parts. Pipe threads shall not be used. ASME B18.2.1 hex-head standards shall be used.

6.1.7 *Pressure-Temperature Ratings*—Valve pressure-temperature rating shall be in accordance with ASME B16.34 except for maximum allowable temperature. Maximum temperature limitations shall be as follows:

6.1.7.1 *Composition B*—1000°F.

6.1.7.2 *Composition D*—775°F.

6.1.8 *End Preparation*—Valves shall be furnished with flanged ends in accordance with ASME B16.5. Flanges shall be cast or forged integral with the valve body, and the inlet and outlet flanges shall be of the same size and pressure rating.

6.1.9 *Bonnet and Bottom Cover Joints*— Bonnet and bottom cover (where applicable) shall be flanged for attachment to the body. Joints shall be secured by either of the following:

(a) Through-bolts or studs threaded the entire length and fitted with a nut on each end. Threads on bolts, studs, and nuts shall be Class 2 fit in accordance with ASME B1.1.

(b) Studs with interference fit at the tap end sufficient to preclude inadvertent backing out and a Class 2 fit at the nut end.

Bonnet and bottom cover shall be located by body guiding (that is, a close tolerance fit between machined diameters on the body, bonnet, and bottom cover) rather than depending on studs or bolts for location. Spiral wound gaskets shall be fully retained, and the joints shall have metal-to-metal take-up to provide controlled compression of the gaskets. To assure easy gasket removal, not more than two gasket-retaining faces for each gasket shall be formed on a single part. Joint design shall assure parallel alignment of the guide bushings. Sufficient bolting area shall be provided to maintain metal-to-metal make-up over at least a three-year period. Bearing surface of nuts and their respective surfaces on the valve shall be finished machined.

6.1.10 *Body Construction*—Valve bodies shall be machined from a one-piece casting or forging and shall be of basic globe configurations with in-line inlet and outlet ports. Steam lines, except for the external downstream pressure sensing line (where used), shall be internally ported in the body and bonnet. Body passages shall produce gradual changes in flow direction so as to reduce any effects of concentrated impingement and 90° turns. In portions of the valve subject to velocity increases and flow direction changes, such as immediately downstream of the seat, the design shall eliminate direct impingement against the walls at close range.

6.1.11 *Control Connections*—Where external downstream sensing is used, a ½-in. iron pipe size (i.p.s.) flanged connection, which is either cast or forged integral with the body or bonnet or welded, shall be provided.

6.1.12 *Internal Trim*—Internal trim (except welded or brazed-in seat rings) shall be readily replaceable without requiring removal of the valve body from the line. The main plug or disk shall be single seated. Guiding of the plug or disk shall prevent binding or seizing and insure proper seating under all design conditions. This requirement shall be maintained with interchangeable parts and under any tolerance stack-up condition.

6.1.13 *Set Point Adjustment*—Means shall be provided for adjusting the set point through the specified range, with the valve under pressure. The adjusting or loading device shall be safeguarded against accidental change in set point.

6.1.14 *Valve Specification Coding*—Basic valve design features shall be specified and recorded using the following valve coding system. The valve specification code contains four fields of information, which describe the construction features of the valve. Each of these four fields are further assigned their respective codes per Tables 2-5.

ASTM F1565	Valve pressure-rating code (Table 2)	Valve composition code (Table 3)	Valve size code (Table 4)	Set pressure-range code (Table 5)

6.1.15 *Maintainability*—Maintenance shall require standard tools to the maximum extent possible. Any special tools, which are not commercially available, required for adjustment or repair shall be identified and shall be supplied as part of the valve, if specified in the ordering information (see Section 5).

7. Performance

7.1 All valves shall meet the requirements of 7.1.1 – 7.8.

TABLE 2 Valve Pressure Rating Code

Pressure Rating	Code
ASME 150	A
ASME 300	B
ASME 600	C
ASME 1500	D