Designation: F 1370 – 92

An American National Standard

Standard Specification for Pressure-Reducing Valves for Water Systems, Shipboard[1]

This standard is issued under the fixed designation F 1370; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers self-contained, globe style, pressure-reducing valves for use in water systems of shipboard installations. These valves are limited to discharge pressure settings of 200 psig (1379 kPa) and below.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following precautionary caveat pertains only to the tests portion, Section 8, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

A 125 Specification for Steel Springs, Helical, Heat Treated[2]

A 193 Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service[3]

A 194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service[3]

A 231 Specification for Chromium-Vanadium Alloy Steel Spring Wire[4]

A 276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes[2]

A 313 Specification for Stainless and Heat-Resisting Steel Spring Wire[4]

A 689 Specification for Carbon and Alloy Steel Bars for Springs[2]

B 21 Specification for Naval Brass, Rod, Bar, and Shapes[5]

B 26 Specification for Aluminum-Alloy Sand Castings[6]

B 61 Specification for Steam or Valve Bronze Castings[5]

B 62 Specification for Composition Bronze or Ounce Metal Castings[5]

B 148 Specification for Aluminum-Bronze Sand Castings[5]

B 150 Specification for Aluminum Bronze Rod, Bar, and Shapes[5]

B 637 Specification for Precipitation Hardening Nickel Alloy Bars, Forgings, and Forging Stock for High-Temperature Service[7]

B 689 Specification for Electroplated Engineering Nickel Coatings[8]

F 467 Specification for Nonferrous Nuts for General Use[9]

F 468 Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use[9]

F 593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs[9]

F 594 Specification for Stainless Steel Nuts[9]

2.2 *ANSI Standards:*[10]

ANSI B1.1 Unified Screw Threads

ANSI B1.12 Class 5 Interference, Fit Thread

2.3 *ISA Standards:*[11]

S75.01 Flow Equations for Sizing Control Valves

S75.02 Control Valve Capacity Test Procedure

2.4 *Federal Specifications:*[12]

QQ-B-637 Brass, Naval: Rod, Wire, Shapes, Forgings, and Flat Products with Finished Edges (Bar, Flat Wire, and Strip)

QQ-C-390 Copper Alloy Casting (Including Cast Bar)

QQ-C-465 Copper-Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 6014, 630, 632M, and 642); Rod, Flat Products with Finished Edges (Flat Wire, Strip, and Bar) Shapes, and Forgings

QQ-N-281 Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections

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[1] This specification is under the jurisdiction of ASTM Committee F-25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.13 on Piping Systems.

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[2] *Annual Book of ASTM Standards*, Vol 01.05.

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

[4] *Annual Book of ASTM Standards*, Vol 01.03.

[5] *Annual Book of ASTM Standards*, Vol 02.01.

[6] *Annual Book of ASTM Standards*, Vol 02.02.

[7] *Annual Book of ASTM Standards*, Vol 02.04.

[8] *Annual Book of ASTM Standards*, Vol 02.05.

[9] *Annual Book of ASTM Standards*, Vol 15.08.

[10] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[11] Available from Instrumentation, Systems, and Automation Society, 67 Alexander Dr., Research Triangle Park, NC 27709.

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

QQ-N-286 Nickel-Copper-Aluminum Alloy, Wrought (UNS N05500)
QQ-N-288 Nickel-Copper Alloy and Nickel-CopperSilicon Alloy, Castings
QQ-S-763 Steel Bars, Wire, Shapes, and Forgings, Corrosion Resisting
QQ-S-766 Steel Corrosion Resisting Plate, Sheet and Strip
QQ-W-390 Wire, Nickel-Chromium-Iron Alloy
TT-P-645 Primer Paint, Zinc Chromate, Alkyd Type

2.5 *Military Standards and Specifications:*[12]

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-F-1183 Fittings, Pipe, Cast Bronze, Silver-Brazing, General Specification for
DOD-P-15328 Primer (Wash), Pretreatment (Formula No. 117 for Metals) (Metric)
MIL-F-20042 Flanges, Pipe and Bulkhead, Bronze (Silver Brazing)
MIL-C-20159 Copper-Nickel Alloy Casting (UNS No. C96200 and C96400)
MIL-F-24227 Fittings and Flanges, Cast Bronze, Silver Brazing Suitable for Ultrasonic Inspection
MIL-B-24480 Bronze, Nickel-Aluminum (UNS No. C95800) Castings for Seawater Service
MIL-S-81733 Sealing and Coating Compound, Corrosion Inhibitive
MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment (Type I—Environmental, and Type II—Internally Excited)
MIL-STD-248 Welding and Brazing Procedure and Performance Qualification
MIL-STD-278 Welding and Casting Standard
MIL-STD-798 Non-destructive Testing, Welding, Quality Control, Material Control and Identification, and Hi-shock Test Requirements for Piping System Components for Naval Shipboard Use

2.6 *Other Publications:*[12]

Naval Sea Systems Command (NAVSEA)

2.7 *Drawings:*[12]

803-1385946 Union Bronze, Silver Brazing WOG for UT Inspection
803-1385947 Flanges, Bronze, 700 PSI WOG for UT Inspection

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:* Descriptions of Terms Specific to This Standard:

3.1.1 *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.

3.1.2 *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.

3.1.3 *hydrostatic proof 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 the valve must meet all performance requirements after the pressure has been removed.

3.1.4 *lockup pressure*—the outlet pressure delivered by a pressure-reducing valve when the flow is reduced to zero; lockup pressure is always greater than set pressure, and in actual practice it may vary with the specific valve design, tolerances, method of sensing downstream pressure, and piping configurations.

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

3.1.6 *set pressure*—the downstream pressure that the valve is set to maintain under a given set of operating conditions (that is, inlet pressure and flow); the valve should ideally be set at downstream pressure approximately equal to the midpoint of the set pressure limits (defined in 3.1.7).

3.1.7 *set pressure limits (set pressure adjustable range)*—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 types and pressure ratings, as specified (see Section 5 and 6.1.21).

4.1.1 *Type I*—Pressurized spring chamber, and

4.1.2 *Type II*—Unpressurized spring chamber.

4.2 *Pressure Ratings*—Valves shall have nominal inlet pressure ratings of 150 or 250 psig (1034 or 1724 kPa), or as specified (see 6.1.21).

5. Ordering Information

5.1 Ordering documentation for valves in accordance with 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 6.1.21),

5.1.3 Quantity of valves,

5.1.4 Set pressure required,

5.1.5 Set pressure limits, if not listed in 7.1.4,

5.1.6 Face-to-face dimensions for valves, if not listed in Table 1,

5.1.7 Regulation accuracy required, if other than as given in 7.1.5,

5.1.8 When a choke feature is required (see 6.1.2),

5.1.9 When tailpieces and nuts are required (see 6.1.15),

5.1.10 Capacity requirement of valves, if not listed in Table 2 (see 7.1.6), and

5.1.11 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 through 6.1.21.

6.1.1 *Materials of Construction*—Materials shall be as specified in Table 3. All materials shall be selected to prevent corrosion, galling, seizing, excessive wear, or erosion where applicable. Cadmium plating is prohibited.

TABLE 1 Face-to-Face Dimensions, in. (mm), ±1/16 (1.59)

Size, in. (mm)	Flanged End		Union End	Flanged End		Union End	
	150 psig (1034 kPa)	250 psig (1724 kPa)	150 and 250 psig (1034 and 1724 kPa)	400 psig (2758 kPa)	700 psig (4826 kPa)	400 psig (2758 kPa)	700 psig (4826 kPa)
0.25 (6.35)	7¼	7⅞	7 7/32			7⅞	7 7/32
0.37 (9.40)	7¼ (184)	7⅞ (200)	7 9/32 (185)			7 9/32 (185)	7 9/32(185)
0.50 (12.7)	7¼ (184)	7⅞ (200)	7 9/32 (185)	6½ (165)	6½(165)	7 9/32 (185)	7 9/32 (185)
0.75 (19.05)	7⅜ (187)	7⅞ (200)	7½ (191)	7½ (191)	7½(191)	8 (203)	8 (203)
1.00 (25.4)	7⅜ (187)	8 (203)	7½ (191)	8½ (216)	8½ (216)	8¾ (222)	8¾(222)
1.25 (31.75)	7 15/16 (202)	8 11/16 (221)	8 5/32 (207)	9 (229)	9 (229)	9½ (241)	9½ (241)
1.50 (38.1)	8¾ (222)	9½ (241)	8 31/32 (228)	9½ (241)	9½(241)	10 (254)	10 (254)
2.00 (50.8)	10 (254)	10¾ (273)	10 7/32 (260)	11½ (292)	11½(292)	11⅞ (302)	11⅞ (302)
2.50 (63.5)	10⅞ (276)	11¾(298)		13 (330)	13 (330)		
3.00 (76.2)	11⅝ (295)	12½(318)		14 (356)	14 (356)		
3.50 (88.9)	11⅝ (295)	12⅝(321)					
4.00 (101.6)	13½ (343)	14½(368)		16 (406)	17 (432)		

TABLE 2 Minimum Required Valve C_v for Types I and II, 150 and 250 psig (1034 and 1724 kPa) Rated Valves with 5 to 30 psig (34 to 207 kPa), 25 to 60 psig (172 to 414 kPa), and 50 to 100 psig (345 to 689 kPa) Set Pressure Adjustable Ranges

Size, in. (mm)	5 to 30 psig (34 to 207 kPa) Set Pressure Adjustable Range			25 to 60 (172 to 414 kPa) psig Set Pressure Adjustable Range			50 to 100 psig (345 to 689 kPa) Set Pressure Adjustable Range		
	Set Pressure, psig (kPa)								
	10 (69)	20 (138)	30 (207)	30 (207)	45 (310)	60 (414)	60 (414)	80 (552)	100 (689)
0.25 (6.35)	0.7	0.9	1.0	0.6	0.7	0.9	0.5	0.6	0.7
0.37 (9.40)	1.4	1.8	2.0	1.2	1.4	1.8	1.0	1.2	1.4
0.50 (12.70)	2.5	3	3.5	2	2.5	3	1.5	2.0	2.5
0.75 (19.05)	3	3.5	4	2.5	3	3.5	2.0	2.5	3.0
1.00 (25.40)	4	5	6	3	4	5	2.6	3.3	4.0
1.25 (31.75)	5.5	7.5	9	5	7	8.5	3.5	4.5	5.5
1.50 (38.10)	7	10	12	6.5	9.5	11.5	5.0	6.0	7.0
2.00 (50.80)	15	20	25	12	17	22	11	13	15
2.50 (63.50)	30	35	40	25	30	35	24	27	30
3.00 (76.20)	45	50	55	40	45	50	35	40	45
3.50 (88.90)	55	60	65	50	55	60	45	50	55
4.00 (101.60)	70	75	80	65	70	75	60	65	70

6.1.2 *General Requirements*—Valves shall be self-contained, spring-loaded, direct-operated, pressure-reducing valves incorporating a balanced valve element. Reduced pressure (not to exceed 200 psig (1379 kPa)) shall be sensed by a diaphragm and compared with a reference spring load. Any force imbalance shall be transmitted directly to and positively reposition a single-seated valve element to limit the set point error within the limits specified in 7.1.5. Type I valves shall be valves in which the spring chamber in combination with the body and bottom cap forms a pressure-containing envelope capable of withstanding the full hydrostatic proof test. These valves shall be specified for special applications in which it is necessary to contain the line media in the event of a failure that subjects the spring chamber to full inlet pressure. The spring chamber assembly need not be leakproof; however, it shall contain line media at hydrostatic proof test pressure without structural failure and shall limit external leakage to a small seepage (in drip form) past the adjusting screw threads and spring chamber joint. Type I valves shall also incorporate a choke feature on the poppet to limit capacity in the event of a diaphragm failure, where specified (see Section 5). Type II valves shall be valves in which the spring chamber does not form part of the pressure-containing envelope.

6.1.3 *Pressure Envelope Rating*—The nominal inlet (see 3.1.5), design (see 3.1.2), and hydrostatic proof test (see 3.1.3) pressures for the pressure-containing envelope (body, spring housing, and bottom cap) shall be as specified in Table 4. The design temperature (see 3.1.2) is also given in Table 4.

6.1.4 *Body Passages*—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 90° impingement against the walls at close range shall be avoided. The body cavity downstream of the seat shall present a high angle (70 to 90°) of incidence to the issuing jet. At points at which direct impingement at close range does occur and cannot be eliminated, the section thickness shall be increased substantially to provide adequate material to withstand the additional erosive effect.

6.1.5 *Diaphragm Construction*—The main diaphragm shall be clamped between flanges on the body and spring chamber to ensure a leaktight flange seal. The flange faces shall have sufficient width, and all edges in contact with the diaphragm shall be properly chamfered or rounded to prevent cutting or tearing of the diaphragm. The valve and diaphragm shall withstand a pressure differential across the diaphragm of twice the highest set pressure or 200 psig (1379 kPa), whichever is greater, for Type I valves. For Type II valves, this pressure differential shall be as follows: For valves of sizes up to 2 in.

TABLE 3 List of Materials

Name of Parts	Material
Body and bottom cap[A]	Valve bronze, Specification B 61, QQ-C-390, Alloy C92200. Copper-nickel, MIL-C-20159, Alloy C96400. Gun metal, QQ-C-390, Alloy C90300. Nickel-aluminum-bronze per MIL-B-24480.
Spring chamber (Type I valves)	Same as for body and bottom cap.
Spring chamber (Type II valves)	Same as for body and bottom cap plus: Brass, QQ-B-637. Aluminum, Specification B 26.
Stem[B]	Nickel-copper alloy, QQ-N-281, or QQ-N-288. Nickel-copper-aluminum alloy, QQ-N-286.
Guide bushings[B]	Nickel-copper-silicon alloy, QQ-N-288, Comp D; or Nickel-copper-aluminum QQ-N-286.
Seat ring	Nickel-copper alloy, QQ-N-281, or Nickel-copper-silicon alloy QQ-N-288, Comp D.
Springs not subject to line media	300 series stainless steel per Specification A 313; QQ-S-763, QQ-W-390; Nickel-copper alloy, QQ-N-281; Nickel-copper-aluminum, QQ-N-286; Nickel plated steel per Specifications A 125, A 231, or A 689 plated to Specification B 689, Type 1, Class (x) 125. Specification B 637 (UNS N07500).
Metallic parts subject to line media	Nickel-copper alloy, QQ-N-281, QQ-N-286, or QQ-N-288. Copper-nickel, MIL-C-20159, Alloy C71500. Valve bronze, Specification B 61, QQ-C-390, Alloy C92200. Aluminum-bronze (cast: QQ-C-390, Alloy C95800; forged: QQ-C-465, Specification B 150, Alloy C63200). Specification B 148, UNS C95800, Specification B 150, UNS C63200.
Metallic parts not subject to line media	Same as above, plus: CRES (300 and 400 series), QQ-S-763, QQ-S-766, Specification A 276. Naval Brass, QQ-B-637, Specification B 21. Nickel plated steel per Specification A 125, plated to Specification B 689, Type 1, Class (x) 125. Bronze, Specification B 62.
Diaphragm	Synthetic fabric reinforced nitrile or fluorocarbon rubber or other materials when specified (see Section 5).
Nonmetallic seals	
Disc insert[C] and static seals	Nitrile or fluorocarbon rubber or other materials when specified (see Section 5).
Dynamic seals	Nitrile or fluorocarbon rubber or other materials when specified (see Section 5).
Bolting	QQ-N-281, QQ-N-286, Specifications F 467, F 468. Specifications F 593, F 594, A 193, and A 194 (stainless steel 300 series).

[A]When threaded parts made of nickel-copper alloys, such as seat ring, guide bushings, and so forth are screwed into a bronze body, the threads on these parts as well as the mating threads in the body shall be given a corrosion-inhibitive coating (polysulfate chromate elastomer) per MIL-S-81733 to minimize the galvanic and crevice corrosion of threads.

[B]The guiding surfaces on the stem (guide posts) and the guide bushings shall have a minimum hardness differential of 50 Brinell hardness numbers. The softer of the two guiding surfaces shall have a minimum hardness of 200 Brinell.

[C]Hardness of the disc insert is to be Shore 75 ±5.

TABLE 4 Design and Test Pressures

Nominal Inlet Pressure Rating, psig (kPa)	Design Pressures, psig (kPa)	Hydrostatic Proof Test Pressure, psig (kPa)	Design Temperature, °F (°C)
150 (1034)	150 (1034)	225 (1551)	165 (74)
250 (1724)	250 (1724)	375 (2586)	165 (74)
400 (2758)	400 (2758)	600 (4137)	165 (74)
700 (4826)	700 (4826)	1050 (7239)	165 (74)

(50.8 mm), it shall be twice the highest set pressure or 375 psig (2586 kPa), whichever is greater; for valves of sizes over 2 in. (50.8 mm), it shall be twice the highest set pressure or 300 psig (2068 kPa), whichever is greater. There shall be no damage or degradation to the performance capabilities of either the valve internals or the diaphragm. However, in no case shall the diaphragm be required to withstand a pressure differential greater than the nominal inlet pressure rating of the valve.

6.1.6 *Valving Element Construction*—The stem shall be of one-piece construction and be top and bottom guided. The valve disc shall be retained on the stem with a threaded retainer using a prevailing torque–locking feature. The disc shall incorporate a resilient seating insert that shall be readily replaceable on all sizes. Guide bushings shall be provided in the body and bottom cap and shall have a minimum thickness of 0.060 in. (1.52 mm). Concentricity, parallelism, squareness, and roundness requirements for all surfaces that establish main valve alignment shall ensure parallel disc/seat contact and free valve movement without sticking or binding in the assembled valve. The valve shall be designed so that these alignment requirements are maintained with interchangeable parts and under any additive tolerance (stackup) condition without requiring machining after assembly of the body and bottom cap. The bottom cap/body joint shall ensure, by positive means, proper alignment of the lower guide bushing to ensure repeated correct reassembly. The bottom cap shall be located by body guiding, that is, a close tolerance fit between machined diameters on the body and bottom cap rather than depending on studs or bolts for location. Where the bottom cap/body joint is of flanged construction, proper parallel alignment of the lower guide bushing shall be ensured by metal-to-metal takeup of at least a portion of the flange faces, which shall be machined true. The finish of the guiding surfaces shall have a roughness height rating (RHR) of 32 or better. The guiding surfaces shall not be used as sealing surfaces.

6.1.7 *Valving Element Balance*—The valve element shall be completely pressure balanced when in the seated position. The dynamic seal shall be accomplished by use of either a diaphragm or a fully retained U-cup or O-ring. Where a U-cup

or O-ring is used, the surface moving against the seal shall have a finish of RHR 16 or better and shall not be used for guiding the stem.

6.1.8 *Seat Ring*—A replaceable threaded seat ring (or a piston chamber for valves with the cage construction design) shall be provided so that it can be replaced with hand tools (see 6.1.18) and does not require machining after assembly. The seat ring shall shoulder against the body to provide a positive pressure-tight joint in which the threads are not used to seal. Where a nonmetallic sealing element is used, a precision-dimensioned gland or cavity shall be provided in either the body or seat ring to ensure proper and controlled retention of the sealing element.

6.1.9 *Bolting Requirements*—The spring chamber/body flange and bottom cap/body flange (if applicable) shall be secured by one of the following methods:

(*1*) Bolts threaded the entire length and fitted with a nut on each end. Threads on bolts and nuts shall have a Class 2 fit in accordance with ANSI B1.1.

(*2*) Tap-end studs with a Class 5 interference fit at the tap end and a Class 2 fit at the nut end. The fit shall be in accordance with ANSI B1.12.

(*3*) Hexagonal head bolts or cap screws.

The bearing surfaces of nuts and bolts and their respective mating surfaces on the valve shall be cast or forged smooth and true or be finish-machined. The bottom cap/body joint may have either a flanged construction, in accordance with the above, or a threaded construction. A properly retained gasket or O-ring shall be provided to seal against external leakage.

6.1.10 *Spring Construction*—Springs shall not be fully compressed under any normal operation or adjustment of the valve. Spring ends shall be squared and ground.

6.1.11 *Set Pressure Adjustment*—The set pressure (see 3.1.6) shall be adjustable with the valve under pressure. The set pressure shall be increased by the clockwise rotation of the adjusting device. The adjusting device shall be provided with a locknut and cap or other suitable means to guard against an accidental change in set point. Set pressure shall be adjustable through a range of not less than 75 to 125 % of the mid-range set pressure with the installed spring without replacing any internal parts (see Section 5).

6.1.12 *Threads*—Threads shall conform to ANSI B1.1. Provisions shall be incorporated, where necessary, to prevent the accidental loosening of threaded parts. Bolting shall generally have a Class 2 fit, in accordance with ANSI B1.1. The material, hardness, finish, and clearances of mating threaded parts shall prevent galling of the threads. Pipe threads shall not be used for main connections, but they may be used for low-stressed internal parts, such as attachment of a pitot tube. When required in Table 3, threads shall be coated.

6.1.13 *Interchangeability*—Parts having the same manufacturer's parts numbers shall be directly interchangeable with each other with respect to installation and performance without requiring selection or fitting. In no case shall parts for a given valve be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance, and strength.

6.1.14 *Accessibility*—Adjustment and repair of the valve shall be possible without removal from the line.

6.1.15 *End Connections*—Valve ends shall be in accordance with the applicable documents listed in Table 5. The valve end connection type shall be as specified (see Section 5 and 6.1.21). Unless otherwise specified in the ordering information (see Section 5), valves with union-ends shall be supplied with the male threadpieces only, without the tailpieces and the union nuts. Flanges and union-end thread pieces shall be cast or forged integral with the valve body. Inlet and outlet connections shall be of the same size and pressure rating.

6.1.16 *Face-to-Face Dimensions*—Face-to-face dimensions for valves shall be in accordance with Table 1. Face-to-face dimensions for valves not covered in Table 1 shall be as specified (see Section 5). For union-end valves, the face-to-face dimension is defined as the distance between the parallel faces of the threaded ends of the valve body.

6.1.17 *Body Configuration*—Valves shall have globe configuration with in-line inlet and outlet ports. Pressure lines, including the reduced pressure sensing line, shall be internally ported in the body.

6.1.18 *Special Tools*—Special tools shall not be required for installing or removing the valve from the pipe line. Special tools may be furnished for servicing valve internals if it can be demonstrated that use of the special tool saves labor or time. Special tools are defined as those tools not listed in the Federal Supply Catalog.[12]

6.1.19 *Painting*—Except for the case of aluminum alloys, painting of the external surfaces of nonferrous metal castings, pipings, or other parts is not required. Parts made of aluminum alloys shall be given one coat of pretreatment per DOD-P-15328, Formula 117, and one coat of primer per TT-P-645, Formula 84.

6.1.20 *Welding and Brazing*—Welding and brazing shall be performed in accordance with MIL-STD-248 and MIL-STD-278.

6.1.21 *Valve Specification Coding*—Basic valve design features shall be specified and recorded using the valve coding system shown in Fig. 1. The valve specification code contains six fields of information, which describe the construction features of the valve. These six fields are each further assigned their respective codes per Tables 6-10.

7. Performance Requirements

7.1 All valves shall meet the following requirements:

7.1.1 *Springs*—Springs shall not exhibit a set in excess of the calculated allowable set (see S1.1.3).

7.1.2 *Hydrostatic Proof Test*—The pressure-containing envelope shall withstand internal hydrostatic pressure of 1.5 times the design pressure (see Table 4 and S1.1.4).

TABLE 5 End Connections

Nominal Pressure Rating, psig (kPa)	Union End	Flanged End
150 (1034)	MIL-F-1183	MIL-F-20042
250 (1724)	MIL-F-1183	MIL-F-20042
400 (2758)	MIL-F-24227	MIL-F-20042
700 (4826)	803-1385946	803-1385947

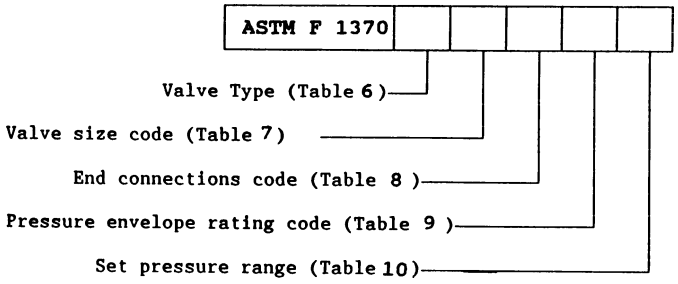

FIG. 1 Valve Coding System

TABLE 6 Valve Type Code

Valve Type	Code
Type 1	1
Type 2	2

TABLE 7 Valve Size Code

Size, NPS	Code	Size, NPS	Code	Size, NPS	Code
0.25	A	1.00	E	2.50	J
0.37	B	1.25	F	3.00	K
0.50	C	1.50	G	3.50	L
0.75	D	2.00	H	4.00	M

TABLE 8 End Connection Code

Type of End Connection	Code
Union ends (NPS 2 and under)	U
Flanged ends	F

TABLE 9 Valve Body Pressure Rating Code

Nominal Pressure Rating, psig (kPa)	Code
150 (1034)	1
250 (1724)	2
400 (2758)	4
700 (4826)	7

TABLE 10 Set Pressure Range Code

Set Pressure Range, psig (kPa)	Code
5 to 30 (34 to 207)	A
25 to 60 (172 to 414)	B
50 to 100 (345 to 689)	C
As specified	X

7.1.3 *Seat Tightness*—The pressure increase after lockup (see 3.1.4) on the downstream (or regulated outlet) side of the valve shall not exceed 10 % of the set pressure or 2.5 psi (17.24 kPa), whichever is greater, over a 15-min period (see S1.1.5).

7.1.4 *Set Pressure Limits*—Unless otherwise specified (see Section 5), the set pressure (see 3.1.7 and Table 10) shall be adjustable within the standard set pressure ranges of 5 to 30, 25 to 60, and 50 to 100 psig (34 to 207, 172 to 414, and 345 to 689 kPa). If required, more than one spring may be used to accomplish this.

7.1.5 *Accuracy of Regulation*—Unless otherwise specified (see Section 5), the valve shall provide an accuracy of regulation (see 3.1.1) per the following:

7.1.5.1 The downstream regulated pressure shall not deviate beyond the values listed in Table 11 when the flow through the valve is increased from zero to the rated capacity.

7.1.5.2 The downstream regulated pressure deviation from the set pressure shall not exceed 0.5 psi (3.45 kPa) for every 10-psi (69-kPa) change in upstream pressure when the upstream pressure is changed at the same flow rate condition.

7.1.6 *Capacity Requirements*—The minimum required valve flow coefficients (C_v) for Type I and II valves, based on the accuracy of regulation specified in 7.1.5, shall be in accordance with Table 2. The minimum required capacity for valves not listed in Table 2 shall be as specified (see Section 5). Valves shall meet the specified capacity required, or any intermediate capacity requirement, while maintaining the regulated pressure within the accuracy limits specified in 7.1.5, without instability and within the vibration requirements of 7.1.7.

7.1.6.1 *Capacity Calculation*—Calculation of the valve flow (C_v) shall be performed from test data (test calculations shall be in accordance with ISA S75.01 and tests in accordance with ISA S75.02) based on the following equations for turbulent flow:

$$C_v = \frac{\text{flow}}{F_p\sqrt{\text{inlet pressure} - \text{minimum delivered flow pressure}}} \quad (1)$$

where:

F_p = piping geometry factor (F_p = 1.0 when pipe reducers are not used),
flow = US gal/min of water at 60°F (16°C),
inlet pressure = psig, and
minimum delivered flow pressure = the set pressure, minus allowable pressure deviation permitted, psig.

For example, a 1½-in. (38-mm), Type II, 150-psig (1034-kPa) rated valve with a 150-psig (1034-kPa) inlet water supply pressure and set at 20 psig (138 kPa). The valve delivers 125 gal/min when the minimum regulated downstream pressure drops to 15.5 psig (107 kPa) (that is, 20 psi (138 kPa) less 4.5 psi (31 kPa); note that Table 11 permits a deviation of 4.5 psi (31 kPa) in the regulated pressure).

TABLE 11 Accuracy of Regulation

Set Pressure, psig (kPa)	Allowable Variation in Downstream Pressure, psi (kPa)
0 to 10 (0 to 69)	2.5 (17.24)
20 (138)	4.5 (31.03)
30 (207)	6.0 (41.37)
45 (310)	7.75 (53.43)
60 (414)	11.75 (81.01)
80 (552)	14.5 (99.97)
100 (689)	12.5 (86.19)
150 (1034)	18.5 (127.55)
200 (1379)	25.5 (175.82)

$$C_v = \frac{125}{1\sqrt{150 - 15.5}} = 10.8 \quad (2)$$

This satisfies the minimum requirement listed in Table 2 for a 1½-in. (38-mm) valve set at 20 psig (138 kPa). For set pressures between those listed in Table 2, the minimum required $C_v$shall be obtained by linear interpolation.

7.1.7 *Vibration*—The valves shall be resistant to Type I environmental vibration in accordance with MIL-STD-167-1. There shall be no resonant frequency from 0 to 33 Hz and no degradation of valve performance when excited in this frequency range (see S1.1.6.3).

7.1.8 *Shock*—The valve shall retain its set performance capability and suffer no structural damage or permanent deformation after shock testing in accordance with MIL-S-901 and MIL-STD-798 (see S1.1.7 and Section 5).

8. Tests

8.1 Each production valve shall pass the tests outlined below:

8.1.1 *Hydrostatic Proof Test*—Pressurize the pressure-containing envelope with water to the hydrostatic proof test pressure specified in Table 4. Hold for a minimum of 3 min, depressurize, and pressurize again for 3 additional min to verify conformance with Table 12.

8.1.2 *Seat Tightness Test*—With water applied to the valve inlet, at pressure equal to the nominal rating of the valve, set the valve lockup at the midpoint of the set pressure range. Measure the downstream pressure increase in a 15-min period in a dead-ended volume not exceeding 100 diameters of downstream piping to verify conformance with Table 12.

9. Marking

9.1 *Body Markings*—Valve bodies shall be permanently marked to show the following information:

9.1.1 Nominal size,

TABLE 12 Qualification Test Outline

Inspection	Requirement	Test Method
Spring	7.1.1	S1.1.3
Valve body and diaphragm hydrostatic proof	7.1.2	S1.1.4
Seat tightness	7.1.3	S1.1.5
Set pressure limits	7.1.4	S1.1.6.1
Accuracy of regulation	7.1.5	S1.1.6.1
Capacity	7.1.6	S1.1.6.2
Vibration MIL-STD-167-1	7.1.7	S1.1.6.3
Shock	7.1.8	S1.1.7

9.1.2 Pressure rating,

9.1.3 Manufacturer's name or trademark, and

9.1.4 Flow direction arrow.

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, and

9.2.4 Manufacturer's model or part number.

10. Quality Assurance System

10.1 The manufacturer shall establish and maintain a quality assurance system which will ensure that all the requirements of this specification are satisfied. This system shall also ensure that all valves will perform in a manner similar 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 that 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.

SUPPLEMENTARY REQUIREMENTS

One or more of the following supplementary requirements shall be applied only when specified by the purchaser in the inquiry, contract, or order. Details of applicable supplementary requirements shall be agreed upon in writing by the manufacturer and the 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 laboratory satisfactory to the customer and shall consist of the examination and tests outlined in Table 12 and specified in S1.1.1 through S1.1.7. Acceptance criteria shall be as given in Table 12.

S1.1.1 *Qualification Test Sample*—A sample valve shall be submitted for each type and 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 type and rating covered by this specification (see S1.1.1.1). Detailed engineering drawings of the test valve and assembly drawings of all sizes of that type and rating shall be submitted with the test valve.

S1.1.1.1 Valves of other sizes may be tested upon specific approval by the customer. The use of only one valve size for qualification of a type and rating in accordance with this specification applies only where the test valve is representative of the basic design features of all sizes of the type and rating for which qualification is desired. The customer reserves the right to determine which variations are significant enough to require separate qualification testing.

S1.1.2 *Examination Before Testing*—Upon receipt of the qualification test sample, the sample valve(s) shall be disassembled and examined visually and dimensionally 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 S1.1.7.

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

S1.1.3.1 The free spring length shall be measured and an allowance of 0.010 in. (0.254 mm) each per 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 fully (solidly) compressed 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 *Valve Body and Diaphragm Hydrostatic Proof Test*—Sample valve body and valve diaphragm hydrostatic tests shall be performed to test the strength and soundness of the pressure-containing envelope. No structural failure, permanent deformation, damage to seating surfaces, or external leakage (except a slight seepage (in drip form) from the spring chamber assemblies in Type I valves) shall be acceptable. A visual and dimensional inspection is required after testing (see S1.1.2).

S1.1.4.1 *Type I Valve Pressure-Containing Envelope*—The hydrostatic test pressure shall be 1.5 times the nominal inlet pressure or design pressure. Table 4 contains a listing of hydrostatic proof pressures. Valve internals shall be removed for the test.

S1.1.4.2 *Type II Valve Pressure-Containing Envelope*—This test shall be performed as above, except that the body/spring chamber shall be blanked off.

S1.1.4.3 *Type I and II Valve Diaphragm Test*—The inlet port shall be blanked off and the outlet section of the valve hydrostatically pressurized to create a pressure differential in accordance with 6.1.5. The valves shall be pressurized for 2 min, depressurized, and pressurized again for 2 min. The valve shall be examined at completion in accordance with S1.1.2.

S1.1.5 *Lockup Pressure Test (Seat Tightness Test)*—The sample valve shall be installed in a test setup that incorporates an accurate means of monitoring pressures at the inlet and outlet (regulated flow) of the valve. The outlet piping shall be arranged so that it shuts off while in a flooded state with no air binding (entrapment) for approximately 100 pipe diameters downstream of the valve. With hydrostatic pressure equal to the rated nominal inlet pressure of the valve applied to the inlet, the valve shall be set to lockup at the midpoint of its pressure range setting. The pressure increase after lockup on the closed downstream (or regulated outlet) side of the valve shall not exceed 10 % of the set pressure or 2.5 psi (17 kPa), whichever is greater, over a 15-min period. If the valve fails to meet these requirements, it shall be given a visual and dimensional examination (S1.1.2) to determine the cause.

S1.1.6 *Composite Test*—The sample valve which has passed the seat tightness test shall be installed in a test setup that incorporates an accurate means of monitoring the flow rate and pressures at the inlet and outlet of the valve. This test setup will facilitate establishment of set pressure limits/accuracy of regulation, capacity, and vibration response.

S1.1.6.1 *Set Pressure Limits/Accuracy of Regulation*—This test shall be conducted in two parts:

(*1*) Measure the downstream pressure at the minimum and maximum of the set pressure range by applying an inlet pressure equal to the nominal valve rating and varying flow from lockup to full flow to lockup. The droop characteristics (fall off in the downstream pressure) shall be determined by following the procedure in 7.1.6.1. The downstream pressure variation shall not exceed the values listed in Table 11.

(*2*) Adjust the set pressure at the mid range of the set pressure adjustment range of the spring. These set pressures shall be 20 psig (138 kPa) for the 5 to 30 psig (34 to 207 kPa) spring, 40 psig (276 kPa) for the 25 to 60 (172 to 414 kPa) psig spring, and 75 psig (517 kPa) for the 50 to 100 psig (345 to 689 kPa) spring. Keeping the flowrate constant, vary the upstream pressure from (10 + set pressure) psig to (110 + set pressure) psig and measure the downstream pressure. The downstream pressure shall not vary by more than 5 psi (34 kPa).

S1.1.6.2 *Capacity Requirements*—Following the above, the valve capacity shall be tested. It shall conform to the requirements of 7.1.6.

S1.1.6.3 *Vibration*—The valve shall be vibration tested with the nominal inlet pressure rating applied to the inlet port and the valve set at approximately the midpoint of the set pressure range. Performance requirements are set forth in 7.1.7.

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 shock 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. After the test, the valve shall be subjected to a visual and dimensional check (S1.1.2) and the tests described in 8.1.1 and 8.1.2. The valve shall meet the requirements of 7.1.8.

S2. Examinations

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

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. The 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 this 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. Packaging and Marking Requirements

S3.1 *Preservation, Packing, and Marking*—Valves shall be individually preserved Level A or commercial, packed Level A, B, C, or commercial as specified (see 5.1.11), and marked in accordance with MIL-V-3.

S3.2 *Cushioning, Dunnage, and Wrapping Materials:*

S3.2.1 *Level A Preservation and Levels A, B, and C Packing*—Utilization of all types of loose-fill materials for shipboard use is prohibited.

S3.2.2 *Commercial Preservation, and Packing*—When loose-fill type materials are used for cushioning, filler, and dunnage, all containers (unit, intermediate, and shipping) shall be marked or labeled with the following information:

"CAUTION

Contents cushioned, etc., with loose-filled material. Not to be taken aboard ship. Remove and discard loose-fill material before shipboard stowage. If required, recushion with polyurethane foam, or transparent flexible cellular material."

S3.3 Cushioning, filler, dunnage, and wrapping materials selected shall have properties (characteristics) resistant to fire.

S3.4 The valve CID/APL number shall be stamped on the valve name plate.

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 right of the manufacturer to establish, and from time to time to alter, the form of organization the manufacturer considers appropriate for its work. Individuals 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 the 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 materials and services conform to specified requirements and that all purchase orders include complete details of the material and services ordered.

S4.7 *Material Control*—The manufacturer shall have a system for material control that ensures that the material received is properly identified and that any required documentation is present, identified as 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 the material during the manufacturing process by a system that identifies the inspection status of the material throughout all stages of manufacture.

S4.8 *Manufacturing Control*—The manufacturer shall ensure that manufacturing operations are conducted 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 quality control plan of the manufacturer shall describe the fabrication operations, including examinations and inspections.

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

S4.11 *Nondestructive Examination*—Provision shall be made to use nondestructive examination, as necessary, to ensure that materials and components comply with the specified requirements. Nondestructive examinations shall be authorized by their employer or qualified by a recognized national body, and their authorizations and 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 materials 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 either originals or copies of such documents.