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INCH-POUND
MIL-V-18030E(SH)
24 August 1990
SUPERSEDING
MIL-V-18030D(SH)
27 December 1976
(See 6.13)

MILITARY SPECIFICATION

VALVES, CONTROL, AIR-DIAPHRAGM-OPERATED (COMPLETE WITH INSTRUMENTATION)

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers air-diaphragm-operated control valves complete with their associated instrumentation.

1.2 Classification. Control valves shall be of the following types and compositions as specified (see 6.2).

Type I - Single-seated, unbalanced.
Type II - Single-seated, direct piston balanced.
Type III - Single-seated, piston balanced incorporating an equalizing valve.
Type IV - Double seated, semi-balanced.
Type V - Three-way, converging service (two inlets - one outlet).
Type VI - Three-way, diverging service (one inlet - two outlets).

Composition A - 2-1/4 percent chromium - 1 percent molybdenum.
Composition B - 1-1/4 percent chromium - 1/2 percent molybdenum.
Composition D - Carbon steel.
Composition E - Non-ferrous.

1.3 Ratings. Ratings shall be as specified in 3.3.2.1.1 and 3.3.2.1.2 (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4820

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

QQ-N-281	- Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections.
QQ-N-288	- Nickel-Copper Alloy and Nickel-Copper-Silicon Alloy Castings.
QQ-S-763	- Steel Bars, Wire, Shapes, and Forgings, Corrosion-Resisting.
PPP-F-320	- Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes.

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MIL-V-3	- Valves, Fittings, and Flanges (Except for Systems Indicated Herein); Packaging of.
MIL-B-233	- Boxes, Supply Support Items, Stowage and Storage.
MIL-S-901	- Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-S-1222	- Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts.
MIL-P-15024	- Plates, Tags and Bands for Identification of Equipment.
MS16142	- Boss, Gasket Seal Straight Thread Tube Fitting, Standard Dimensions for.
MIL-R-17131	- Rods and Powders, Welding, Surfacing.
MIL-L-19140	- Lumber and Plywood, Fire-Retardant Treated.
MIL-F-20042	- Flanges, Pipe and Bulkhead, Bronze (Silver Brazing).
MIL-G-21032	- Gaskets, Metallic-Asbestos, Spiral Wound.

STANDARDS

MILITARY

MIL-STD-167-1	- Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited).
MIL-STD-278	- Welding and Casting Standard.
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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(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, BLDG. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form). (DoD adopted)
B1.12 - Class 5 Interference-Fit Thread.
B16.5 - Pipe Flanges and Flanged Fittings. (DoD adopted)

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 105 - Standard Specification for Forgings, Carbon Steel, for Piping Components.
A 182 - Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service. (DoD adopted)
A 216 - Standard Specification for Steel Castings, Carbon Suitable for Fusion Welding, for High-Temperature Service. (DoD adopted)
A 217 - Standard Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure Containing Parts, Suitable for High-Temperature Service. (DoD adopted)
A 395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures. (DoD adopted)
A 564 - Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless and Heat-Resisting Steel Bars and Shapes.
A 675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties. (DoD adopted)
B 61 - Standard Specification for Steam or Valve Bronze Castings. (DoD adopted)
B 369 - Standard Specification for Copper-Nickel Alloy Castings. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)
AMS 5373 - Alloy Castings, Sand, Corrosion and Heat Resistant
60Co - 29Cr - 4.5W as Cast.

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.5) in accordance with 4.3.

3.2 Materials. Materials shall be as specified in table I. Materials for parts other than those listed in table I shall be selected to prevent galling, seizing, or excessive wear on operating parts. Clearance shall prevent interferences due to thermal expansion.

TABLE I. List of materials.

Name of parts	Composition A	Composition B	Composition D	Composition E 1/
Body bonnet, and bottom flange	ASTM A 182 grade F22 ASTM A 217, grade WC9	ASTM A 182 grade F11 ASTM A 217, grade WC6	ASTM A 105, grade II ASTM A 216, grade WCB ASTM A 675, grade 60	ASTM B 61 ASTM B 369, alloy 964
Yoke	ASTM A 395 ASTM A 216, grade WCB			
Gaskets	Steam service - all pressure ratings Oil and water service - gauge pressure rating 600 lb/in^2 and above - MIL-G-21032			
Bolting 2/ Externally threaded Internally threaded	Grade B16 Grade 4	Grade B16 Grade 4	Grade B7 Grade 2H	Grade B7, or austenitic CRES Grade 2H, 405 or austenitic CRES

See footnotes at end of table.

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TABLE I. List of materials - Continued.

Name of parts	Composition A	Composition B	Composition D	Composition E 1/
Packing	See 3.3.2.8			
Diaphragm	See 3.3.3.5			
Internal trim	See 3.2.1			
Stem and packing box	Austenitic CRES, PP-S-763			Nickel-Copper, QQ-N-281 Austenitic CRES
Piston	Martensitic or precipitation hardening CRES-hardened, ASTM A 564, type 630, or QQ-S-763			Nickel-copper, QQ-N-281 Austenitic CRES, QQ-S-763 ASTM B 61
Other parts	See 3.2.1			

1/ Where composition E valves are to be installed in sea water services, all internal trim and external hardware (i.e., bolting and packing glands) shall be of nickel-copper alloys.

2/ All bolting shall be in accordance with MIL-S-1222 (see 6.10). Higher temperature rated bolting materials may be used in lower temperature applications.

3.2.1 Internal trim materials. When the following categories of trim materials for the control valve are specified and the contracting activity is uncertain regarding the category of trim material best suited for the particular application, the valve manufacturer may be given responsibility for selecting the proper trim material from the above categories, or other suitable trim combinations for the service conditions specified (see 6.2). Materials for the seat or seat ring, plug, guide posts, bushings (if not cage guided), and cage, where applicable, shall consist of the materials specified in (a) through (d), unless otherwise approved by the contracting activity.

(a) Cobalt alloy. Seating and guiding surfaces shall be either wrought or cast cobalt alloy, or an inlay of cobalt alloy not less than 3/32 inch thick for the main seat and disc surfaces. Where inlays are used, welding rods shall be as listed below.

(b) Hardened CRES. Plug shall be hardened 400 series or 17-4Ph CRES and the seat ring shall be cobalt alloy. Guiding surfaces shall be hardened CRES or cobalt alloy.

(c) 18-8 CRES. Plug and seat ring shall be 300 series CRES. Guide bushings or cage shall be hardened 17-4Ph or 400 series CRES.

(d) Nickel-copper alloy. All trim components shall be monel or S-monel.

Trim materials for (a) through (d) above shall be in accordance with the following specifications:

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Wrought or case cobalt alloy	SAE AMS 5373
Inlaid cobalt alloy (welding rod)	MIL-R-17131, type MIL-RCo-Cr-A
Hardened 400 series CRES	QQ-S-763
18-8 series CRES	QQ-S-763
17-4Ph CRES	ASTM A 564, type 630
Monel	QQ-N-281
S-monel	QQ-N-288, composition D

3.2.2 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3 Construction. Construction shall be as specified in 3.3.1 through 3.3.4 (see 6.3).

3.3.1 General requirements.

3.3.1.1 Threads. Threads shall conform to ANSI B1.1. Where necessary, provisions shall be incorporated to prevent the accidental loosening of threaded parts. Pipe threads shall not be used.

3.3.1.2 Bolts and nuts. Hex head bolts and nuts shall be in accordance with MIL-S-1222.

3.3.1.3 Interchangeability. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance, and strength.

3.3.1.4 Accessibility. Valves shall be constructed to be accessible for adjustment and repair without requiring removal from the line.

3.3.1.5 Maintainability. Internal parts shall be constructed to permit easy disassembly and reassembly with standard tools or special tools and to prevent the incorrect reassembly of the valve. Positioning and alignment of all parts in assembly shall employ positive means so that correct reassembly is repeatedly assured.

3.3.1.6 Special tools and wrenches. Special tools required for maintenance of the valve shall be furnished. Special tools are defined as those tools not listed in the Federal Supply Catalog (copies of this catalog may be consulted in the office of the Defense Contract Administration Services Management Area (DCASMA)). Ordinary tools or wrenches shall not be furnished. Unless otherwise specified (see 6.2), special tools shall be furnished in a repair parts box conforming to type M of MIL-B-233.

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3.3.2 Body subassembly.

3.3.2.1 Pressure-temperature ratings.

3.3.2.1.1 Pressure-temperature ratings compositions A, B, and D. The design and pressure-temperature rating for compositions A, B, and D valves shall be in accordance with ANSI B16.5 for classes 150, 600, 900 and 1500, except for the maximum temperature limitations as follows:

Composition A - 1050 degrees Fahrenheit (°F)
Composition B - 1000°F
Composition D - 775°F

3.3.2.1.2 Pressure-temperature ratings composition E. Composition E valves shall be constructed for a working gauge pressure of 100 pounds per square inch (lb/in^2) at 425°F.

3.3.2.2 End preparation. Valves shall be furnished with flanged ends in accordance with ANSI B16.5 for composition A, B, and D valves, and MIL-F-20042 for composition E valves. Flanges shall be cast or forged integral with the valve body. The inlet and outlet flange shall be of the same size and pressure rating. Unless otherwise specified (see 6.2), valves shall be of a basic globe configuration with inline inlet and outlet ports.

3.3.2.3 Body passages. For control valves intended for application under erosive conditions, body passages shall be constructed to produce gradual changes in flow direction so as to reduce any affects of concentrated impingement and 90-degree turns.

3.3.2.4 Bonnet and bottom flange joints.

3.3.2.4.1 Bonnet and bottom flange joints, composition A, B, and D valves. Bonnet and bottom flange, where applicable, for composition A, B, and D valves shall be flanged for attachment to the body and shall be located by body guiding, a close tolerance fit between machined diameters on the body, bonnet, and bottom flange rather than depending on studs or bolts for location. Where spiral wound gaskets are used, they shall be fully retained and the joints shall have metal-to-metal take-up to provide controlled compression of the gaskets. Joint construction shall assure parallel alignment of the valve guiding surfaces. Sufficient bolting area shall be provided to maintain metal-to-metal make-up over at least a 3-year period. Flanges shall be secured by either of the following:

(a) Through bolts threaded the entire length and fitted with a nut on each end. Threads on bolts and nuts shall be a class 2 fit in accordance with ANSI B1.1.
(b) Studs shall be in accordance with MIL-S-1222, style b, except the dimensions of the interference fit shall be in accordance with ANSI B1.12.

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3.3.2.4.2 Bonnet and bottom flange joints, composition E valves. For composition E valves in sizes 1-1/2 inches and below, a straight machine threaded and gasketed bottom cap may be utilized, and, in all size composition E valves, the bonnet and bottom flange joints may be secured with cap screws in addition to the methods specified in 3.3.2.4.1(a) and (b). Joint construction shall assure parallel alignment of the valve guiding surfaces.

3.3.2.5 Spot or back facing. Bearing surfaces of nuts and their respective surfaces on the valve shall be finish machined on composition A, B, and D valves and cast smooth and true without nut interference, or be finish machined for composition E valves.

3.3.2.6 Bonnet construction. Valves shall be constructed to limit packing temperatures to a maximum of 500°F under any operating condition for which the valve is designed. Where necessary, radiation or extension bonnet shall be provided for this purpose. A packing lubricator shall not be used.

3.3.2.7 Packing box assembly: A packing box assembly shall be provided to seal against leakage along the stem. Sealing bellows shall not be used. Packing gland shall be of bolted construction and shall be constructed so that the actuator assembly can be removed without disturbing the packing adjustment.

3.3.2.8 Packing. Packing shall be designed for sustained operation at the temperature and pressure conditions to which it will be subjected.

3.3.2.9 Gasket. The spiral wound gasket shall retain sufficient residual load in service to maintain a leak-tight joint over at least a 3-year period under normal operating conditions.

3.3.2.10 Internal trim.

3.3.2.10.1 Guiding surfaces. A difference in hardness of at least 100 points Brinell shall be maintained between the rubbing surfaces for main valve guiding. This requirement does not apply if both the guide posts and bushings are stellited or if the hardness of either exceeds 450 Brinell. Rubbing surfaces for valve guiding shall have a finish of roughness height rating (RHR) 16 or better.

3.3.2.10.2 Seat rings. Where quick change cage trim is not required (see 6.2), threaded-in seat rings may be provided. On valves used on steam service greater than a gauge pressure of 225 lb/in^2, seat rings shall be either seal welded circumferentially, or gasketed. On other applications of threaded-in seat rings, a seat may be provided by a make-up against machined surfaces. In no case shall close fitting threads be used to provide a seal. Threaded-in seat rings shall be provided with substantial lugs to facilitate installation and removal.

3.3.3 Diaphragm actuator assembly.

3.3.3.1 Operating range. Unless otherwise approved by the contracting activity, the actuator assembly shall operate on a standard gauge pressure of 3 to 15 or 6 to 30 lb/in^2 air signal ranges.

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3.3.3.2 Reversibility. Direct acting and reverse acting actuators shall be interchangeable on body subassemblies without requiring modification or additional parts to the body subassemblies.

3.3.3.3 Yoke. Yoke construction shall allow easy access to the stuffing box, stem connection, and spring adjuster from either side of the valve. Universal mounting pads shall be provided on opposite rides of the yoke for mounting valve positions or other accessories or both.

3.3.3.4 Travel indicator. A travel indicator shall be provided to indicate valve plug position. The indicator scale shall be attached to the yoke and marked in inches on one side of a dividing line and the percentage of opening on the other.

3.3.3.5 Diaphragms. Diaphragms shall be deep molded and uniform contact shall be maintained between the diaphragm plate and diaphragm during full valve travel. Diaphragms shall be molded from Neoprene or Buna-N, or equal, and shall be synthetic fabric reinforced to provide a minimum burst strength of 150 lb/in^2 over a 2-inch opening.

3.3.3.6 Diaphragm spring. When practicable, only one diaphragm spring shall be required. The ends of the spring shall be ground within 1 degree of its perpendicular axis. The spring compression shall be readily adjustable while the valve is in service. Spring and spring parts shall be coated with a rust inhibiting material.

3.3.3.7 Diaphragm case. The diaphragm case shall be constructed for a maximum operating pressure of 50 lb/in^2 gauge. The case shall be made of steel, coated with a rust inhibiting material, or aluminum.

3.3.3.8 Air connections. Air connections between the pilot, actuator, and other accessories shall be in accordance with MS16142, straight thread and O-ring seal.

3.3.3.9 Manual override. When specified (see 6.2), manual override shall be furnished. Location shall be as specified (see 6.2). A clockwise rotation of the handwheel shall close the valve.

3.3.4 Instrumentation. Unless otherwise specified (see 6.2), the valve manufacturer shall furnish, as part of the valve, the instrumentation necessary to accomplish the required control function (see 6.6.5). The process connection to controllers pilots or transmitters shall be flanged. The overall construction shall permit the use of the most simple and direct instrumentation system consistent with performance requirements. Construction of all instrumentation shall emphasize simplicity, maintainability, ruggedness, and reliability. Wherever compatible from a performance, sensitivity, and speed of response standpoint, intermittent bleed instrumentation shall be used.

3.4 Performance.

3.4.1 Capacity. Required capacity of the valve shall be as specified (see 6.2).

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3.4.2 Rangeability. Rangeability for the various flow characteristics shall be as follows:

(a) Equal percentage - 50-to-1, minimum
(b) Modified linear - 35-to-1, minimum
(c) Linear - 25-to-1, minimum
(d) Quick opening - 15-to-1, minimum

3.4.3 Seat tightness. Maximum allowable leakage, under the test conditions specified in 4.5.2.3, shall not exceed the following values:

Type	Percent of maximum valve capacity
I	0.01
II	.25
III	.01
IV	.50
V	.01 (in each direction)
VI	.01 (in each direction)

3.4.4 External leakage, valve body subassembly. There shall be no visible external leakage.

3.4.5 Leakage, diaphragm case. There shall be no leakage past the diaphragm or externally from the diaphragm case (see 4.5.2.4).

3.4.6 Mechanical shock and vibration. Valves shall be constructed to meet the mechanical shock requirements specified in MIL-S-901, grade A, class I, and MIL-STD-798, and the environmental vibration requirements specified in MIL-STD-167-1, type I. This shall apply to the entire valve, including all associated instrumentation. During and subsequent to these conditions, the equipment shall not fail to perform its principal function, and the deviation in the instrument output pressure signal shall not exceed 3 percent of its output pressure range. Any instrumentation intended to be valve-mounted should be so mounted during shock and vibration testing.

3.4.7 Stem leakage. There shall be no visible leakage past the packing under operating conditions. For steam service, detection may consist of viewing against a dark background or use of a mirrored surface.

3.4.8 Hysteresis. Under operating conditions, and at any position within the full stroke of the stem, a change in signal pressure of 0.35 lb/in^2 in either direction shall cause valve movement. The maximum difference in valve position between increasing and decreasing pressure shall not exceed 2 percent of stroke.

3.4.9 Linearity. The relationship between air signal and stem travel shall be linear within plus or minus 3 percent.

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3.5 Marking.

3.5.1 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 or "inlet" and "outlet" shall be cast or forged integral with the valve body or stamped on the outside diameter (od) of the flanges.

3.5.2 Identification plates. Each valve and pilot shall have an identification plate made of CRES or brass in accordance with MIL-P-15024. Identification plates shall be permanently fastened to a part of the valve not subjected to working pressure and which will not be covered by insulation. Identification plates shall contain the following data or a space therefor:

(a) Manufacturer's CAGE code.
(b) PIN number (see 6.9).
(c) Maximum inlet temperature, pressure rating, and pressure differential operating limitation.
(d) Flow characteristics and flow coefficient (C_v) rating.
(e) Diaphragm actuator air operating range.
(f) Adjustable set pressure range.
(g) Manufacturer's model and part number or identification.
(h) Manufacturer's drawing numbers, assembly, and component identification.
(i) Applicable manual number.
(j) Space for nine-digit component identification number.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

(a) First article inspection (see 4.3).
(b) Quality conformance inspection (see 4.5).

4.3 First article inspection. First article inspection shall consist of the examination and tests specified in 4.4 (see 6.3).

4.4 First article examination and tests. The first valve of the same type, composition, and rating furnished under a contract or order shall undergo the first article examination and tests specified in 4.4.1 through 4.4.2.3, and 4.5.2.1 through 4.5.2.3.

4.4.1 Examination. The valve shall be disassembled and visually and dimensionally examined to determine conformance to the requirements of this specification and drawings. Particular emphasis shall be placed on the dimensions, finishes, and condition of the guiding and seating surfaces. In lieu of disassembly for examination, valves shall be visually and dimensionally examined prior to assembly.

4.4.2 Test methods.

4.4.2.1 Operational tests. The valve shall be operationally tested as follows:

(a) The valve shall be assembled and subjected to operating pressure and temperature. Stem leakage shall not exceed that specified in 3.4.7. Tapping the valve, or other means to overcome sticking during the test, shall not be permitted.
(b) Hysteresis shall be tested at 10, 25, 50, 75, and 90 percent of stroke. A signal change of 0.35 lb/in^2 in either direction shall cause valve movement at each position. A hysteresis loop shall be obtained and the maximum difference in valve position between increasing and decreasing pressures shall not exceed 2 percent of stroke.
(c) Linearity of travel shall be tested at 0, 25, 50, 75, and 100 percent of stroke. The relationship between air pressure and stem travel shall be linear as specified in 3.4.9.
(d) If a valve positioner is supplied, it shall be bypassed for the above tests.

Where the specified operating conditions exceed those available at the manufacturer's facilities, consideration may be given to allowing these tests to be conducted at the closest available operating conditions, provided the manufacturer has verifiable test data based on previous tests at or above the specified operating conditions, showing that the packing is suitable from a sealing and hysteresis standpoint for the specified operating conditions.

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4.4.2.2 Flow tests. A flow test shall be conducted to determine the valve C_v and the flow characteristics. Flow rating shall be as specified (see 6.2), and the flow characteristics shall fall within the limits defined (see 6.6.4). This test may be waived where the manufacturer supplies verifiable test evidence based on previous testing that the valve shall meet these requirements.

4.4.2.3 Shock and vibration tests. When specified (see 6.2), valves shall be subjected to shock testing in accordance with MIL-S-901, grade A, class I, and MIL-STD-798, and the vibration tests specified in MIL-STD-167-1, type I. Operation during testing shall be as specified in 3.4.6. Post shock operational tests shall be as specified in 4.4.2.1 and deviations shall not exceed the values listed by more than 50 percent. Extension of previous shock and vibration tests may be considered where changes involve such aspects as the substitution of an inner valve design or a reverse acting for a direct acting actuator, or vice versa. Previous acceptance of a body subassembly-actuator combination may extend to the same body subassembly in combination with a smaller actuator, provided that smaller actuator has passed shock and vibration testing.

4.5 Quality conformance inspection. Each valve offered for delivery shall be subjected to the examination specified in 4.5.1 and the tests specified in 4.5.2.1 through 4.5.2.4 (see 6.3 and 6.11).

4.5.1 Examination. Each valve shall be visually examined to verify valve configuration (see 1.2) and compliance with the requirements of 3.3.1.3, 3.3.1.4, 3.3.1.5, 3.3.1.6, and 3.3.2.2.

4.5.2 Test methods.

4.5.2.1 Nondestructive tests. Each valve shall undergo the radiographic, magnetic particle, and dye penetrant tests in accordance with MIL-STD-278.

4.5.2.2 Hydrostatic test. Each valve shall be hydrostatically tested as follows prior to any painting of the valve body:

(a) Composition A, B, and D valves - in accordance with ANSI B16.5.
(b) Composition E valves - two times the nominal pressure rating.

4.5.2.3 Seat leakage test. Tests for seat leakage shall be conducted on each valve as follows:

(a) Valves with a pressure of 3 to 15 lb/in^2 gauge, range springs shall be tested with a pressure of 0 or 18 lb/in^2 gauge on the diaphragm.
(b) Valves with a pressure of 6 to 30 lb/in^2 gauge, range springs shall be tested with a pressure of 0 or 36 lb/in^2 gauge on the diaphragm.
(c) Valves with other ranges shall be tested with zero or the normal supply pressure on the diaphragm.

The line pressure during this test shall be the working pressure and shall be applied in the direction of flow. Maximum allowable leakage shall be as specified in 3.4.3. During this test, a check shall be made for external leakage.

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4.5.2.4 Diaphragm case leakage. A leakage test shall be made on each valve with air at the pressure of 50 lb/in^2 gauge after complete assembly. Detection shall be by soap bubble solution. There shall be no visible leakage over a 5-minute period.

4.6 Inspection of packaging. Sample packs, and the inspection of the preservation, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.7.)

5.1 General.

5.1.1 Navy fire-retardant requirements.

(a) Treated lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B - Type II - weather resistant.
Category 1 - general use.
Level C - Type I - non-weather resistant.
Category 1 - general use.

(b) Fiberboard. Fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packing forms shall meet the flamespread index and the specific optic density requirements of PPP-F-320.

(c) Cushioning and wrapping materials. The use of excelsior, newspaper, shredded paper (all types), and similar hygroscopic or nonneutral materials and all types of loose fill materials for packaging (preservation and packing) applications such as cushioning, fill, stuffing, and dunnage is prohibited. Materials selected for cushioning and wrapping shall have properties (characteristics) for resistance to fire (see 6.8). Cushioning or wrapping materials, as applicable, shall be provided to prevent item and package damage and to prevent free movement of the container contents.

5.2 Packaging requirements. The packaging (preservation, packing and marking) requirements of valves shall be in accordance with MIL-V-3 for the level of preservation (A, C, or commercial); level of packing (A, B, C, or commercial); and marking, including packaging acquisitioning options therein as specified (see 6.2).

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The diaphragm operated valves specified in this specification are intended for throttling and on-off service.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number and date of this specification.
(b) Type and composition required (see 1.2).
(c) Rating required (see 1.3).
(d) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
(e) When first article inspection is required (see 3.1).
(f) Internal trim materials when specific materials are required (see 3.2.1).
(g) If special tools should be furnished in a manner other than as specified (see 3.3.1.6).
(h) Whether valves should be other than of a basic globe configuration (see 3.3.2.2).
(i) Whether quick change trim is required (see 3.3.2.10.2).
(j) Whether a manual override is required, and if required, its location (see 3.3.3.9).
(k) Whether manufacturer shall furnish instrumentation (see 3.3.4).
(l) Required capacity of valve (see 3.4.1).
(m) Flow characteristics required (see 4.4.2.2 and 6.6.4).
(n) Whether mechanical shock and vibration testing is required (see 4.4.2.3).
(o) When treated lumber and plywood is not required (see 5.1.1(a)).
(p) Level of preservation, packing, and other acquisitioning options required (see 5.2).
(q) Service conditions:

    (1) Fluid and range of temperatures.
    (2) Minimum and maximum flow rates required.
    (3) Minimum and maximum inlet and outlet pressure.
    (4) Rate of load change.
    (5) Control function required.

(r) Brief description of application and any special performance or construction requirements.

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided

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and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.3	DI-E-7031	Drawings, engineering and associated lists	----
4.3	DI-T-4902	First article inspection report	----
4.5	DI-T-5329	Inspection and test reports	----

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, military specifications and standards that have been cleared and listed in DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.5 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first ___ production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.6 Definitions. The definitions of 6.6.1 through 6.6.11 are applicable to this specification.

6.6.1 Internal trim. Internal trim should include internal parts of the control valve such as seat rings, plugs, stems, guide bushings, cage, pistons, and so forth.

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6.6.1.1 Quick change cage trim. Quick change cage trim consists of a gasket sealed seat ring which is held in position by a cage, which may be either separate from or integral with the seat ring which is in turn held in position by either the bonnet or bottom flange. This design should permit the rapid replacement of all internal trim by avoiding the use of any threads located within the valve body, such as seat ring threads.

6.6.2 Flow coefficient (C_v). Flow coefficient C_v is a basic capacity rating for valves which relates flow rate to the inlet and outlet pressure for a particular fluid. For water service, defined as the number of gallons per minute (gal/min) of 60°F water that will flow through the valve with a 1 lb/in^2 pressure drop across the valve.

6.6.3 Rangeability. Rangeability is a measure of the usable range of a control valve and defined as the ratio of the maximum to the minimum controllable C_v. This maximum and minimum controllable C_v establishes the throttling range over which a given control characteristic can be maintained and within which the valve can perform a useful throttling function.

6.6.4 Flow characteristics. The inherent flow characteristics for control valves covered by this specification is as defined in (a) through (e).

(a) Equal percentage. Equal percentage is when the percentage change in C_v per increment of lift remains constant over the entire operating range of the valve. This characteristic should be based on a minimum C_v plug just off the seat of 2 percent maximum capacity. For an ideal characteristic, 8-1/3 percent increase in lift produces 38 percent increase in C_v. Actual increase in C_v should be from 33 to 43 percent.

(b) Linear. Linear is when the change in C_v increment of lift remains constant over the entire operating range of the valve. Actual characteristics may vary plus or minus 5 percent, for linearity, if minimum C_v, plug just off the seat, does not exceed 4 percent of maximum capacity.

(c) Modified linear. Modified linear is a characteristic which is a compromise between equal percentage and linear where the valve exhibits a linear characteristic during the middle portion of the lift and a decreased sensitivity at the lower and upper portions of the list. Minimum C_v, plug just off the seat, should not exceed 3 percent of maximum capacity.

(d) Quick opening. Quick opening means that the C_v increases rapidly with lift and reaches a maximum value at a lift equal to approximately 25 percent of the seat diameter.

(e) Three-way. Three-way is when total flow area remains constant at all positions of the valve stem.

6.6.5 Instrumentation. The term instrumentation, when used in this specification refers to any pneumatic instrumentation, control pilots, transmitters, relays, selectors, positioners, instrument air reducing valves, and strainers, required for operation of the control valve in the system.

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6.6.5.1 Constant bleed instrument. Constant bleed instrument is an instrument or instrument system which continually exhausts or bleeds a certain amount of the control air to atmosphere, even when the control valve actuator pressure is being maintained at a constant value.

6.6.5.2 Intermittent bleed instrument. Intermittent bleed instrument is an instrument or instrument system which only exhausts or bleeds control air to atmosphere when it is necessary to decrease the control valve actuator pressure. Under steady load conditions where there is no change in actuator pressure required, both the supply and vent functions are shut off and there is no loss of control air to atmosphere.

6.6.6 Direct acting control pilot or transmitter. The output signal increases as the measured variable or input signal increases.

6.6.7 Reverse acting control pilot or transmitter. The output signal decreases as the measured variable or input signal increases.

6.6.8 Direct acting actuator. An increase in the pressure to the actuator results in a downward stroke of the stem.

6.6.9 Reverse acting actuator. An increase in the pressure to the actuator results in an upward stroke of the stem.

6.6.10 Air-to-open, normally closed. A control valve, actuator plus body subassembly, is of air-to-open construction if an increase in pressure to the actuator causes the plug to move away form the seated position.

6.6.11 Air-to-close, normally open. A control valve, actuator plus body subassembly, is of air-to-close construction if an increase in pressure to the actuator causes the plug to move toward the seated position.

6.7 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.8 Cushioning and wrapping materials. Materials having properties for resistance to fire (see 5.1.1(c)) and acceptable for use within unit packs and shipping containers for Navy acquisitions are:

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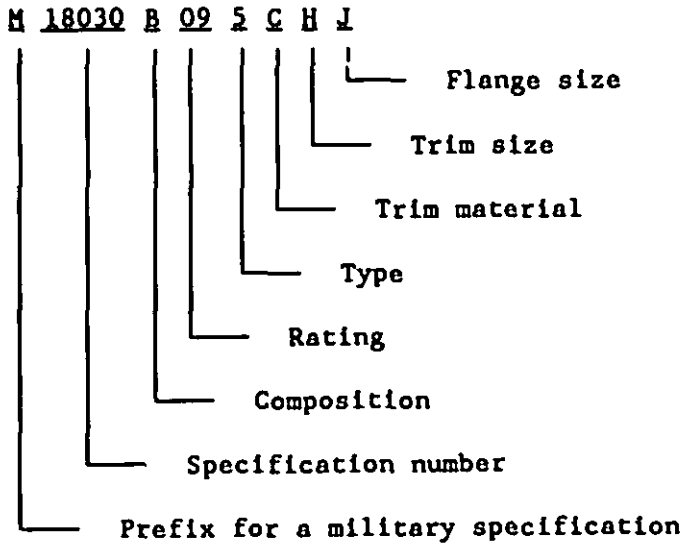
Material	Specification
Paper, kraft, treated (fire resistant)	A-A-1894
Paper, kraft, wrapping	UU-P-268, type II, grade C or D
Fiberboard	PPP-F-320, class - domestic/fire retardant
Plastic film, flexible, cellular	PPP-C-795, class 3 - fire retardant
Polystyrene expanded, resilient	PPP-C-850, grade SE
Plastic, open cell, cushioning	PPP-C-1842, type I, style B
Bound fiber	PPP-C-1120, type III or IV, class C
Rubber, latex foam	MIL-R-5001, grade A
Rubber, cellular	MIL-R-6130, grade A
Fibrous glass	MIL-C-17435
Polystyrene foam	MIL-P-19644, type II
Rubber, cellular, synthetic	MIL-R-20092, class 5
Polyurethane foam	MIL-P-26514
Polyurethane foam, flexible, open cell	MIL-F-81334
Foam, combustion, retardant, for cushioning supply items aboard navy ships	MIL-F-87090

6.9 Part or Identifying Number (PIN). The PIN number to be used for control valves acquired to this specification are created as follows:



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PIN Codes. The following codes can be used to create and interpret PIN numbers:

Composition

A - 2-1/4 percent chromium, 1 percent molybdenum, maximum temperature 1050°F (see 3.3.2.1.1).
B - 1-1/4 percent chromium, 1/2 percent molybdenum, maximum temperature 1000°F, (see 3.3.2.1.1).
C - Carbon steel, maximum temperature 775°F (see 3.3.2.1.1).
D - Non-ferrous, maximum temperature 425°F (see 3.3.2.1.2).

Rating

01 - Class 150.
06 - Class 600.
09 - Class 900.
15 - Class 1500.

Type

1 - Single-seated, unbalanced.
2 - Single-seated, direct piston balanced.
3 - Single-seated, piston balanced incorporating an equalizing valve.
4 - Double-seated, semi-balanced.
5 - Three-way, converging service (two inlets - one outlet).
6 - Three-way, diverging service (one inlet - two outlets).

Trim materials

A - Cobalt alloy (see 3.2.1).
B - Hardened CRES (see 3.2.1).
C - 18-8 CRES (see 3.2.1).
D - Nickel-copper alloy (see 3.2.1).

Flange and trim size

A - 0.5	J - 3.5
B - 0.75	K - 4.0
C - 1.0	L - 5.0
D - 1.25	M - 6.0
E - 1.5	N - 8.0
F - 2.0	P - 10.0
G - 2.5	R - 12.0
H - 3.0	

PIN number example.

M18030BC5CHJ - Air-diaphragm-operated control valve in accordance with MIL-V-18030, made from 1-1/4 percent chromium - 1/2 percent molybdenum, class 900, 1000°F max, three-way, converging service (two inlets - one outlet) design, 300 series CRES plug and seat ring, 17-4Ph or 400 series CRES guide bushings or cage, 3 inch trim size and 3.5 inch flanges.

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6.10 Bolting. The applicable specification for valve bolting is MIL-S-1222, revision H or subsequent.

6.11 Quality conformance inspection report. Test reports should be prepared in accordance with MIL-STD-831 (see 4.5).

6.12 Subject term (key word) listing.

Cobalt alloy
Diaphragm actuator
Monel
Valve, on-off
Valve, throttling

6.13 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Review activity:
DLA - SS

Preparing activity:
Navy - SH
(Project 4820-N033)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-V-18030E(SH)	22 August 1990

3. DOCUMENT TITLE
VALVES, CONTROL, AIR-DIAPHRAGM-OPERATED (COMPLETE WITH INSTRUMENTATION)

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code)	
Technical Point of Contact (TPOC): Mr. Carl Williams (SEA 56Y23) PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS	(1) Commercial TPOC: 703-602-0367	(2) AUTOVON 8-332-0367
c. ADDRESS (Include Zip Code) Commander, Naval Sea Systems Command Department of the Navy (SEA 55Z3) Washington, DC 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	