INCH-POUND

MIL-DTL-5523E
23 November 2011
SUPERSEDING
MIL-V-5523D
28 February 1991

DETAIL SPECIFICATION

VALVE; RELIEF, HYDRAULIC PRESSURE

Inactive for new design after 16 October 2009.

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the requirements for hydraulic pressure relief valves.

1.2 Classification. Relief valves are of the following types and classes as specified.

1.2.1 Type I Rectangular envelope, conforming to AN6279.

1.2.2 Classes:

Class YZ – Adjustable from 100 to 1,000 psi at rated relief flow
Class AB – Adjustable from 1,000 to 2,300 psi at rated relief flow
Class CD – Adjustable from 2,300 to 3,850 psi at rated relief flow

1.2.3 Other classes. Relief valves adjustable to the range of more than one class, carry in the Part or Identifying Number (PIN) the abbreviated letter designation of the lowest and highest pressure class, for example: A valve adjustable from 1,000 to 3,850 psi would be AN6279AD.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

AN6248	Pump Hydraulic Hand, Type 3000
AN6279	Valve - Hydraulic Pressure Relief Two Port
MIL-G-5514	Gland Design, Packing, Hydraulic, General Requirements For
MIL-DTL-5516	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 160°F (71°C)
MIL-DTL-5541	Chemical Conversion Coatings on Aluminum And Aluminum Alloys
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-PRF-6083	Hydraulic Fluid, Petroleum Base, For Preservation And Operation
MIL-A-8625	Anodic Coatings, For Aluminum And Aluminum Alloys

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to FluidFlow@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil.

MIL-PRF-83282	Hydraulic Fluid Fire Resistant, Synthetic Hydrocarbon Base, Metric NATO Code Number H-537
MIL-DTL-83488	Coating, Aluminum, High Purity
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft And Missile
MS28774	Retainer, Packing Backup, Single Turn, Polytetrafluoroethylene
MS28777	Washer, Flat Aircraft Hydraulic Backup
MS28783	Ring, Gasket, Back-Up, PTFE

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-889	Dissimilar Metals
MS16624	Ring, Retaining, External, Basic (Tapered Section Type)
MS16625	Ring, Retaining, Internal, Basic (Tapered Section Type)
MS21344	Fittings -- Installation Of Flared Tube, Straight Threaded Connectors, Design Standard For

(Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of documents are those cited in the solicitation or contract.

ASME INTERNATIONAL

ASME B46.1	Surface Texture (Surface Roughness, Waviness, and Lay)

(Copies of these documents are available online at http://www.asme.org or from the ASME International, Three Park Avenue, New York, NY 10016-5990.)

ASTM INTERNATIONAL

ASTM B633	Electrodeposited Coatings of Zinc on Iron And Steel, Standard Specification For
ASTM B700	Electrodeposited Coatings of Silver for Engineering Use, Standard Specification For
ASTM B545	Electrodeposited Coatings of Tin, Standard Specification for
ASTM E1444	Magnetic Particle Testing, Standard Practice for

(Copies of these documents are available online at http://www.astm.org or from the ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

AEROSPACE INDUSTRIES ASSOCIATION (AIA)

NASM20995	Wire, Safety or Lock
NASM 33540	Safety Wiring, Safety Cabling, Cotter Pinning, General Practices For

(Copies of these documents are available online at http://www.aia-aerospace.org or from the Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3901.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 17025	General requirements for the competence of testing and calibration laboratories

(Copies of these documents are available online at http://www.iso.ch or from the International Organization for Standardization American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.)

NCSL INTERNATIONAL

NCSL Z540.3	Requirements for the Calibration of Measuring and Test Equipment

(Copies of these documents are available online at http://www.ncsli.org or from NCSL International 2995 Wilderness Place, Suite 107 Boulder, Colorado 80301-5404)

SAE INTERNATIONAL

SAE AMS-QQ-N-290	Nickel Plating (Electrodeposited)
SAE AMS 2404	Plating, Electroless Nickel
SAE AMS 2460	Plating, Chromium
SAE AS4059	Aerospace Fluid Power – Cleanliness for Hydraulic Fluids
SAE AS5169	Fitting, Port Plug and Bleeder
SAE AS5202	Port or Fitting End, Internal Straight Thread, Design Standard
SAE AS5440	Hydraulic Systems, Aircraft, Design, and Installation, Requirements For
SAE AS8775	Hydraulic System Components, Aircraft and Missiles, General Specification For
SAE AS8879	Screw Threads - UNJ Profile, Inch Controlled Radius Root with Increased Minor Diameter
SAE AS28775	Packing, Preformed, - MS28775 O-Ring
SAE AS28778	Packing, Preformed, Straight Thread Tube Fitting Boss

(Copies of these documents are available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 of these documents (outside USA), www.sae.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern.

3.2 First article. When specified (see 6.3), a sample shall be subjected to first article inspection in accordance with 4.4.

3.3 Materials. Materials shall be as specified herein and shall conform to all applicable specification sheets. When a definite material is not specified, a material shall be used which will enable the pump to meet the requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of acceptance of the finished product.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials shall be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3.2 Metals. All metals shall be compatible with the fluid and intended temperature, functional, service, and storage conditions to which the components will be exposed. The metals shall possess adequate corrosion-resistant characteristics or shall be suitably protected by the use of coatings equivalent to those listed in table I to resist corrosion which may result from such conditions as dissimilar metal combinations, moisture, salt spray, and high temperature deterioration, as applicable. Where not indicated, class or type is at the option of the manufacturer, subject to approval by the procuring activity. Dissimilar metals are defined in MIL-STD-889.

3.3.2.1 Copper or aluminum alloys. All copper alloys shall be suitably protected with a coating specified in table I, except that cadmium and zinc plating shall not be used in applications subject to abrasion. Other metallic coatings, which shall have been demonstrated to be satisfactory to the Government, such as electroless nickel and electrodeposited 85 percent tin, 15 percent cadmium alloy, may be used. All aluminum alloys shall be anodized in accordance with MIL-A-8625, type II coating, except that in the absence of abrasive conditions the anodize may be type I coating, where applicable, or may be a chemical film in accordance with MIL-DTL-5541.

TABLE I. Metal coatings.

Coating	Specification
Zinc Plating	ASTM B633
Chromium Plating	SAE AMS 2460
Nickel Plating	SAE AMS-QQ-N-290
Silver Plating	ASTM B700
Tin Plating	ASTM B545
Electroless Nickel	SAE AMS 2404
Aluminum Coating	MIL-DTL-83488, Type I or II

3.3.2.2 Type I components. Except for internal surfaces in constant contact with hydraulic fluid, ferrous alloys shall have a chromium content of not less than 12 percent, or shall be suitably protected against corrosion as specified in 3.3.2, 3.3.2.1 and table I. O-ring grooves for external seals shall not be considered as internal surfaces in constant contact with hydraulic fluid. Use of magnesium shall be subject to the approval of the procuring activity.

3.3.2.3 Residual magnetism. Parts made of material that is capable of retaining residual magnetism, but are not intended to function as magnets, shall be demagnetized sufficiently to prevent system or component malfunction, including malfunction due to accumulation of magnetic contaminants.

3.3.3 Plastic parts. The use of plastic parts shall be subject to the approval of the procuring activity for the specific application involved. Valves shall not contain plastic parts; other than AN or MS standard parts, unless otherwise authorized by the contracting activity.

3.3.4 Standard parts. Standard parts (MS, AN, NAS, or JAN) shall be used wherever they are suitable for the purpose, and shall be identified on the drawing by their (MS, AN, NAS, or JAN) PIN. Commercial utility parts, such as screws, bolts, nuts, and cotter pins may be used, provided they possess suitable alteration, and provided the corresponding standard PIN are referenced in the parts list and, if practicable, on the contractor's drawings. In the event there is no suitable corresponding standard part in effect on date of invitation for bids, commercial parts may be used provided they conform to all requirements of this specification.

3.4 Design and construction.

3.4.1 General. The configuration, dimensions, and other details of design of standard valves shall conform to AN6279. Non-standard parts of components shall conform to the applicable manufacturer's drawing as governed by SAE AS5440 or SAE AS8775.

3.4.2 Temperature range. Valves shall be designed and so constructed as to insure satisfactory operation throughout the temperature range of -65°F to 160°F (-53.9°C to 71.1°C) for Type I valves.

3.4.3 Threads. Straight threads conforming to SAE AS8879, Unified Fine Thread Series, classes UNF-3A and UNF-3B shall be used, unless it can be demonstrated that the use of other threads will result in a superior product. Pipe threads shall not be used except for permanently installed plugs.

3.4.4 Fluids. Components shall be designed to operate with MIL-PRF-5606, MIL-PRF-83282 or MIL-PRF-87257 hydraulic fluid.

3.4.5 Seals.

3.4.5.1 General. Components shall be so designed that, in assembly of parts, sufficient clearance exists to permit assembly of the components without damage to O-rings or backup rings where they pass threaded parts or sharp corners. MIL-G-5514 and MS21344 shall be used for Type I system packing installation.

3.4.5.2 Packing type I valves. All packing and gaskets shall be in accordance with SAE AS28775, or SAE AS28778. Backup rings shall be in accordance with MS28774, MS28777, or MS28783.

3.4.6 Safetying. All threaded parts shall be securely locked or safetied by safety wiring, self-locking nuts, or other approved methods. Safety wires shall be applied in accordance with NASM 33540 and shall conform to NASM20995. Star washers and jam nuts shall not be used as locking devices.

3.4.7 Retainer rings. Except where they are positively retained form being dislodged from their grooves, retainer or snap rings shall not be used in any location where failure of the ring will allow blow-apart of the valve caused by internal pressure. Neither shall they be used in locations where the buildup of clearances and manufacturing tolerances will allow destructive end play in the assembly contributing toward failure of packings or gaskets, brinelling, or fatigue failure of parts. For retainer ring applications other than those where retention of hydraulically pressurized parts is involved, such as locking in place nonpressurized end caps, etc., rings shall be in accordance with MS16625 and MS16624, or other approved designs. The rings shall be capable of being installed and removed with standard Pin-type pliers, or other standard tools developed for use with the specified rings.

3.4.8 Function-adjustment screws. Function-adjustment screws shall be so designed and constructed that they can be positively locked to prevent loosening under vibration or flow. It shall be possible to adjust and lock the adjustable screws with a standard wrench or screw driver, and in addition, lock wire may be used to insure positive lock, if required. Where practicable, the adjustment means shall be such that the adjustment can be made under full system pressure with negligible loss of fluid during the adjustment. Standard countersunk hex head (Allen type or equivalent) steel adjustment screws may be used in sizes up to 0.50 inch hex. For pressure adjustment screws, a suitable seal, permanently marked with the pressure setting, shall be attached to the lock wire.

3.4.9 Structural strength. The valves shall have sufficient strength to withstand all loads or combinations of loads resulting from hydraulic pressure, temperature variations, actuation or operations, and torques loads for connection of tube fittings.

3.4.10 Rated flow capacity. The rated flow shall be as specified in table II and the applicable detail standard.

3.4.11 Pressure drop at rate flow. Pressure drop at rated flow shall not exceed the values specified herein and the applicable detail standard.

3.4.12 Fluid connections.

3.4.12.1 Bosses. All internally thread bosses for connecting fittings and SAE AS5169 plugs shall conform to SAE AS5202. Bosses shall be made sufficiently deep or shall incorporate fitting stops to prevent damage to internal mechanism or restriction of fluid flow when universal fittings are screwed into the bosses to excessive depths.

3.4.12.2 Fluid connection marking. All ports for tube connections shall be clearly and permanently marked to indicate the connections to be made using nomenclature in accordance with MIL-STD-130. Where applicable, the directions of flow shall be indicated. The use of abbreviations should be avoided, but if used shall be the general industry accepted abbreviations as applicable for the marking. Use of a single letter for marking such as “P” for pressure and “C” for cylinder is not acceptable. Decalcomanias shall not be considered a permanent marking.

3.4.12.3 Plugs. All plugs, except permanently installed plugs that will not have to be removed during the life of the component, shall conform to SAE AS5169 for type I systems.

3.4.13 Alignment. All plungers, poppets, balls, pistons, etc., shall be accurately guided to prevent misalignment or chattering on their seats.

3.5. Performance.

3.5.1 Proof pressure. The valve shall withstand the proof pressure specified in table II without malfunction or leakage, when tested in accordance with 4.4.2.3.1 for qualification inspection.

3.5.2 Burst pressure. The valve shall not leak, rupture, or fail at any pressure below the minimum burst pressure specified in table II, when tested in accordance with 4.4.2.3.2.

3.5.3 Normal temperature performance. There shall be no evidence of external leakage when tested in accordance with 4.4.2.4 for qualification inspection or 4.5.4.2 for conformance inspection.

3.5.4 Extreme temperature performance. There shall be no evidence of external leakage when tested in accordance with 4.4.2.5.

3.6 Interchangeability. All parts having the same manufacturer's PIN shall be directly and completely interchangeable with each other with respects to installation and performance. Subassemblies composed of selected mating components must be interchangeable as assembled units, and shall be so indicated on the manufacturer's drawings. The individual components of such assembled units need not be interchangeable.

3.6.1 Special tools. The design shall be such that special or unusual tools will not be required for normal maintenance and inspection of the valve.

3.7 Weight. Weight shall be maintained as low as possible, consistent with the requirements of this specification. The weight of the assembled valve shall be specified in the manufacturer's assembly drawings.

3.8 Finish.

3.8.1 Surface roughness. Surface roughness finish, as required, shall be established, and shall be specified on the manufacturer's drawing in accordance with ASME B46.1. Determination of surface finishes shall be made with stylus type instruments as specified in ASME B46.1. If surface defects are unacceptable, it shall be specifically designated that all imperfections will be within stated limits or that prescribed special inspection procedures will be followed. At least where a surface of 16 micro-inch roughness height or finer is designated, the essential process description for its generation shall be in addition to surface measurements that constitute part of the requirement for compliance. When necessary, waviness and lay shall be specified.

3.8.2 Coating. Upon request of the procuring activity, the contractor shall provide test data or perform specific tests which are considered necessary to determine that the material and plated coatings employed in the component are suitable for the intended service.

3.9 Lubricants. It is desired that only hydraulic fluid conforming to MIL-PRF-5606, MIL-PRF-83282 or MIL-PRF-87257 be used to lubricate seals during installation and assembly of hydraulic components. A light coating of hydraulic fluid conforming to MIL-PRF-6083 will be permitted. If other lubrication is necessary, the means of lubrication and the lubricant used must be approved by the procuring activity. Lubrication shall be so accomplished that no disassembly for relubrication is necessary during endurance testing or normal service life. Copious use of petrolatum shall be avoided.

3.10 Physical defects inspection. All magnetizable highly stressed parts shall be subjected to magnetic inspection in accordance with ASTM E1444. Non-magnetizable highly stressed parts shall be inspected by a suitable process for detecting physical defects. Where such inspection is necessary, it shall be specified on the manufacturer's drawings.

3.11 Identification of product.

3.11.1 Name plate. Each valve shall be identified by means of a durable identification plate, clearly and permanently marked with the following information, and shall be attached in accordance with MIL-STD-130.

Valve, Relief, Hydraulic Pressure (Relief pressure range)
Type I
Specification MIL-DTL-5523
MS or AN PIN
Stock No.
Manufacturer's PIN
Manufacturer's Serial No.
Contract or Order No.
Manufacturer's Name or Trade mark or Code

3.12 Hydraulic pressure setting. All hydraulic pressure relief valves which are furnished under contract, other than direct Government procured and indirect shipment such as spares, shall be set by means of a power-driven pump to deliver rated flow at the differential pressure required by the specific contract (+25, -0 psi for Class YZ, +50, -0 psi for Class AB, and +100, -0 psi for Class CD), with a return port back pressure of 200+25 psi for Class AB and CD valves only. This pressure setting shall be impressed on a led seal, or equivalent, attached to the lockwire of the unit. As the pressure adjustment is altered, this seal shall be destroyed and replaced with a new seal properly stamped with the new pressure setting and attached to the lockwire. When emergency circumstances dictate, the valve may be set with a hand pump to first flow at the minimum rate of 1.5 cc (30 drops) per minute, at the pressure of 95 percent of the specified setting value. This is the emergency setting pressure.

3.12.1 Government procured and indirect shipment. Government procured and indirect shipment such as spare valves shall be tagged with a tag containing the following:

NOTICE

Valve requires pressure setting adjustment. Valve will be set by means of a power-driven pump to deliver rated flow (2.5, 7, 12, and 32 GPM minimum for dash 4, 6, 8, and 12, respectively) at the differential pressure required by the specific application (see applicable manual –[+25, -0 psi for class YZ, +50, -0 psi for Class AB and +100, -0 psi for class CD]), with a return port back pressure of 200 ± 25 psi for class AB and CD valves only. This pressure setting shall be impressed on a lead seal, or equivalent attached to the lockwire of the unit. As the pressure adjustment is altered, this seal will be destroyed and replaced with a new seal properly stamped with new pressure setting. When emergency circumstances dictate, the valve may be set with a hand pump to first flow at the minimum rate of 1.5 cc (30 drops) per minute, at the pressure of 95 percent of the specified setting value. Remove tag when pressure setting has been completed.

3.13 Workmanship. Valves shall be free from cracks, laps, seams, burrs, longitudinal and spiral tool marks, or any other defects that may detrimentally affect their intended use (see 4.5.4.1).

4. VERIFICATION

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

a. First article inspection (see 4.4)
b. Conformance inspection (see 4.5)

4.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained or identified by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ISO 17025 and NCSL Z540.3 as applicable.

4.3 Inspection conditions. Unless otherwise specified, all inspection shall be performed in accordance with the test conditions specified in 4.3.1 in this specification.

4.3.1 Test fluids. First article inspections shall be performed with oil conforming to MIL-PRF-5606, MIL-PRF-83282 or MIL-PRF-87257. Acceptance tests shall be performed with oil conforming to MIL-PRF-5606, MIL-PRF-83282, MIL-PRF-87257 or MIL-PRF-6083.

4.3.2 Filtration. The test fluid shall be continuously filtered in order to obtain SAE International Class 3 contamination limits (or better), in accordance with SAE AS4059 for contamination limits, specified as follows:

Size (Microns)	Particle Count Per 100 Milliliters
5-10	24000
10-25	5360
25-50	780
50-100	110
100-Up	11

4.3.3 Temperatures. Except where otherwise specified, the test of this specification shall be performed at room temperature (70 to 90 degrees Fahrenheit) and an oil temperature of 70 to 100 degrees Fahrenheit. The actual ambient temperatures shall be recorded.

4.4 First article inspection.

4.4.1 Test sample. The test sample consists of three valves of classes YZ, AB, and CD of each size fabricated in accordance with manufacturer's drawings. The valves shall be identified with the manufacturer's PIN and such other information as required by the qualifying activity. The valves shall be prepared as follows:

4.4.1.1 Minimum clearance specimen. One specimen shall be assembled of parts which have been selected to provide that the clearance with regard to linear and diametrical tolerances between moving and nonmoving members, conducive to malfunctioning at extreme temperatures, shall not exceed 110 percent of the minimum designed clearance permitted by the manufacturer's drawings. For cases of sliding parts where packing friction would

influence the performance of the component, such as pistons operated by spring, etc., the maximum packing friction anticipated shall be induced in the test specimen. In these cases O-ring packing glands shall be fabricated to provide maximum design O-ring squeeze, including the effect of adverse O-ring cross section tolerances and high-swell fluids. This specimen shall be marked “MIN”.

4.4.1.2 Maximum clearance specimen. The second specimen shall be assembled of parts which have been selected to provide that the clearance with regards to linear and diametrical tolerances between moving members, conducive to malfunctioning as a result of wear associated with prolonged operation will be not less than 90 percent of the maximum designed clearance permitted by the manufacturer’s drawings. This specimen shall be marked “MAX”.

4.4.1.3 Typical specimen. A specimen assembled from parts conforming to manufacturer’s drawings. This specimen shall be marked TYP.

4.4.1.4 Tolerance considerations. In machining these specimens, surface finishes shall be of no finer degree than the surface finishes as will be produced on production units. Packing glands may be fabricated to nominal dimensions. Lapped or selectively fitted parts need not be made to adverse limits. To facilitate fabrication of adverse tolerance units, it is permissible for one of the mating parts required to produce the critical clearance to be outside of drawing tolerances, provided that the clearance as established falls within the range specified. In the event that the design clearances in themselves are extremely close, the 10-percent limitations on clearance may be adjusted or waived entirely, but at the discretion of the qualifying activity. In case of waiver of adverse tolerance specimens, tests shall be conducted on two representative production samples, and the test report shall analyze the effects of adverse tolerance conditions.

4.4.2 First article tests. First article inspections shall be performed on each valve of the test sample, except where a specific valve is identified in the test. The first article inspection shall consist of the following tests and shall be performed in the sequence listed:

a. Examination of product. (see 4.4.2.1)

b. Immersion. (see 4.4.2.2)

c. Proof pressure. (see 4.4.2.3.1)

d. Normal temperature performance. (see 4.4.2.4)

e. Extreme temperature performance. (see 4.4.2.5)

f. Burst pressure. (see 4.4.2.3.2)

4.4.2.1 Examination of product. Each valve shall be examined in accordance with the requirements of 4.5.4.1.

4.4.2.2 Immersion.

4.4.2.2.1 Other nonmetallic parts. Components containing nonmetallic parts other than plastic parts or MS or AN standard seals in glands conforming to MIL-G-5514 shall be immersed in hydraulic fluid for a period of 7 days at a temperature of not less than 160°F (71.1°)prior to conducting the qualification tests specified herein. All internal parts shall be in contact with the fluid during this period. If this test is necessary as a result of the use of nonstandard packing installations, or if the packings pass over holes, ports, step diameters, threads, etc., and if the inside diameter, outside diameter, or sides of the seal are unrestrained during any part of their normal operation, the packing used in the test samples shall be fabricated of a compound specified in MIL-DTL-5516 having the highest swell, and the fluid shall be that approved by MIL-PRF-5606, MIL-PRF-83282 or MIL-PRF-87257 having the highest swell characteristics. (The Government will designate the applicable high-swell packing compound and fluid upon request to the activity responsible for qualification.) After the above immersion, the equipment shall remain in the high-swell fluid at normal room temperature until ready for test. It shall not be exposed to air for any appreciable length of time during the tests.

4.4.2.3 Pressure tests.

4.4.2.3.1 Proof pressure type I system valves. Proof pressure, as specified for its class in table II, shall be applied simultaneously to both the pressure and return ports at a rate not exceeding 25,000 psi per minute and held for at least 2 minutes. When subjected to the rated proof pressure specified in table II the valve shall meet the requirements of 3.5.1.

4.4.2.3.2 Burst pressure type I system valves. With all ports except the pressure port plugged, pressure shall be applied at a rate not exceeding 25,000 psi per minute as specified for burst pressure in table II. This pressure shall be held for at least 2 minutes. When subjected to the rated burst pressure specified in table II the valve shall meet the requirements of 3.5.2.

TABLE II. Operational requirements at normal and high temperatures.

Rated flow press. setting (psi)			Min reseat press. (percent of rated flow pressure)	Emergency setting press. (percent of rated flow press.)		Proof press (psi)	Burst press (psi)
Class	(Min)	(Max)		(Min)	(Max)		
YZ	100	1000	82	85	100	1500	2500
AB	1000	2300	82	85	100	3000	5000
CD	2300	3850	82	85	100	4500	7500

4.4.2.4 Normal temperature performance. Valves when subjected to the normal temperature performance test shall meet the requirements of 3.5.3. The following details shall apply:

4.4.2.4.1 Minimum setting. A typical setup for this test is specified on figure 2. The power-driven pump shall be used for the following tests. With a pressure at the outlet port of 200 ± 25 psi, for class AB and CD valves only, the test valve shall be adjusted to deliver rated flow, as specified on the applicable drawing, at a differential pressure equivalent to the minimum pressure setting specified for its class in table II. Inlet pressure shall be decreased gradually until leakage corresponding to a maximum value leakage as shown in table III can be determined. This pressure will be considered as the reseat pressure, and its value shall meet that specified in table II. The reduction of pressure shall be continued slowly, and leakage shall be observed at pressure valves equivalent to approximately 0.75, 0.50, and 0.25 of the rated flow pressure setting of the valve. Leakage shall not exceed .5 cc (approximately 10 drops) per minute. The pressure shall then be increased gradually, and leakage shall be observed at pressure values equivalent to approximately 0.25, 0.50, and 0.75 of the rated flow pressure setting of the valve. The pressure shall then be increased slowly until a leakage equivalent to 3 times the value specified in table III is noted. The pressure at this value shall not be less than 91 percent of the rated flow pressure. Leakage shall be equivalent to that observed during the reduction of pressure portion of this test. Rated flow shall occur at the original pressure setting. In all instances leakage shall be observed at the outlet port and it shall be taken during the third minute following a 2-minute waiting period.

TABLE III. Allowable leakage.

Tube Size	Max Leakage cc/min
-4	0.5
-6	0.5
-8	2
-12	3

4.4.2.4.2 Maximum setting. The tests outlined under paragraph titled “Minimum setting” shall be repeated with the valve adjusted to deliver rated flow at a differential pressure equivalent to the maximum pressure setting specified for its class in table II.

4.4.2.4.3 Leakage and emergency setting pressure. With the pressure setting unaltered after completion of maximum setting tests and by use of the hand pump specified on figure 2, leakage readings shall be taken at pressure values equivalent to approximately 0.25, 0.50, and 0.75 of the rated flow pressure setting of the valve under conditions of increasing as well as decreasing pressure. Leakage during the third minute after a 2-minute waiting period shall not exceed 0.5 cc (approximately 10 drops) per minute. Pressure shall then be increased until leakage exceeds the value specified in table III. This value shall be considered as the emergency setting pressure and shall be within the limits specified in table II.

4.4.2.4.4 Endurance. A typical setup for life cycling is specified on figure 1. The endurance test shall be performed on the maximum clearance specimen and shall consist of adjusting the valve to the maximum pressure setting at rated flow at normal temperature as specified in table II, and the cycling at the rate of 5 to 35 cpm for 50,000 cycles. Each cycle shall consist of imposing rated flow through the valve, and reducing pressure to substantially zero. After completion of this test, internal leakage at the reseat pressure and 0.25, 0.50, and 0.75 of the rated flow pressure setting, shall be a maximum of two times the values permitted in 4.4.2.4.2.

4.4.2.5 Extreme temperature performance. Extreme temperature tests shall be conducted on a valve (or valves) assembled with parts to the most adverse tolerances conducive to binding at the temperature tested. Valves when subjected to the normal temperature performance test shall meet the requirements of 3.5.4. The following details shall apply:

4.4.2.5.1 Low temperature performance. A typical setup for this test is specified on figure 3. On the test valve (minimum clearance specimen) apply pressure and flow to this valve with the hand pump at the rate of one full stroke per minute. Note the highest pressure which can be developed at room temperature. The temperature of the cold chamber shall be reduced to -65°F + 2°F (-53.9° + 1.1°C) and held for a minimum of 3 hours with the valve unpressurized. The valve shall then be pressurized to approximately 90 percent of the minimum allowable reseat pressure specified in table II and held for a minimum of 3 additional hours. The above hand pump test and the tests outlined under 4.4.2.4.4 shall be repeated. Leakage and pressure valves obtained at -65°F (-53.9°C) shall not vary more than +10 percent of -5 percent from those obtained during room temperature tests.

4.4.2.5.2 High temperature performance. Using the test temperature setup specified on figure 2, the minimum clearance valve specimen shall be adjusted to deliver rated flow at a differential pressure equivalent to the maximum pressure setting specified in table II. The valve and hydraulic fluid of the test setup shall be stabilized at test temperature for a minimum period of 6 hours. The power driven pump tests outlined under 4.4.2.4.2 shall be repeated. Leakage and rated flow shall not be greater than those observed at room temperature, and reseat pressure shall meet the pressure valve specified in table II. Test temperature shall be 160°F + 5°F (71.1°C +2.8°C) for type I system valves.

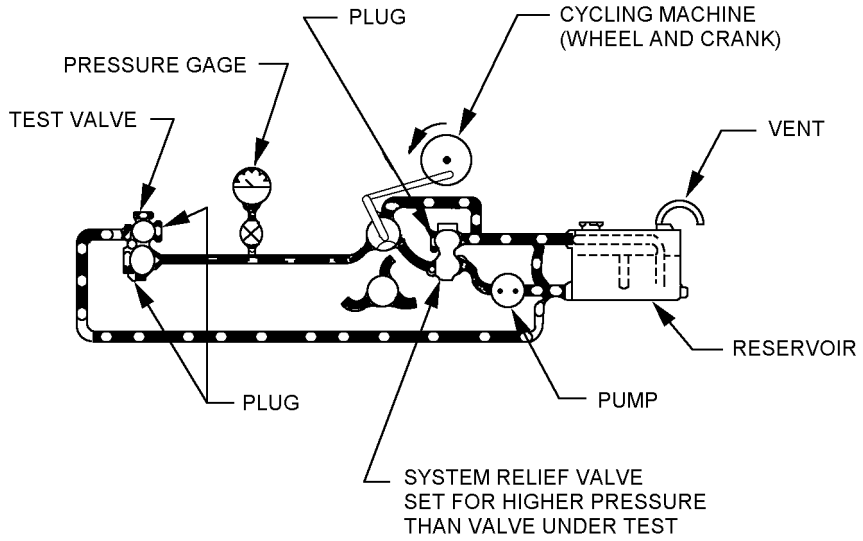
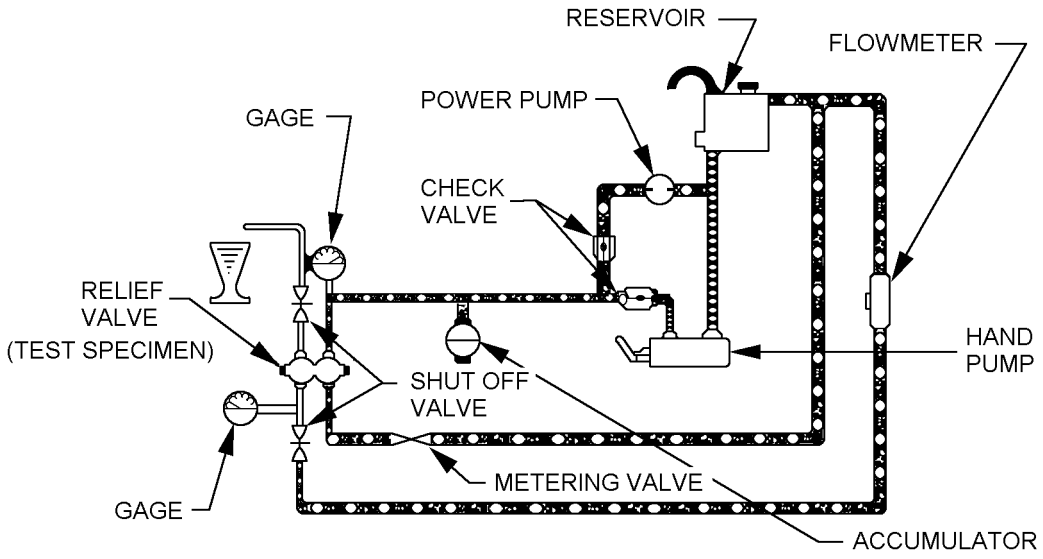


FIGURE 1. Typical relief valve endurance test installation.



NOTE: GAGES SHALL BE PLACED AS CLOSE TO THE VALVE PORTS AS PRACTICABLE.

FIGURE 2. Typical schematic diagram for normal temperature performance tests.

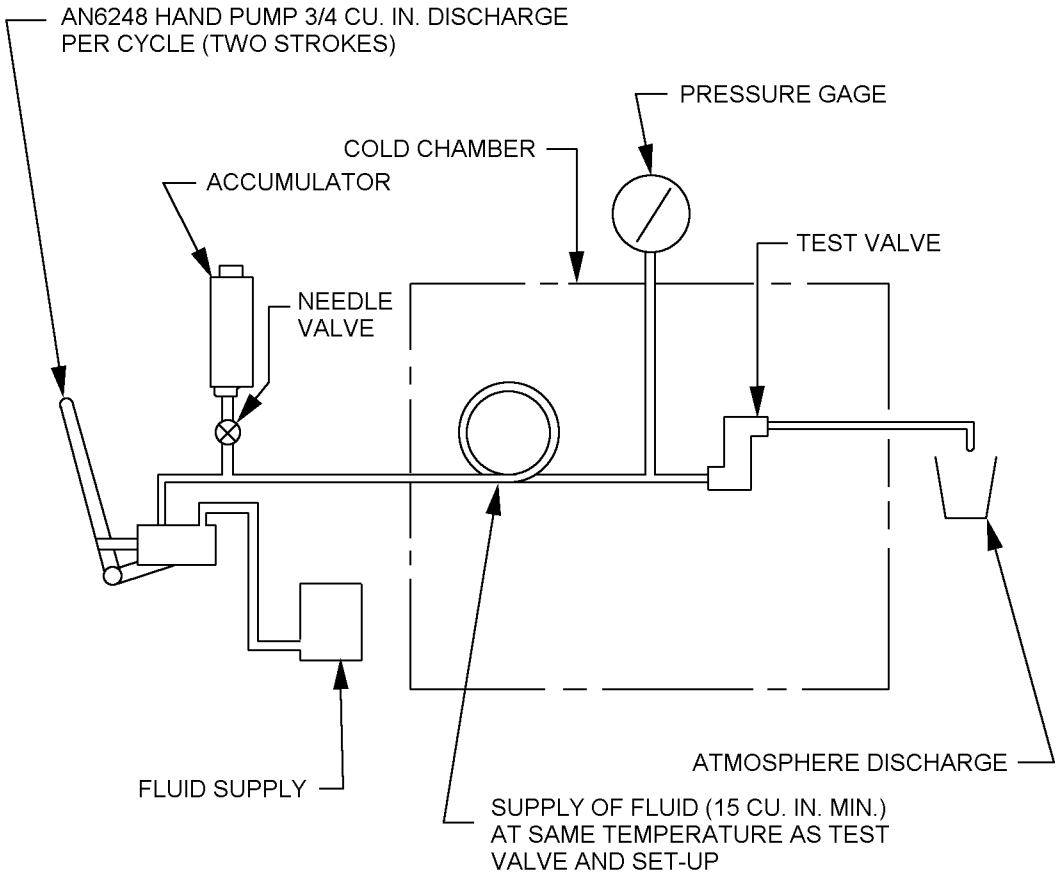


FIGURE 3. Typical schematic diagram for low temperature performance tests.

4.5 Conformance inspection. Conformance inspection shall consist of individual tests and sampling tests,

4.5.1 Individual tests. Each valve is to be furnished under contract and shall be subjected to:

a. Examination of product. (4.5.4.1)

b. Normal temperature performance. (4.5.4.2)

4.5.2 Sampling tests. Valves up to 2 percent of the contract may be selected for any other tests which the inspector considers necessary to determine conformance with the requirements of this specification.

4.5.3 Rejection and retest. When an item selected from a production run fails to meet the specification, no items still on hand or later produced shall be accepted until the extent and cause of failure have been determined and appropriately corrected. The contractor shall explain to the Government representative the cause of failure and the action taken to preclude recurrence. After correction, all the tests shall be repeated.

4.5.4 Test method.

4.5.4.1 Examination of product. Each valve shall be carefully examined to determine conformance with the requirements of this specification for design, weight, workmanship, marking, conformance to applicable drawings, and for any visible defects. The manufacturer's drawings and the manufacturer's applicable specifications which were submitted when qualification approval was granted, shall be used by the inspector, as necessary, to determine that the valves submitted for acceptance under contract are identical to design when submitted for qualification.

4.5.4.2 Normal temperature performance. Unless otherwise specified, the valve shall be subjected to its rated flow by means of a power-driven pump at the maximum pressure settings specified in table II, with a back pressure at the outlet port of 200 psi, for class AB and CD valves only, and the pressure differential between the ports observed. This is the setting pressure. The pressure shall then be reduced to the reseat pressure specified for its class in table II, and the outlet port opened for observation of leakage. This pressure shall be maintained constant and the leakage observed during the third minute. Leakage shall not exceed that specified in table III. The pressure shall then be increased slowly until a leakage equivalent to 3 times the value specified in table III is noted. The pressure at this value shall be not less than 91 percent of the rated flow pressure.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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 relief valves covered by this specification are intended for use in aircraft hydraulic systems, whose normal operations are covered by SAE AS5440, to provide for relief of excessive pressure and should not be used with any hydraulic fluid other than that conforming to MIL-PRF-5606, MIL-PRF-83282 or MIL-PRF-87257, unless otherwise specified by the procuring activity.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Applicable government and manufacturer's PIN.

c. Level of packaging and packing required (see section 5).

6.3 First article. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first article samples. 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.

6.4 Detail and assembly drawings. Detail and assembly drawings should be furnished with each new model valve submitted for qualification tests. Assembly drawings should show a cutaway section of all details in their normal assembled position and should carry material, finish, plating, and PIN's of all details and subassemblies. The following data should be furnished on or together with all assembly drawings:

a. Mounting position and dimensions.

b. Port dimensions.

c. Over-all dimensions.

d. Flow capacity.

e. Pressure range.

f. Dry weight.

g. Method of adjusting pressure rating.

h. Dismantling procedure and procedure for replacing synthetic packings, if needed.

i. Maximum calculated stress of springs and design calculations illustrating the springs endurance limits under adverse tolerances.

6.5 Subject term (key word) listing.

Aircraft
Rated flow

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

CONCLUDING MATERIAL

Custodians:
Army – GL
Navy - SH
Air Force - 99
DLA - CC

Preparing activity:
DLA - CC

(Project 4820-2010-004)

Review activities:
Army – AT, AV, CR4
Navy – AS, MC, SA
Air Force – 11, 71

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.daps.dla.mil.