Designation: F 1565 – 00

An American National Standard

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

This standard is issued under the fixed designation F 1565; 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:*

A 105/A 105M Specification for Carbon Steel Forgings for Piping Applications[2]

A 182/A 182M Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service[2]

A 193/A 193M Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service[2]

A 194/A 194M Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both[2]

A 216/A 216M Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service[3]

A 217/A 217M Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service[3]

A 515/A 515M Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate-and Higher-Temperature Service[4]

A 516/A 516M Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service[4]

A 547 Specification for Steel Wire, Alloy, Cold-Heading Quality, for Hexagon-Head Bolts[5]

2.2 *American Society of Mechanical Engineers (ASME) Standards:*[6]

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:*[7]

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

2.4 *Military Standards and Specifications:*[7]

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

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[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] *Annual Book of ASTM Standards*, Vol 01.01.

[3] *Annual Book of ASTM Standards*, Vol 01.02.

[4] *Annual Book of ASTM Standards*, Vol 01.04.

[5] Discontinued. See 1990 *Annual Book of ASTM Standards*, Vol 01.03.

[6] Available from American Society of Mechanical Engineers, Headquarters, Three Park Ave., New York, NY 10016–5990. (Telephone: 212–591–7722, Telex: 710–591–5267, Fax: 212–591–7674)

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

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

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.

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

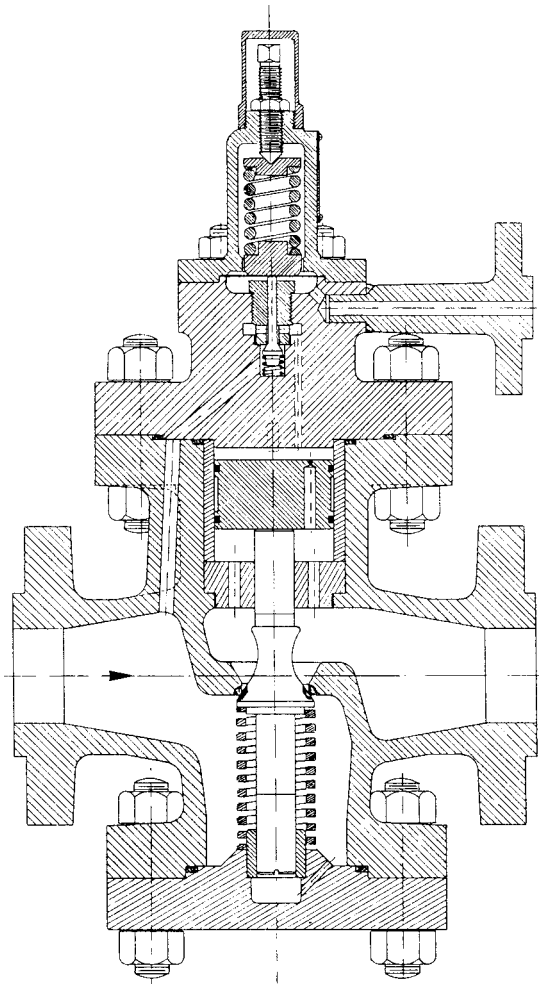
5.1 Ordering documentation for valves under this specification shall include the following information, as required, to describe the equipment adequately.

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).



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

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

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.

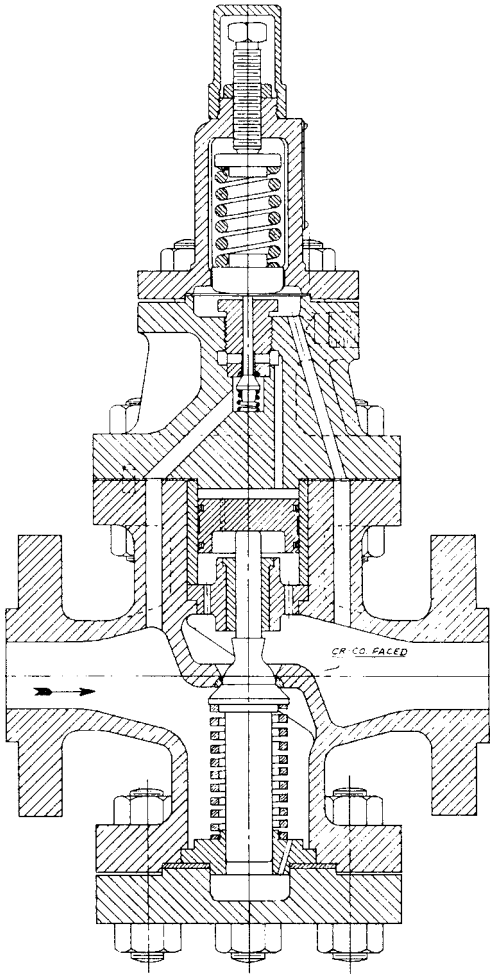
5.1.11 Special tools, if required (see 6.1.15).

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)

TABLE 1 List of Material

Name of Parts	Composition B	Composition D
Body, bonnet, and bottom cover[A]	ASTM A 182/A 182M, Grade F 11 ASTM A 217/A 217M, Grade WC6	ASTM A 105/A 105M, ASTM A 216/A 216M, Grade WCB, ASTM A 515/A 515M, A 516/A 516M, A 547
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 A 193/A 193M, Grade B16 ASTM A 194/A 194M, Grade 2H	ASTM A 193/A 193M, Grade B7 ASTM A 194/A 194M, Grade 2H

[A] If desired by the manufacturer, the higher grade bolting materials may be used in lower temperature categories (for example, Specification A 194/A 194M, 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 A 182/A 182M, Grade F 22 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.

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 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 inadverdent 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 F 1565	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.

7.1.1 *Springs*—Springs shall not exhibit a set in excess of the calculated allowance (See S1.3).

TABLE 2 Valve Pressure Rating Code

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

TABLE 3 Valve Composition Code

Valve Composition	Code
Composition B	B
Composition D	D

TABLE 4 Valve Size Code

Size (NPS)	Code	Size (NPS)	Code	Size (NPS)	Code
0.25	A	1.25	E	3.00	J
0.50	B	1.50	F	3.50	K
0.75	C	2.00	G	4.00	L
1.00	D	2.50	H	as specified	X

TABLE 5 Set Pressure Range Code

Set Pressure Range, psig	Code
10–65	1
35 to 125	2
100 to 450	3
400 to 600	4
As specified	0

7.2 *Accuracy of Regulation*—The valve shall have an accuracy of regulation (see 3.1) of ±5 % or ±2 psi, whichever is greater unless otherwise specified in 5.1.

7.3 *Capacity*—The actual steam flow capacity required, in pounds per hour (lbs/hour), based on the minimum inlet pressure and highest reduced outlet pressure setting under which the valve will be required to operate, shall be as specified (see 5.1). The valve shall meet the specified capacity requirement, or any intermediate capacity requirements down to 10 % of the specified capacity requirement, and shall operate without hunting, chattering, or excessive noise or vibration, or exceeding the accuracy of regulation specified in 7.2, under all specified operating conditions.

7.4 *Range of Set Pressure Adjustment (Set Pressure Limits)*—Valve shall be capable of meeting the performance requirements specified in 7.2 and 7.3 when set at any point within the required range of set pressure adjustment. Unless otherwise specified (see 5.1), valve set pressure shall be adjustable over a range specified in Table 5.

7.5 *Seat Tightness*—With a dead-end downstream volume not exceeding the volume represented by 100 diameters of downstream pipe, any steam leakage from the inlet to the outlet of the valve shall be limited below a value which will cause a discharge pressure buildup of 10 psi in a 1-h period.

7.6 *External Leakage*—There shall be no external leakage which can be detected by use of a mirrored surface and bubble fluid.

7.7 *Mechanical Shock and Vibration*— Valve shall meet the mechanical shock requirements defined by Grade A, Class I of MIL-S-901, the HI-shock test guidance of MIL-STD-798, and the environmental vibration requirements defined by Type I of MIL-STD-167-1 up to and including 33 Hz.

7.8 *Endurance*—Valves shall be capable of passing the 5-h endurance test as outlined in S1.1.6.

8. Tests Required

8.1 Each production valve shall pass the tests outlined in 8.2-8.5.

8.2 *Nondestructive Tests*—Nondestructive tests shall be as specified in NAVSEA S9074–AR-GIB-010/278 and in accordance with NAVSEA T9074–AQ-GIB-010/271. Acceptance criteria shall be in accordance with MIL-STD-178. This shall include RT, MT/PT, pressure, and visual testing as delineated in the above specifications.

8.3 *Hydrostatic Test*—Valves shall be tested in accordance with ASME B16.34. There shall be no external leakage, permanent distortion, or structural failure.

8.4 *Seat Tightness Test (Dead-End Test)*—Using steam or air, with an inlet pressure equal to the nominal rating, the outlet pressure in a dead-end volume representing not more than 100 diameters of the downstream pipe shall not rise more than 10 psi in a 1-h period.

8.5 *External Leakage Test*—Pressure containing parts shall be tested with steam or air to the maximum working pressure to check for external leakage. There shall be no external leakage which can be detected by use of a mirrored surface (for steam) or bubble fluid (for air).

9. Marking

9.1 *Body Markings*—The manufacturer's name or trademark and the body material composition shall be cast or forged integral with the valve body. The size, rating, and a flow arrow shall be cast or forged integral with the valve body or die stamped on raised metal pads (⅛-in. added wall thickness minimum), or stamped on the outside diameter of the flanges.

9.2 *Identification Plates*—An identification plate of corrosion-resistant metal shall be attached to the valve and shall list the following:

9.2.1 Manufacturer's name.

9.2.2 Valve specification code.

9.2.3 Set pressure range.

9.2.4 ASME pressure class rating.

9.2.5 Manufacturer's model or part number.

10. Quality Assurance System

10.1 The manufacturer shall establish and maintain a quality assurance system that will ensure all the requirements of this specification are satisfied. This system shall also ensure that all valves will perform in a similar manner to those representative valves subjected to original testing for determination of the operating and flow characteristics.

10.2 A written description of the quality assurance system the manufacturer will use shall be available for review and acceptance by the inspection authority.

10.3 The purchaser reserves the right to witness the production tests and inspect the valves in the manufacturer's plant to the extent specified on the purchase order.

11. Keywords

11.1 marine; ship; steam; valves

SUPPLEMENTARY REQUIREMENTS

One or more of the following supplementary requirements S1, S2, S3, or S4 shall be applied only when specified by the purchaser in the inquiry, contract, or order. Details of those supplementary requirements shall be agreed upon in writing by the manufacturer and purchaser. Supplementary requirements shall in no way negate any requirement of the specification itself.

S1. Initial Qualification Testing

S1.1 Qualification tests shall be conducted at a facility satisfactory to the customer and shall consist of the examinations and tests selected from those specified in S1.1.1 through S1.1.10 and delineated in the ordering data (see outline of tests in Table 2). The tests may be conducted on representative valve sizes and pressure classes to qualify all sizes and pressure classes of valves provided the valves are of the same type and design. Evidence of prior approval of these tests is acceptable.

S1.1.1 *Qualification Test Sample*—A sample valve(s) shall be submitted for each pressure rating for which qualification approval is desired (for sample size(s) required for shock qualification, see S1.1.7). Qualification approval, based on the examination and test of the sample, will then apply to all sizes of that pressure rating covered by this specification (see S1.1.1.1). Cross-sectional assembly drawings of all sizes of that type and rating shall be submitted with the test valve.

S1.1.1.1 Upon specific approval by the customer, valves of other sizes may be tested. Use of only one valve size for qualification of a type and rating under this specification only applies where the test valve is representative of the basic design features of all sizes of the pressure rating for which qualification is desired. The customer reserves the right to determine what are significant variations requiring separate qualification testing.

S1.1.2 *Examination Before Testing*—Upon receipt of the qualification test sample, the sample valve(s) shall be disassembled and visually and dimensionally examined to determine conformance with the requirements of this specification and complete dimensional conformance to the detailed engineering drawings.

S1.1.2.1 Upon satisfactory completion of the examination specified in S1.1.2, the valve(s) shall be tested as specified in S1.1.3 through S1.1.9.

S1.1.3 *Spring Test*—The spring from the disassembled sample valve shall be visually and dimensionally examined as follows:

S1.1.3.1 The free spring length shall be measured and an allowance of 0.010 in. per each inch of free spring length calculated. Fraction of inches of free spring length shall be prorated and added to the calculations for allowance.

S1.1.3.2 The spring shall be compressed to its working height and released.

S1.1.3.3 Ten minutes after release, the spring shall be measured again.

S1.1.3.4 The spring shall not exhibit a set in excess of the allowance calculated in S1.1.3.1.

S1.1.4 The valve shall be subjected to and must pass the tests outlined in 8.1-8.4 (nondestructive test, hydrostatic test, seat tightness test, and external leakage test).

S1.1.5 *Performance Test*—The performance tests shall be conducted with the valve set at the upper, mid-point, and lower setting of the adjustable set pressure range required by the application (see 5.1). Test medium shall be steam. The maximum inlet temperature, the range of operating inlet pressures, and the maximum flow capacity required shall be as specified (see 5.1) to meet the application requirements. The required accuracy of regulation shall be maintained. There shall be no evidence of hunting, chattering, or any other unstable or unsatisfactory operation of the valve during any portion of the required operational range of the valve.

S1.1.5.1 The flow shall be varied from lock-up to the maximum flow rating of the valve and back (see 5.1). This test shall be conducted under the following sets of conditions:

Condition (a) Max inlet pressure − lowest set pressure.
Condition (b) Min inlet pressure − lowest set pressure.
Condition (c) Min inlet pressure − mid-point set pressure.
Condition (d) Max inlet pressure − mid-point set pressure.
Condition (e) Max inlet pressure – highest set pressure.
Condition (f) Min inlet pressure − highest set pressure.

During each group of test conditions (that is, (a) and (b), (c) and (d), and (e) and (f), no alteration shall be made to the set pressure adjustment, or any other portion of the valve. The duration of the test at each condition shall not exceed 30 s.

S1.1.6 *Endurance Test*—The valve shall be subjected to a 5-h operational test to check functioning and performance. Test medium shall be steam. The 5-h test shall include not less than 25-min aggregate time within each of the following specific flow ranges: 95 ± 5 % maximum rated flow; 25 ± 3 % maximum rated flow; and 10 ± 2.5 % maximum rated flow. The valve shall operate at all times without evidence of instability, without allowing delivered pressure to vary from specified limits, and without requiring any maintenance, repair, or adjustment effort. At the successful completion of the 5-h test, the valve shall be removed and completely disassembled. All parts shall be examined for signs of excessive wear or any other condition indicating impending failure or malfunction. Any such condition shall constitute grounds for failure of the valve to pass these tests, regardless of how satisfactorily the valve performed during the 5-h test. Impending failure or malfunction is defined as one which can be expected to occur within one year of operation.

S1.1.7 *Shock Test*—Sample size(s) for shock qualification testing shall be in accordance with MIL-STD-798. The valve shall be subjected to the high-impact mechanical requirements for Grade A, Class I of MIL-S-901 to determine its resistance to high-impact mechanical shock. The shock test shall be performed with the nominal hydrostatic pressure applied to the inlet port. During impact, an instantaneous, reversible pressure excursion is allowable.

S1.1.8 *Vibration Test*—The valve shall be vibration tested in accordance with Type I of MIL-STD-167-1.

S1.1.9 *Maintenance Demonstration*—The maintenance actions specified in 6.1.3 shall be demonstrated.

S1.1.10 *Posttest Examination*—After completion of the tests specified in 8.2-8.5 and S1.1.5 through S1.1.7, the test valve shall be disassembled and visually and dimensionally examined. Any damage, excessive wear, or signs of galling or pitting shall be cause for rejection.

S2. Examinations

S2.1 *Lot*—All valves of the same type and size offered for delivery at one time shall be considered a lot for the purpose of sampling.

S2.2 Sampling for visual and dimensional examination. A random sample of valves shall be selected from each lot as shown below and shall be examined as specified in S2.3 and S2.4. Failure of any valve in a sample to pass the examination specified in S2.3 and S2.4 shall be cause for rejection of the lot.

Lot Size	Sample Quantity
2 to 25	1
26 to 65	2
66 to 180	3
Over 180	4

S2.3 *Visual Examination*—A visual examination shall be made of the sample valves selected in accordance with S2.2 to verify conformance to the requirements of the specification.

S2.4 *Dimensional Examination*—A dimensional examination shall be made on the sample valves selected in accordance with S2.2 to verify conformance with the approved master drawing.

S3. Technical Data and Certification Requirements

S3.1 *Drawings*—Assembly drawings, information sheets, or catalog sheets of the pressure-reducing valve shall be provided to indicate the design and materials used in the valve.

S3.2 *Technical Manuals*—A technical manual or instruction booklet shall be supplied that provides a description of the valve, its operation and maintenance instructions, and illustrated parts breakdown. It shall also include wrench sizes and assembly torques (or equivalent) for all bolting and threaded assemblies, and step-by-step disassembly and reassembly procedures.

S3.3 *Certification*—Certification shall be provided indicating that the valve meets all requirements of the purchase order.

S4. Quality Assurance

S4.1 *Scope of Work*—The written description of the quality assurance system shall include the scope and locations of the work to which the system is applicable.

S4.2 *Authority and Responsibility*—The authority and responsibility of those in charge of the quality assurance system shall be clearly established.

S4.3 *Organization*—An organizational chart showing the relationship between management and the engineering, purchasing, manufacturing, construction, inspection, and quality control groups is required. The purpose of this chart is to identify and associate the various organizational groups with the particular functions for which they are responsible. These requirements are not intended to encroach on the manufacturer's right to establish, and from time to time to alter, whatever form of organization the manufacturer considers appropriate for its work. Persons performing quality control functions shall have a sufficiently well-defined responsibility and the authority and the organizational freedom to identify quality control problems and to initiate, recommend, and provide solutions.

S4.4 Review of quality assurance system. The manufacturer shall ensure and demonstrate the continuous effectiveness of the quality assurance system.

S4.5 *Drawings, Design Calculations, and Specification Control*—The manufacturer's quality assurance system shall include provisions to ensure that the latest applicable drawings, design calculations, specifications, and instructions, including all authorized changes, are used for manufacture, examination, inspection, and testing.

S4.6 *Purchase Control*—The manufacturer shall ensure that all purchased material and services conform to specified requirements and that all purchase orders give full details of the material and services ordered.

S4.7 *Material Control*—The manufacturer shall include a system for material control that ensures the material received is properly identified and that any required documentation is present, identified to the material, and verifies compliance to the specified requirements. The material control system shall ensure that only the intended material is used in manufacture. The manufacturer shall maintain control of material during the manufacturing process by a system that identifies inspection status of material throughout all stages of manufacture.

S4.8 *Manufacturing Control*—The manufacturer shall ensure that manufacturing operations are carried out under controlled conditions using documented work instructions. The manufacturer shall provide for inspection, where appropriate, for each operation that affects quality or shall arrange an appropriate monitoring operation.

S4.9 *Quality Control Plan*—The manufacturer's quality control plan shall describe the fabrication operations, including examinations and inspections.

S4.10 *Welding*—The quality control system shall include provisions for ensuring that welding conforms to specified requirements. Welders shall be qualified to the appropriate standards and the qualification records shall be made available to the inspection authority if required.

S4.11 *Nondestructive Examination*—Provisions shall be made to use nondestructive examination as necessary to ensure that material and components comply with the specified requirements. Nondestructive examinations shall be authorized by their employer and/or qualified by a recognized national body, and their authorizations/qualification records shall be made available to the inspection authority if required.

S4.12 *Nonconforming Items*—The manufacturer shall establish procedures for controlling items not in conformance with the specified requirements.

S4.13 *Heat Treatment*—The manufacturer shall provide controls to ensure that all required heat treatments have been applied. Means should be provided by which heat treatment requirements can be verified.

S4.14 *Inspection Status*—The manufacturer shall maintain a system for identifying the inspection status of material during all stages of manufacture and shall be able to distinguish between inspected and non-inspected material.

S4.15 *Calibration of Measurement and Test Equipment*—The manufacturer shall provide, control, calibrate, and maintain inspection, measuring and test equipment to be used in verifying conformance to the specified requirements. Such calibration shall be traceable to a national standard and calibration records shall be maintained.

S4.16 *Records Maintenance*—The manufacturer shall have a system for the maintenance of inspection records, radiographs, and manufacturer's data reports that describe the achievement of the required quality and the effective operation of the quality system.

S4.17 *Sample Forms*—The forms used in the quality control system and any detailed procedures for their use shall be available for review. The written description of the quality assurance system shall make reference to these forms.

S4.18 *Inspection Authority*—The manufacturer shall make available to the inspection authority at the manufacturer's plant a current copy of the written description of the quality assurance system. The manufacturer's quality assurance system shall provide for the inspection authority at the manufacturer's plant to have access to all drawings, calculations, specifications, procedures, process sheets, repair procedures, records, test results, and any other documents as necessary for the inspection authority to perform its duties in accordance with this supplementary requirement. The manufacturer may provide for such access by furnishing the inspection authority with originals or copies of such documents.