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SUPERSEDING
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MILITARY SPECIFICATION

VALVE; FUEL SHUTOFF SOLENOID OPERATED, 28 VOLT DC

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

1. SCOPE

1.1 Scope. This specification covers solenoid-operated, hydrocarbon fuel shutoff valves.

1.2 Classification. The solenoid-operated hydrocarbon fuel shutoff valve shall be of the following sizes, as specified (see 6.2):

1/4 inch - for use in 1/4 inch outside diameter tubing lines
3/8 inch - for use in 3/8 inch outside diameter tubing lines
1/2 inch - for use in 1/2 inch outside diameter tubing lines

*2. APPLICABLE DOCUMENTS

*2.1 Government documents.

*2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

P-D-680	Dry Cleaning Solvent
QQ-C-320	Chromium Plating (Electrodeposited)
QQ-P-416	Plating, Cadmium (Electrodeposited)
TT-S-735	Standard Test Fluids, Hydrocarbon
PPP-B-636	Box, Shipping Fireboard

MILITARY

MIL-P-116	Method of Preservation
DOD-D-1000	Drawings, Engineering and Associated Lists
MIL-S-4040	Solenoid, Electrical, General Specifications for
MIL-P-5315	Packing, Preformed, Hydrocarbon Fuel Resistant

* Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: the Engineering Division, San Antonio ALC/MMEDO, Kelly AFB, TX 78241 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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MIL-G-5572	Gasoline, Aviation, Grades 80/87, 100/130, 115/145
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT, General Requirement for
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-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-T-83133	Turbine Fuel, Aviation, Kerosene Type, Grade JP8
MIL-C-83286	Coating Urethane, Aliphatic Isocyanate, for Aerospace Application
MIL-C-83723	Connector, Electrical, (Circular, Environment Resisting), Receptacles and Plugs, General Specification for

STANDARDS

FEDERAL

FED-STD-151	Metal; Test Methods
FED-STD-595	Color

MILITARY

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-143	Standards and Specification, 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 Control of Age-Sensitive Elastomeric Material
MS20995	Wire, Safety or Lock
MS29527	Valve, Fuel Shutoff, Solenoid Operated, 28V DC, 60 PSI Operating Pressure
MS33588	Nut, Self Locking, Aircraft Design and Usage Limitation of

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

*2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ASTM D 3951	Standard Practice for Commercial Packaging

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

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Society of Automotive Engineers

ARP 868 Pressure Drop Test for Fuel System Components

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

3. REQUIREMENTS

*3.1 First article. When specified, a sample shall be subjected to first article inspection (see 4.3 and 6.2).

3.2 Components. The complete shutoff valve shall consist essentially of a solenoid and a valve constructed to meet the performance requirements of this specification.

3.3 Materials. Materials and processes used in the manufacture of solenoid valves shall be of high quality, suitable for the purpose intended, and shall conform to applicable Government specifications. Materials conforming to the contractor's specifications may be used provided the specifications are released by the Services and contain provisions for adequate tests. The use of the contractor's specifications will not constitute waiver of Government inspection. All materials used in the valve shall be sufficiently resistant to fuels conforming to TT-S-735, MIL-G-5572, MIL-T-5624 and MIL-T-83133 of aromatic content from 0 to 30 percent, to assure satisfactory operation as herein defined.

3.3.1 Metals. All metals used in the construction of solenoid valves shall be of a corrosion-resisting type or shall be suitably protected to resist corrosion during the normal life of the valve. The use of dissimilar metals especially brass, copper, or steel in direct contact with aluminum alloy shall be avoided whenever practicable. Dissimilar metals are defined in MIL-STD-889.

3.3.2 Castings. Castings shall be clean, sound, and free from blow holes, porosity, cracks, and any other defects.

3.3.3 Selection of materials. Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-143, except as specified in 3.3.3.1.

3.3.3.1 Standards parts. Standard parts (MS or AN) shall be used wherever they are suitable for the purpose, and shall be identified on the drawing by their part numbers. Commercial utility parts such as screws, bolts, nuts, and cotter pins may be used, provided they possess suitable properties and are replaceable by the standard parts (MS or AN) without alteration, and provided the corresponding standard part numbers 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 or request for proposal, commercial parts may be used provided they conform to all requirements of this specification.

3.4 Design. The valves shall be designed to permit the positive shutoff of fuel under all conditions described herein.

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3.4.1 Lubrication. The valve shall require no lubrication throughout its life.

3.4.2 Internal passages. Internal liquid passages shall be as large as practicable and entrance and exit holes shall be rounded and free from burrs in order to minimize restriction of flow.

3.4.3 Rated flow. The rated flow of shutoff valves shall be as shown on MS29527.

3.4.4 Operating pressure. The valve shall permit satisfactory operation at pressures of 0 to the maximum operating pressures specified on the applicable MS over the complete range of flow specified.

3.4.5 Temperature range. The valve shall operate satisfactorily throughout a temperature range of -65 to +200°F.

3.4.6 Operating time. The solenoid shall open or close the valve in 1 second maximum time.

3.4.7 Special tools. The design shall be such as to accommodate to the greatest possible extent, disassembly, reassembly, or service maintenance by those tools and items of maintenance equipment which are normally available as commercial standards.

3.4.8 Normal position of valve. The valve shall be normally closed (closed when solenoid is not energized).

3.5 Constructions. The va've shall be constructed to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service use.

3.5.1 "O" rings. "O" rings, wherever used, shall be in accordance with MIL-P-5315.

3.5.2 Drawing. The valve shall be constructed in accordance with the applicable MS.

3.5.3 Threads.

3.5.3.1 Screw threads. All screw threads shall be in accordance with MIL-S-8879.

3.5.3.2 Pipe threads. Pipe threads shall be used for permanent closures only. Pipe threads when used shall be in accordance with MIL-P-7105.

3.5.3.3 Locking of parts. All threaded parts shall be securely locked by cotter pins or some other approved method. Self-locking nuts shall be used in accordance with MS33588. Safety wire shall be in accordance with MS20995 and shall have a minimum diameter of 0.032 inch. The use of staking or lock washers is prohibited.

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3.6 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. Changes in the manufacturer's part number shall be governed by the drawing number requirements of DOD-D-1000.

3.7 Serviceability. All synthetic rubber parts shall be readily replaceable with a minimum replacement of attaching parts.

3.8 Electrical.

3.8.1 Design voltage. The valve shall be capable of satisfactory operation at inlet pressures up to the maximum operating pressure specified on the applicable MS and outlet pressure of zero with any terminal potential in the range of 18 to 30 volts, direct current.

3.8.2 Power consumption. The electric power consumption of the valve when operating under any conditions described herein with applied terminal potential between 18 and 30 volts shall not exceed that specified on the applicable MS.

3.8.3 Electrical connectors. Electrical connectors shall be in conformance with MIL-C-83723.

3.8.4 Internal grounds. The solenoid shall not be internally grounded.

3.8.5 Electrical contacts. Electrical contacts, when required, shall be as specified on the applicable MS.

3.8.6 Solenoid. The solenoid shall be a type I solenoid conforming to MIL-S-4040.

3.9 Finish.

3.9.1 Aluminum. All aluminum alloy parts shall be anodized in accordance with MIL-A-8625, unless adequately treated for corrosion prevention in some other manner acceptable to the procuring activity.

3.9.2 Steel. Steel parts, other than corrosion-resisting steel, not in moving contact, shall be cadmium plated in accordance with QQ-P-416, type II, class 2. Sliding or rotating steel parts shall be chromium plated in accordance with QQ-C-320 or adequately treated in some other acceptable manner for corrosion prevention. Cadmium plating shall not be used on parts in moving contact because galling of the plating could cause malfunctioning. Materials requiring cadmium plating shall not be used in components that can come into contact with fuel during operation. Stainless steel parts shall be passivated.

3.9.3 Nonferrous metals. Brass, bronze, and copper-alloy parts shall be cadmium plated in accordance with QQ-P-416, type II, class 3.

*3.9.4 Paint finish. Any parts painted shall be finished with one coat of primer in conformance with MIL-P-23377 and one coat of polyurethane MIL-C-83286, color 17038 of FED-STD-595.

3.10 Performance. The valve shall satisfy all the performance requirements when subjected to the tests specified in 4.6.

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3.11 Markings. All markings shall be durable to prevent obliteration during service usage.

3.11.1 Flow direction. The valve shall incorporate a permanent arrow to indicate the normal direction of fuel flow.

3.11.2 Color code. Color code shall be in accordance with MIL-F-8615.

3.12 Identification of product.

3.12.1 Marking of parts. Each part or assembly shall be marked with the part number which shall be the same as the drawing number of that part or assembly. An assembly consists of parts that are permanently fastened together by welding, brazing, soldering, or riveting. Exceptions to this marking are those parts that do not have a suitable or sufficient surface for a part number.

3.12.2 Synthetic rubber parts. All synthetic rubber parts excepting "O" rings and parts with no suitable surface, shall have painted, stamped with ink, or otherwise noted on the part, the year and month of the curing date of the part.

3.12.3 Curing date tag. A decalcomania or a small metal tag in accordance with the requirement of MIL-STD-1523, giving the year and month of the curing date of the oldest synthetic rubber part in the valve, shall be secured to the outside of the valve.

3.12.4 Nameplate. A nameplate containing the following information properly and legibly filled in, shall be securely attached to the valve, or the same informationn may be etched, engraved, embossed or stamped in a suitable location on the valve.

VALVE: FUEL SHUTOFF,
SOLENOID-OPERATED 28V DC
MIL-V-8610
MS29527 - (appropriate dash number)
Manufacturer's Part No.
Manufacturer's Serial No.
Manufacturer's name or trademark
US

3.13 Workmanship. All details of workmanship shall be in accordance with highgrade manufacturing practice covering this class of aircraft accessories.

3.13.1 Cleaning. The valves shall be thoroughly cleaned of foreign material while being assembled and after final assembly.

*3.13.2 Manufacturer's drawings. Manufacturer's drawings submitted with the first article samples shall include a sectional view showing all parts in their normal assembled position and shall specify part numbers of all parts and sub-assemblies. The following data shall be furnished on or together with the assembly drawings:

(a) Detailed internal construction
(b) Internal, external, and overall dimensions
(c) Materials of construction, treatment and finish
(d) Weight

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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 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 assure supplies and services conform to prescribed requirements.

*4.2 Classification of inspection. The examination and testing of the valves shall be classified as:

(a) First article inspection (see 4.3)
(b) Quality conformance inspection (see 4.4)

*4.3 First article inspection. First article inspection shall consist of the examination and tests as specified under 4.6, and shall be conducted in the order specified in 4.3.1. Quantity production shall be withheld until the first article samples have been pronounced satisfactory by the procuring activity. The approval of the first article samples shall not relieve the contractor of this obligation to submit sample for the quality conformance inspections.

*4.3.1 First article test samples. The first article test samples shall consist of two valves of each size specified on the contract or order, representative of the production equipment. They shall be tested at a laboratory designated by the procuring activity or, when so stated in the contract, at the contractor's plant under the supervision of the procuring activity (see 6.2).

Valve No. 1

(a)	Examination of product	(4.6.1)
(b)	Explosion 1/	(4.6.9.1)
(c)	Calibration	(4.6.2)
(d)	Dielectric strength	(4.6.5)
(e)	Fuel resistance and low temperature	(4.6.6)
(f)	Endurance	(4.6.7)
(g)	Calibration	(4.6.2)
(h)	Dielectric strength	(4.6.5)
(i)	Disassembly and inspection	(4.6.10)

Valve No. 2

(a)	Examination of product	(4.6.1)
(b)	Calibration	(4.6.2)
(c)	Dielectric strength	(4.6.5)
(d)	Vibration test	(4.6.3)
(e)	Valve leakage	(4.6.2.2)
(f)	Valve body leakage and proof pressure	(4.6.2.5)

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(g)	Minimum voltage	(4.6.2.4)
(h)	Contaminated fuel	(4.6.4)
(i)	Salt spray test	(4.6.9.2)
(j)	Accelerated corrosion	(4.6.8)
(k)	Calibration	(4.6.2)
(l)	Dielectric strength	(4.6.5)
(m)	Disassembly and inspection	(4.6.10)

1/ If the method of conducting the explosion test will render the unit unsatisfactory for the remaining tests this test shall be conducted on a separate additional test sample.

4.3.2 Manufacturer's test report. The test report submitted with the test samples shall conform to MIL-STD-831 and shall include the following:

(a) Report of all tests, graphically presented when possible, together with a detailed statement indicating compliance or extent of noncompliance with all requiremnts of this specification, referring specifically to paragraph numbers.

(b) Outline and description of tests and test conditions.

(c) Copies of test log sheets.

4.4 Quality conformance inspection. The quality conformance inspection shall consist of inidvidual tests.

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

(a)	Examination of product	(4.6.1)
(b)	Valve leakage (10 percent and maximum operating pressure only)	(4.6.2.2)
(c)	Minimum voltage	(4.6.2.4)
(d)	Valve body leakage and proof pressure	(4.6.2.5)
(e)	Dielectric strength	(4.6.5)

4.4.2 Rejection and retest. Any valve which has been rejected may be reworked or replaced to correct the defects, and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished to the procuring activity. Valves rejected after retest shall not be resubmitted without specific approval of the procuring activity.

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4.5 Test conditions.

4.5.1 Cleaning. Prior to testing the valve, all internal parts normally in contact with the fuel, shall be thoroughly cleaned to remove all foreign matter.

4.5.2 Leakage. For all leakage tests, valves shall be mounted in a position such that the weight of the movable sealing element tends to open the valve.

4.5.3 Test fluid. Unless otherwise specified, fuel in accordance with MIL-G-5572, grade 100/130 or grade 115/145, or TT-S-735, type I, shall be used for all tests. Any fluid in conformance with P-D-680 (or any other fluid acceptable to the procuring activity) may be used as a substitute for the test fuel for all tests, except wherein a specific fluid is specified.

4.5.4 Room temperature and pressure. Unless otherwise specified, all test shall be conducted with the valve and fuel at a room temperature between 70 and 90°F and at atmospheric pressure.

4.5.5 Operating voltage. Unless otherwise specified, the valve shall be operated with a terminal potential of 27 volts.

4.6 Inspection methods.

4.6.1 Examination of product. Each valve shall be carefully examined to determine conformance with the requirements of this specification not covered by tests.

4.6.2 Calibration.

4.6.2.1 Pressure drop. The pressure drop through the valve shall not exceed the applicable value listed on MS29527. The test shall be conducted as recommended in ARP868. Sufficient data shall be taken to satisfactorily plot a "pressure drop vs flow curve."

4.6.2.2 Valve leakage. With the valve closed, the inlet port shall be subjected to fuel pressures in 2 percent increments from 0 to 10 percent to maximum operating pressure and in 10 percent increments from 10 percent to maximum operating pressure. The valve shall be actuated immediately before the application of each increment of pressure and each pressure shall be maintained for a minimum period of 3 minutes. There shall be no leakage.

4.6.2.3 Valve back pressure leakage. With the valve closed and the inlet port open, the out port shall be subjected to a fuel pressure of 10 psi for a period of [illegible] minutes. There shall be no leakage.

4.6.2.4 Minimum voltage. The solenoid valve shall be operated to determine the minimum operating voltage with inlet pressure equal to the maximum operating pressure and discharge restricted to maintain rated flow. Pressure on the out port of the closed valve shall be atmospheric. The valve shall operate satisfactorily with a terminal potential at the unit of 18 volts.

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4.6.2.5 Valve body leakage and proof pressure. With the valve in the open position and the outlet port plugged, the valve shall be subjected to a fluid pressure of twice the maximum operating pressure specified on the applicable MS for a minimum period of 5 minutes. There shall be no leakage from any portion of the valve or evidence of distortion of any part.

4.6.2.6 Burst pressure. With the valve in the open position and the outlet port plugged, the valve shall be subjected to fluid pressure of three times the maximum operating pressure of the valve for a minimum period of 5 minutes. The pressure shall then be reduced to the maximum operating pressure specified on the applicable drawing, and at this reduced pressure there shall be no leakage. Any evidence of damage or permanent distortion shall be cause for rejection.

4.6.3 Vibration. The solenoid valve shall be subjected to the vibration tests, procedure I of MIL-STD-810. No damage to the valve shall result from the vibration tests. Any severe resonant condition encountered during this test shall be cause for rejection. There shall be no evidence of leakage through the closed valve or external leakage at any time during this test.

4.6.4 Contaminated fuel. Fuels containing a quantity and type of contaminant conforming to table I, for every 20 gallons, shall be pumped at rated flow through the valve in a recirculating system. The valve shall be operated at the rate of 6 cpm with the solenoid energized approximately 75 percent of the time for 2,000 cycles. The fuel shall be properly agitated to keep the contaminant uniformly distributed in the circulating fuel. An inlet pressure of 25 psi shall be maintained on the valve with the discharge restricted to obtain rated flow. Pressure on the out port of the closed valve shall be atmospheric. The dynamic leakage test, using a shutoff pressure of 25 psi instead of the 60 psi specified, shall be conducted periodically at least once every 200 cycles during the contaminated fuel test. The valve shall then be subjected to the calibration test.

TABLE I. Contaminated fuel endurance test dust

Contaminant description	Particle size	Quantity
Sharp silica sand	Smaller than 30 mesh Larger than 50 mesh	0.2 gram
Sharp silica sand	Smaller than 50 mesh Larger than 100 mesh	0.2 gram
Prepared dust AC Spark Plug Co Part No. 1543637 or equal	0-5 microns 12 ±2 percent 5-10 microns 12 ±3 percent 10-20 microns 14 ±3 percent 20-40 microns 23 ±3 percent 40-80 microns 30 ±3 percent 80-200 microns 9 ±3 percent	1.6 grams

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4.6.5 Dielectric strength. A potential of 1,000 volts (rms) alternating current at commercial frequency shall be applied between the coil terminals and other exposed metal parts for a period of 1 minute. Current flow in excess of 2 milliamperes of breakdown of insulation shall constitute failure.

4.6.6 Fuel resistance and low temperature. The fuel resistance and low temperature test shall be conducted in accordance with table II.

4.6.6.1 Dynamic leakage. Fuel shall be directed through the valve at rated flow with shutoff pressure of 60 psi. The valve shall be actuated from open to closed. At the end of a 2 minute waiting period with the shutoff pressure maintained at 60 psi and the outlet pressure at zero, there shall be no leakage through any part of the valve.

4.6.7 Endurance. The endurance test shall be conducted in accordance with table III.

4.6.8 Accelerated corrosion. Without immersing the solenoid, the valve, with open ports, shall be immersed in a solution consisting of 2 1/2 percent by weight of sodium chloride in distilled water. After immersion, the solution shall be drained and valve shall be heated in an oven to a temperature of 125° to 135°F for a period of not less than 1 hour. The immersion and heating cycle shall be repeated 50 times. The valve shall not be operated at any time during the immersion cycles. Immediately after completing the immersion cycles, the valve shall be washed out with warm water to remove all salt accumulations after which the valve shall be dried, wetted with fuel, and subjected to the minimum voltage test (4.6.2.4). Corrosion of any part of the valve to a degree which might affect performance shall be cause for rejection.

4.6.9 Environmental.

4.6.9.1 Explosion. This test is applicable to solenoid valves which include electrical contacts which open and close during operation and which are not enclosed in a hermetically sealed housing. The test shall be conducted with the valve mounted inside a test chamber having a transparent window on one side and opposite side closed by this nonporous paper to permit instant pressure relief during explosion. The chamber shall be equipped with a suitable means for vaporizing fuel and maintaining a predetermined air-fuel mixture throughout the test chamber. Means shall be provided for introducing explosive air-fuel mixture, and the valve shall be actuated 15 times with a terminal voltage of 30 volts at a rate of 1 actuation per minute. Air pressure shall be applied to the inlet of the valve (outlet at atmospheric pressure) such that rated pressure of the valve occurs when the valve is closed. At least once during every 5 actuations, the mixture in the valve shall be exploded, using an auxiliary means of igniting the mixture if necessary, and after the 15 actuations the mixture in the chamber was explosive. A total of 15 test, of 15 actuations each as described above, shall be performed on the valve with explosive mixtures having air-fuel ratios by weight of 12.6:1 and 15.5:1, and other mixtures spaced between these limiting values. The valve shall confine all sparks and flame within the electrical enclosure. Any explosion within the unit shall not ignite the surrounding explosive mixture or cause any damage to the valve.

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TABLE II. Fuel resistance and low temperature test schedule.

Period 1/	Fuel resistance				
	Phase I soak	Phase I dry	Phase II soak	Phase II dry	Low temperature
Component configuration	Valve 2/mounted in normal manner in a recirculating system	Drained, valve closed ports open	Valve 2/mounted in normal manner in a recirculating system	Drained, valve ports open	Valve 2/ mounted in normal manner in a recirculating system
Test fluid	TT-S-735 type III	None	TT-S-735, type III	None	TT-S-735, type I
Period duration	96 hours (4 days)	24 hours	18 hours	30 hours	18 hours
Ambient and test fluid temperature	200° ±2°F	Circulating air at 200° ±2°F	200° ±2°F	Circulating air at 200° ±2°F	Lower the fluid temperature to -67° ±2°F and maintain at -67° ±2°F for a minimum of 18 hours
Operation or tests during period	With a minimum of 2 gallons test fluid, operate (energize) the valve for 60 min/day with a terminal potential of 28 Volts DC During energized condition, maintain rated flow. During non-energize condition, maintain 60 psig. The dynamic leakage test of 4.6.6.1 shall be conducted daily. 4/	None	Same as for the phase I soak	None	None

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TABLE II. Fuel resistance and low temperature test schedule-(continued)

Period 1/	Fuel resistance				
	Phase I soak	Phase I dry	Phase II soak	Phase II dry	Low temperature
Operation or test immediately after period	Conduct leakage tests of 4.6.2.2, 4.6.2.3, and 4.6.2.5 at room temperature, using TT-S-735, type III fluid	(a) Conduct leakage tests same as for phase I soak period at room temperature, using TT-S-735 type I fluid. (b) Conduct dielectric strength tests	Same as for the phase I soak period	Same as for phase I dry	(a) Operate valve twice with 18 volts, 60 psi, and rated flow at low temperature. (b) Conduct leakage test same as for the phase I soak period while still at the low temperature.

1/ Each period shall follow immediately after the preceding one in the order noted.

2/ The valve shall be installed in a suitable recirculating system using not less than 2 gallons of the specified test fluid.

3/ Temperatures given are for fluid and ambient air, except as noted.

4/ At the completion of the cycling, the valve shall complete the soaking in a submerged condition.

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TABLE III. Endurance test schedule

Test	Dry Endurance	Wet endurance		
Period	Endurance and altitde	Room temperature 1/	High temperature	Low temperature
Test set-up or valve configuration.	Suitable test setup, 60,000 ft. pressure altitude.	Suitable recirculating test setup.	Suitable recirculating test setup.	Suitable recirculing test setup.
Test procedure during period.	(a) Dry with 2/ open ports, 4 hours at 200° ±2°F at sea level pressure (b) Cycle valve for 5,000 cycles dry at test altitude. (c) Wet valve with test fluid.	(a) Cycle valve for 55,000 cycles circulating test fluid through the valve at the flow rate specified on MS29527 and imposing 60 psi pressure on the valve in the "off" position. (b) See 1/.	(a) Cycle valve for 20,000 cycles as for room temperature period, except that the flow should be in the opposite direction and rated flow need not be achieved. (b) Pressure should be a minimum of 5 psi	Cycle valve for 5,000 cycles as for room temperature period, except that the flow should be in the opposite direction and rated flow need not be achieved.
Ambient and test fluid temperature	Room	Room	130° ±5°F	-67 ±2°F
Number of periods	4	1	1	1
Test after completion of period	After final period, conduct closed valve fuel pressure leakage test.	Conduct the following test: (a) Valve body leakage test. (b) Closed valve air suction leakage test. (c) Closed valve fuel pressure leakage test.	None; however, there shall be no visible leakage from the valve during the test.	None; however, there shall be no visible leakage from the valve during the test.

1/ The dynamic leakage test shall be conducted at the beginning of the room temperature test period; at approximately half way through the period; and again at the conclusion of the period.

2/ Valve to be energized.

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4.6.9.2 Salt spray. The solenoid valve with the inlet and outlet ports plugged shall be subjected to salt spray in accordance with FED-STD-151 for a period of 50 hours. At the end of the test period the salt deposits shall be removed with warm water. The valve shall be dried, wetted with fuel, and subjected to the minimum voltage test (4.6.2.4). Any evidence of corrosion that might affect the performance of the valve shall be cause for rejection.

4.6.10 Disassembly and inspection. The solenoid valve shall be disassembled and inspected. Any evidence of deterioration or excessive wear shall be cause for rejection.

*5. PACKAGING

*5.1 Preservation. Preservation shall be level A, C, or Commercial/Industrial Packaging.

*5.1.1 Level A.

*5.1.1.1 Cleaning. Solenoids shall be cleaned in accordance with MIL-P-116, Process C-1.

*5.1.1.2 Drying. Solenoids shall be dried in accordance with MIL-P-116.

*5.1.1.3 Preservation application. None required

*5.1.1.4 Unit packaging. Unless otherwise specified, each solenoids shall be individually packaged in accordance with MIL-P-116, method II, insuring compliance with the general requirements paragraph under methods of preservation (unit protection) and the physical requirements paragraph under methods of preservation (unit protection) and the physical requirements paragraph therein.

*5.1.1.5 Intermediate packaging. Solenoids, unit packed as specified in 5.1.1.4 shall be placed in intermediate containers conforming to PPP-B-636. Intermediate containers shall be uniform in size, shape, and quantities, shall be of minimum tare and cube and shall contain multiples of five unit packages, not to exceed 100 packages or 10 pounds. No intermediate packaging is required when the total quantity shipped to a single designation is less than 50 units.

*5.1.2 Level C. The Level C preservation for solenoids shall conform to the requirements of MIL-STD-794 for this level.

*5.1.3 Commercial. The commercial/industrial preservation of solenoids shall be in accordance with the requirements of ASTM D 3951.

*5.2 Packing. Packing shall be Level A, B, C, or commercial/industrial as specified (see 6.2).

*5.2.1 Level A. The packaged solenoids shall be packed in containers as specified in MIL-STD-794 for Level A protection.

*5.2.2 Level B. The packaged solenoids shall be packed in containers as specified in MIL-STD-794 for Level B protection.

*5.2.3 Level C. The packaged solenoids shall be packed in containers as specified in MIL-STD-794 for Level C protection.

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*5.2.4 Commercial. The packaged solenoids shall be packed in accordance with the requirements of ASTM D 3951.

*5.3 Marking.

*5.3.1 Levels A, B and C. In addition to any special or other identification marking required by the contract (see 6.2) each unit pack, intermediate and exterior container and unitized load shall be marked in accordance with MIL-STD-129.

*5.3.2 Commercial. Commercial/industrial marking shall be in accordance with the requirements of ASTM D 3951.

6. NOTES

6.1 Intended use. The solenoid-operated shutoff valve covered by this specification are intended for use in 28-volt direct-current aircraft systems with small flow requirements handling hydrocarbon fuel, such as combustion heating units, auxiliary power plants, oil dilution systems, and priming systems.

*6.2 Ordering data. Acquisition documents should specify the following:

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

(b) Size of valve required (see 1.2).

(c) Where the first article test samples should be sent, the activity responsible for testing and instructions concerning the submittal of test reports (see 4.3.1 and 4.3.1.2).

(d) Level of preservation, unit packaging, and packing required (see 5.1).

(e) When other than MIL-STD-794 packing is required (see 5.2).

(f) Location and condition for first article testing (see 4.3).

1/ Information to be entered by the manufacturer.

6.3 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this documents based on the entire content irrespective of the marginal notations and relationship to the previous issue.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-V-8610B	Valve; Fuel Shutoff Solenoid Operated, 28 Volt DC

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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