

MIL-V-7899B
20 September 1974
 SUPERSEDING
 MIL-V-7899A
 16 June 1970

MILITARY SPECIFICATION

VALVES, CHECK, AIRCRAFT FUEL SYSTEM

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

1. SCOPE

1.1 Scope. This specification covers low-pressure check valves suitable for use with hydrocarbon fuels, fuel vapors, and air.

1.2 Classification. The check valves shall be of the following classes based on the applicable temperature ranges of MIL-F-8615.

Class	Low Temp Fuel and Ambient	High Temp	
		Fuel	Ambient
A	-67°F	135°F	160°F
B	-67°F	200°F	350°F

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

P-D-680	Dry Cleaning Solvent
TT-S-735	Standard Test Fluids; Hydrocarbon
VV-G-109	Gasoline, Unleaded
PPP-B-636	Box, Fiberboard

Military

MIL-P-116	Preservation-Packaging, Methods of
MIL-D-1000	Drawings, Engineering and Associated Lists
MIL-P-5315	Packing, Preformed, Hydrocarbon Fuel Resistant
MIL-G-5572	Gasoline, Aviation: Grades 80/87, 100/130, 115/145

FSC 2915

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MIL-T-5624	Turbine, Fuel, Aviation, Grades JP-4 and JP-5
MIL-C-6021	Casting, Classification and Inspection of
MIL-R-6855	Rubber, Synthetic Sheets, Strips Molded or Extended Shapes
MIL-C-7024	Calibrating Fluid, Aircraft Fuel System Components
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification for
MIL-I-8500	Interchangeability and Replaceability of Component Parts for Aircraft and Missiles
MIL-F-8615	Fuel System Components: General Specification for
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter: General Specification for
MIL-N-25027	Nut, Self-Locking, 250°F, 450°F, and 800°F, 125 KSI FTU, 60 KSI FTU, and 30 KSI FTU
MIL-R-25988	Rubber, Silicone, Oil and Fuel Resistant
MIL-R-83248	Rubber, Fluorocarbon Elastomer, High Temperature Fluid, and Compression Set Resistant

STANDARDSMilitary

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing of
MIL-STD-810	Environmental Test Methods
MIL-STD-831	Test Reports, Preparation of
MIL-STD-889	Dissimilar Metals
MIL-STD-1523	Age Controls of Age-Sensitive Elastomeric Items
MS21344	Fittings - Installation of Flared Tube Straight Threaded Connectors, Design Standard for
MS28882	Valve, Fuel Check, Low Pressure, Gasket Seal Straight Thread Connection
MS28884	Valve, Fuel Check, Low Pressure, Flared Tube Connection
MS29521	Valve Element - Swing Check, Fuel
MS33540	Safety Wiring and Cotter Pinning, General Practices for
MS33588	Nuts, Self-Locking, Aircraft, Design and Usage Limitations of

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Society of Automotive Engineers, Inc.

ARP 868 Pressure Drop Test for Fuel System Components

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10017.)

American Society for Testing and Materials

ASTM D-1655 Aviation Turbine Fuels

(Application for copies should be addressed to the Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19106.)

3. REQUIREMENTS

3.1 Qualification. The valves furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.3).

3.2 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.3 Materials. Materials and processes used in the manufacture of check valves shall be suitable for the purpose and shall conform to applicable Government specifications. Materials conforming to contractor's specifications may be used provided the specifications are released by the services and contain provisions for adequate tests. The use of contractor's specifications shall not constitute waiver of Government inspection.

3.3.1 Metals. All metals used in construction of the valves shall be corrosion resistant or protected to resist corrosion during normal service life of the valve when in storage or during normal service use. The selection of metals shall be based on the stress corrosion limits of the material and not on the normal yield strength. Internal stresses due to assembly methods and stresses due to assembly in the next assembly shall be considered. The torque limits specified in MS21344 for the applicable fitting end shall be used for this purpose.

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3.3.1.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact with each other.

3.3.1.2 Magnesium and copper. Magnesium or copper or the alloys thereof shall not be used in contact with fuel.

3.3.2 Finish. Plating and protective treatments shall be in accordance with applicable Government specifications. Anodizing shall be in accordance with MIL-A-8625. Painting shall not be used on surfaces that may be in contact with fuel.

3.3.3 Fungus resistance. Materials that contain nutrients to fungi shall not be used in the valves.

3.3.4 Rubber material. Rubber materials shall conform to the following:

	Class A	Class B
MIL-P-5315	X	
MIL-R-6855 (Class I)	X	
MIL-R-25988	X	X
MIL-R-83248	X	X

3.3.5 Castings. Castings shall be Class I in accordance with MIL-C-6021.

3.4 Design and construction. The check valves shall conform to MS28882 and MS28884. Swing check elements shall conform to MS29521.

3.4.1 Rated flow. At rated fuel flow, the valves shall not exceed the pressure drop requirements of table I.

TABLE I. Flow Capacity and Pressure Drop

Valve Size (MS Designation)	Rated Fuel Flow, GPM	Maximum Pressure Drop, Inches of Water
-04	1.25	28
-06	3.75	28
-08	6.0	28
-10	10	28
-12	15	20
-16	30	20
-20	50	20
-24	70	20
-32	130	20

3.4.2 Pressure and leakage. The check valves shall be designed for an operating pressure of 60 psig, a proof pressure of 120 psig and an ultimate pressure of 180 psig with no external leakage. When the pressure is reduced from ultimate to proof pressure, the check valve shall function properly. Internal leakage in the check direction shall not exceed 0.01 cc per minute with a pressure differential from outlet to inlet from 4 inches of water up to 60 psig.

3.4.3 Operation. The valves shall open at a pressure differential from inlet to outlet of less than 8 inches of water and permit flow of fuel, fuel vapors, or air in one direction and check the flow in the opposite direction before the outlet pressure becomes equal to the inlet pressure. In the absence of fluid pressure, the check valve element shall remain closed with the valve assembly in either the horizontal or vertical position.

3.4.4 Fuel resistance. The valves shall function properly and be resistant to fluids conforming to MIL-G-5572, MIL-T-5624, MIL-C-7024, and TT-S-735 (all containing up to 30 percent aromatics by volume) and also P-D-680, VV-G-109, and ASTM D-1655 jet fuels, Types A, A-1, and B, and other comparable fuels.

3.4.5 Screw threads. Screw threads shall conform to MIL-S-7742 or MIL-S-8879.

3.4.5.1 Locking of parts. Threaded parts shall be locked by safety wire, cotter pins, or self-locking nuts in accordance with MS33540, MS33588, and MIL-N-25027. Self-locking nuts shall not be used where loosening or disengagement could result in the nut or other parts entering the fuel system. The use of lockwashers or staking is prohibited.

3.4.6 Contaminated fuel. The valve shall be capable of operating with fuel containing contaminants in accordance with MIL-F-8615.

3.4.7 Lubrication. The valves shall not require any lubrication except the fluid in which it operates.

3.5 Performance. The valve shall demonstrate satisfactory performance when subjected to the following tests as described in Section 4:

- a. Examination of product
- b. Calibration
- c. Endurance
- d. Contaminated fuel
- e. Vibration

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- f. Accelerated corrosion
- g. Fuel resistance and extreme temperature
- h. Ultimate pressure
- i. Disassembly and inspection.

3.5.1 Swing check element. Valve elements conforming to MS29521 shall be mated to a test fixture for the accomplishment of the above performance tests, except the ultimate pressure test.

3.6 Interchangeability. The assembly and all component parts are governed by MIL-I-8500.

3.7 Drawings. Drawings shall be in accordance with MIL-D-1000. The top assembly drawing shall list each component part, part number, material, and material specification. Finishes shall also be shown, as applicable.

3.8 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.8.1 Nameplate. A nameplate shall be securely attached to the valve. The information shall conform to MIL-STD-130, or the same information may be etched, engraved, embossed, or stamped in a suitable location on the valve:

VALVE, CHECK, AIRCRAFT
MS part number
Manufacturer's part number
Manufacturer's name or trade-mark.

3.8.2 Age marking. Age control markings shall be in accordance with MIL-STD-1523.

3.9 Color. A color marking shall be applied in accordance with MIL-F-8615.

3.10 Workmanship. The workmanship shall be in accordance with all applicable specifications, drawings, and quality control plans.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 assure supplies and services conform to prescribed requirements.

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

- a. Qualification inspection (4.4)
- b. Quality conformance inspection (4.5).

4.3 Test conditions

4.3.1 Temperature and pressure. Unless otherwise specified, the tests shall be conducted with the valves and fuel at a temperature between 60° and 90°F and at atmospheric pressure. All pressures specified are gage pressures.

4.3.2 Test fluids. The pressure drop test shall be conducted using fluid conforming to MIL-C-7024, Type II. Jet fuel, MIL-T-5624 or cleaning solvent, P-D-680, may be substituted, provided the test data is corrected to account for the differences in specific gravity and viscosity of these fluids from MIL-C-7024. For other tests where no fluid is specified, any fluid specified in 3.4.4 may be used.

4.4 Qualification inspection (see 6.3)

4.4.1 Test samples. The test samples shall consist of two valves of each size representative of the production items. The samples shall be identified with the manufacturer's part number and test item numbers as referenced in the test report.

4.4.1.1 Data to accompany test samples. The test samples shall be accompanied by a complete set of production drawings and a parts list.

4.4.2 Test report, test samples, and data for the qualifying activity. When the tests are conducted at a location other than the laboratory of the qualifying activity, the following shall be furnished to that activity:

- a. A test report in accordance with MIL-STD-831

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- b. The test samples referenced in the test report
- c. The data required under 4.4.1.1.

4.4.3 Qualification examination and tests. The qualification inspection shall consist of the examination and tests conducted on the test samples in the order listed in table II. Leakage tests (4.6.2.2.1) shall be conducted after each test. Each valve shall satisfactorily complete the required tests without failure.

TABLE II

Inspections	Valve #1	Valve #2
Examination of Produce	4.6.1	4.6.1
Calibration (Initial)	4.6.2	4.6.2
Endurance		4.6.3
Contaminated fuel		4.6.3.1
Vibration	4.6.4	
Accelerated Corrosion	4.6.5	
Fuel Resistance and Extreme Temp	4.6.6	
Ultimate Pressure	4.6.7	4.6.7
Calibration (Final)	4.6.2	4.6.2

4.5 Quality conformance tests. The quality conformance tests shall consist of:

- a. Individual tests
- b. Sampling tests.

4.5.1 Individual tests. Each valve shall be subjected to the following tests:

- a. Examination of product (4.6.1)
- b. Leakage (4.6.2.2).

4.5.2 Sampling tests. One valve out of each lot of 100 or less shall be subjected to the following tests in the order listed:

- a. Examination of Product (4.6.1)
- b. Ultimate Pressure (4.6.7)
- c. Calibration (4.6.2).

4.6 Inspection methods

4.6.1 Examination of product. All items shall be inspected and certified to be in accordance with this specification, the applicable military standard, and the manufacturer's drawings. The units shall be clean and free of any contaminants, oil, grease, or any other material not specified on the assembly drawing.

4.6.2 Calibration

4.6.2.1 Pressure drop. The fuel pressure drop through the valve shall be determined in accordance with SAE test procedure ARP-868. Data shall be taken at 5, 20, 50, and 100 percent rated flow, and at other points as needed, for plotting a satisfactory flow curve.

4.6.2.2 Internal leakage. Internal leakage shall not exceed 0.01 cc per minute at outlet pressures from 4 inches of fuel up to 60 psig.

4.6.2.2.1 Air pressure leakage. Air or dry nitrogen pressure shall be applied to the outlet of the valve while it is immersed in fluid (water may be used) with the valve vertical and inlet up at a depth no greater than 1 inch below the surface. Test pressures of 4 inches of fuel, 1 psig, 10 psig, 30 psig and 60 psig shall be applied in succession. During 1-minute waiting periods at each pressure, no bubbles shall be released. For individual tests, pressures of 4 inches of fluid and 60 psig shall be used.

4.6.2.2.2 Proof pressure. Following the tests of 4.6.2.2.1, the pressure shall be raised from 60 psig to 120 psig and held for 1 minute. There shall be no evident leakage or other failure. For individual tests the time shall be 10 seconds.

4.6.2.2.3 Fuel pressure leakage. Fuel pressures shall be applied to the valve outlet while the inlet is connected to a small bore calibrated pipette capable of detecting liquid volume changes of .005 cc. Test pressures of 4 inches of fuel, 1 psig, 10 psig, 30 psig, and 60 psig shall be applied in succession, with 1-minute waiting periods at each pressure. Leakage shall not exceed 0.01 cc per minute. For individual tests, a pressure of 60 psig shall be used.

4.6.2.3 Valve opening and closing. With the valve mounted in a test setup as shown in figure 1, the valve opening and closing pressures shall be determined. The calibrated burete shall be slowly lowered until the liquid level in the burete begins to rise. The liquid head difference between the two liquid levels is the opening pressure. The burete shall remain in this position. When the liquid level in the burete ceases to climb, this liquid differential is the closing pressure. The opening pressure shall be less than 8 inches of water. The valve shall close before the liquid head differential becomes zero. Water may be used for this test. The test shall be repeated three times.

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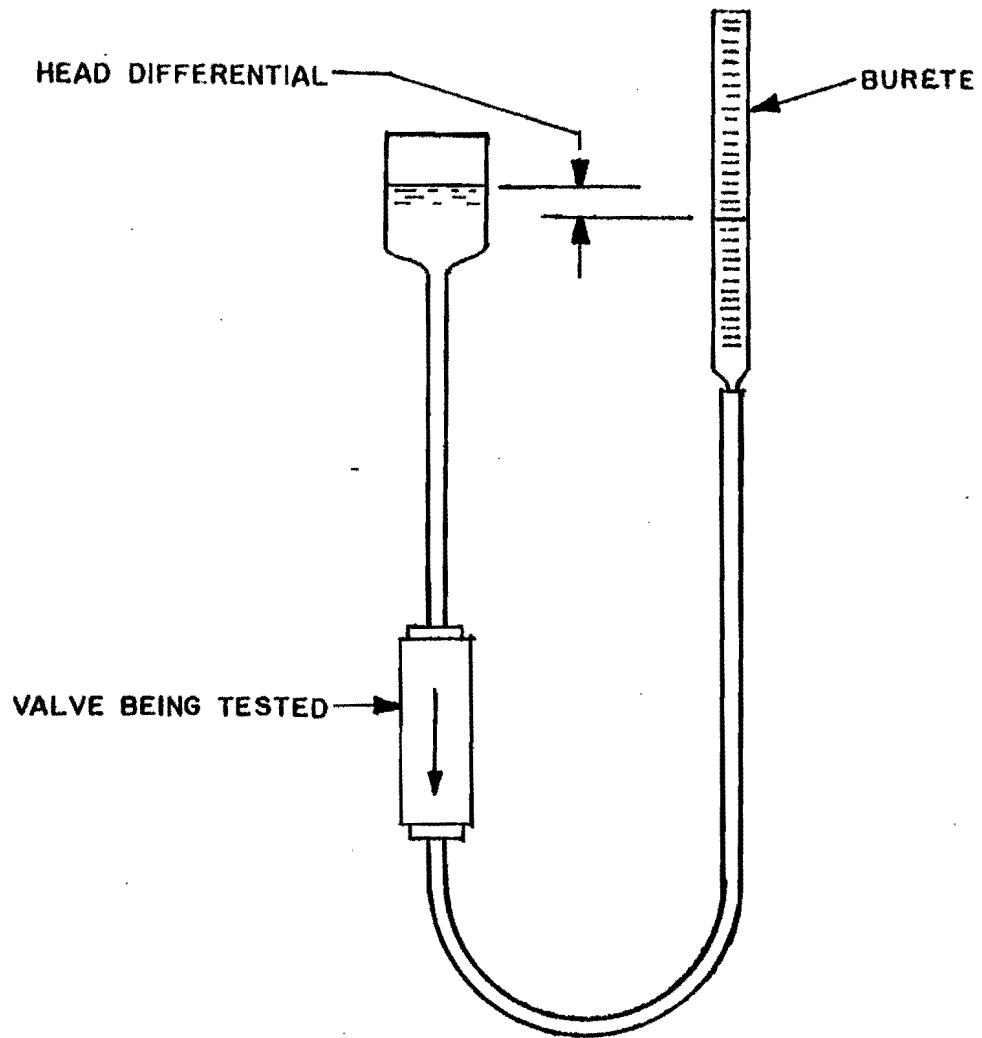


FIGURE 1. Test Apparatus for Valve Opening and Closing Test

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4.6.3 Endurance. An endurance test of 100,000 cycles shall be conducted in accordance with MIL-F-8615. The altitude portion is not applicable. The dry portion shall be conducted with air or dry nitrogen. The cycle rate shall be 15 cycles per minute maximum. A cycle is defined as follows:

- a. Valve open and flowing rated flow
- b. No-flow pressure shall be 60 psig
- c. Inlet flow is shut-off and vented to zero psig with the outlet being 60 psig.

4.6.3.1 Contaminated fuel. Using the same test procedure of 4.6.3 1000 cycles of operation shall be conducted with the fuel containing contaminants conforming to MIL-F-8615 (except cotton linters). 500 cycles shall be at 90 to 100 percent rated flow and 500 cycles at 10 to 20 percent rated flow.

4.6.4 Vibration. The valve shall be vibrated dry, in accordance with procedures of MIL-STD-810 for equipment installed in aircraft and helicopters. The vibration load level shall be 2G's from 20 to 33 Hz, 10G's from 74 to 2000 Hz, and at a double amplitude of .036 inch from 33 to 74 Hz.

4.6.5 Accelerated corrosion. The complete valve with open ports shall be immersed in a solution consisting of 2-1/2 percent of weight of sodium chloride in distilled water. After immersion, the solution shall be drained, and the valve shall be heated in an oven to a temperature of 130° ±5°F for 1 hour. The immersion and heating cycle shall be repeated 50 times. The valve shall not be operated any time during the above 50 cycles. Immediately after completion of the immersion cycles, the valve, in the assembled state, may be flushed with warm water to remove salt accumulations.

4.6.6 Fuel resistance and extreme temperature. This test shall be accomplished in accordance with MIL-F-8615.

4.6.7 Ultimate pressure. A fluid pressure of 180 psig shall be applied for a period of 1 minute to the inlet port with the outlet capped and then to the outlet port with the inlet capped. There shall be no external leakage.

4.6.8 Disassembly and inspection. Following completion of all tests, all test articles shall be disassembled for inspection. There shall be no evidence of failure, deterioration, distortion, excessive corrosion or undue wear.

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4.7 Preparation for delivery. Preparation for delivery provisions shall be inspected for conformance to section 5.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Check valves shall be preserved and packaged in accordance with level A or C as specified (see 6.2).

5.1.1 Level A. The valves shall be preserved and packaged in accordance with MIL-STD-794, and Method III of MIL-P-116, one each in unit container conforming to PPP-B-636, domestic class.

5.1.2 Level C. The valves shall be individually preserved and packaged in a manner that will provide protection against corrosion, deterioration or physical damage so that serviceability is assured during shipment from supply sources to the first receiving activity.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. Valves packaged as specified in 5.1.1 should be packed in shipping boxes conforming to PPP-B-636, weather-resistant class. Shipping boxes shall be of uniform shape and size and of minimum tare, weight, and cube consistent with protection required.

5.2.2 Level B. Valves packaged as specified in 5.1.1 should be packed in shipping boxes conforming to PPP-B-636, domestic class. Other requirements specified in 5.2.1 shall apply.

5.2.3 Level C. Valves shall be packed in exterior shipping containers in a manner that will insure safe transportation at lowest rate to the point of delivery and shall meet, as a minimum, all requirements of carrier rules and regulations.

5.3 Marking. In addition to any marking required by the contract or order, interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The fuel check valves covered by this specification are intended for use in aircraft fuel systems.

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6.2 Ordering data. Procurement documents should specify:

- a. MS part number
- b. Quantity required
- c. Applicable levels of preservation, packaging, and packing (see 5.1 and 5.2).

6.3 Data. Data generated by this specification is not deliverable unless specified on the Contract Data Requirements List (DD Form 1423) referencing the appropriate data item description in the military departments' Authorized Data List (ADL). The data produced by this document is as follows:

- a. Qualification test report and test samples (see 4.4.2)
- b. Data to accompany test samples (see 4.4.1.1).

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List for this specification is the Aeronautical Systems Division, Attn: ASD/ENJP, Wright-Patterson Air Force Base, Ohio 45433 and information pertaining to qualification of products may be obtained from that activity.

6.5 Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:

Army - AV
Navy - AS
Air Force - 11

Preparing activity:

Air Force - 11

Project No. 2915-0073

Review activities:

Army - ME, MI
Air Force - 82