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INCH-POUND
MIL-DTL-12211G
5 February 2009
SUPERSEDING
MIL-DTL-12211F
10 March 2003

DETAIL SPECIFICATION

SWITCH, PRESSURE

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

1. SCOPE

1.1 Scope. This specification covers two types of automotive pressure switches (see 6.1). Type I switches operate when fluid pressures drop below predetermined values and type II switches operate when fluid pressures exceed predetermined values.

1.2 Classification. Switches furnished under this specification will be of the following types and classes as specified (see 6.2). All switches shall be (waterproof).

Type I	-	Sufficiently low pressure closes contacts.
Type II	-	Sufficiently high pressure closes contacts.
Class 1	-	High vibration (see 6.4).
Class 2	-	Low vibration (see 6.4).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 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 documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to switch@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

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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.

FEDERAL STANDARDS

FED-STD-H28 - Screw Thread Standards for Federal Services.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-12211/1 - Switch, Pressure, SPST, Waterproof.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130 - Identification Marking of US Military Property.
MIL-STD-202 - Electronic and Electrical Component Parts.
MIL-STD-810 - Environmental Engineering Considerations and Laboratory Test.
MIL-STD-889 - Dissimilar Metals.
MS27152 - Switch, Pressure-Warning. Low Air Pressure 60 PSI, SPST, Waterproof.
MS75062 - Switch, Pressure-Stoplight, Vehicular, Air Brake System, 24 Volt, Waterproof.
MS75063 - Switch, Pressure-Stoplight, Vehicular, Hydraulic Brake System,24 Volt, Waterproof.
MS90530 - Switch, Pressure-Warning SPST, Waterproof, 24 Volt, DC.

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

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications 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.

DRAWINGS

ARMY

7321326 - Sending Unit, Low Oil Pressure Warning.
11669414 - Switch, Pressure.

(Copies of drawings required by contractors in connection with specific acquisition functions should be obtained from the acquiring activity, or as directed by the contracting officer.)

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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 these documents are those cited in the solicitation or contract (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/NCSL Z540-1 - Laboratories, Calibration, and Measuring and Test Equipment.

INTERNATIONAL ORGANIZATION for STANDARDS (ISO)

ISO 10012-1 - Equipment, Quality Assurance Requirements for Measuring - Part 1: Meteorological Confirmation System for Measuring Equipment.

(Applications for copies can be obtained online at www.ansi.org or through the American National Standards Institute, 11 West 42nd Street New York, NY 10036).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B117 - Salt spray (Fog) Apparatus, Operating.

(Application for copies can be obtained online at www.astm.org or through the American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.)

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

2.4 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 takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The switches furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.3).

3.2 Materials. Materials shall be as specified herein and in referenced specifications, standards and drawings. Material shall be free of defects that adversely affect performance or serviceability of the finished product (see 4.7.1).

3.2.1 Dissimilar metals. Dissimilar metals shall be protected from galvanic corrosion in accordance with requirements of MIL-STD-889 (see 4.7.1).

3.2.2 Pure tin. The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of switch components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see 6.5).

3.3 Interface and physical dimensions. Switches shall conform to MS27152, MS75062, MS75063 or MS90530, Drawings 7321326 or 11669414; and to other applicable standards or drawings, as specified (see 4.7.1, 4.7.2 and 6.2).

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3.3.1 Threaded parts. Screw threads of the form, number per inch, and class specified on the applicable drawing or military standard shall be in accordance with FED-STD-H28 (see 4.7.2).

3.3.2 Rating. The switch shall be operated in nominal 24 volts (V) direct current (dc) electrical systems, and shall operate a nominal 6 watt (3 candlepower) lamp, or loads as specified on applicable MS standards or drawings (see 4.7.2).

3.4 Performance.

3.4.1 Calibration (see 4.7.3).

3.4.1.1 Type I switches. Type I switches shall close on decreasing pressure within the pressure range specified on the applicable MS standard or drawing, and shall remain closed while the pressure is below the lower value specified therein. Type I switches shall open on subsequently increasing pressure at not less than the lower value and not more than 2 pounds per square inch (psi) above the upper value (see 4.7.3.1).

3.4.1.2 Type II switches. Type II switches shall close on increasing pressure, within the actuation range specified on the applicable MS standard or drawing and shall remain closed while the pressure is above the upper value specified therein. Type II switches shall open on subsequently decreasing pressure at not more than the upper value and not less than 2 psi below the lower value (see 4.7.3.2).

3.4.2 Terminal strength. Terminals shall withstand a force of 25 pounds without becoming deformed more than .062 inch (1.57 mm) or evidencing damage to the switch body. The switch shall subsequently meet the requirements of 3.4.1.1 or 3.4.1.2, as applicable (see 4.7.4).

3.4.3 Pressure overload. Switches shall withstand a pressure overload, as specified on the applicable MS standard or drawing for 1 minute. After overloading, the change in switch opening or closing pressure shall be not more than 8 percent. If no overload pressure is specified, pressure shall be 10 times actuating and overload pressures shall conform to table I (see 4.7.5).

TABLE I. Pressures for type I, class 2 of MS90530.

Actuating pressure	Overload pressure (psi)
4 - 8	50
9 - 13	50
15 - 19	50
23 - 27	50
28 - 32	100
44 - 50	100
60 - 65	150

3.4.4 High voltage. Switches shall withstand 220 V root mean square (rms) at 60 hertz (Hz) for 1 minute without evidence of sparking, arcing, burning, smoking, charring, or other insulation damage (see 4.7.6).

3.5 Environmental conditions.

3.5.1 Corrosion resistance. Switches shall withstand 200 hours of salt spray with no degradation in performance (see 4.8.1).

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3.5.2 Fungus resistance. Switches shall withstand 90 days of exposure to fungus with no degradation in performance (see 4.8.2).

3.5.3 Immersion. Switches shall meet the requirements specified in 4.8.3 and there shall be no evidence no leakage.

3.5.4 Extreme temperature resistance. Switches shall open and close within the pressure ranges specified herein or on the applicable MS standard or drawing, within a temperature range of minus (-) 65 to plus (+) 250 degrees Fahrenheit (°F) (see 4.8.4).

3.5.5 Shock. Switches shall withstand an acceleration force of 50 gravity units (g's) applied once in each direction of each axis of the switch. During shock application, switches shall be energized and a pressure of 10 psi above the upper actuation pressure specified on the applicable MS standard or drawing or table II, as applicable, shall be applied to type I switches. Similarly, a pressure of 10 psi below the lower actuation pressure shall be applied to type II switches. Switches shall not actuate during shock application and shall evidence no loosened, distorted or broken parts (see 4.8.5).

3.5.6 Vibration resistance.

3.5.6.1 Class 1 switches. Class 1 switches shall withstand vibration amplitude of .03 inch (0.7 mm) or 50 g's, whichever is less, in a cycle range of 10 to 3,500 Hz, applied in each direction of each axis of the switch. During vibration, switches shall be energized and pressure applied as specified in 3.5.5. Switches shall not actuate during vibration and shall evidence no loosened, distorted, or broken parts (see 4.8.6.1).

3.5.6.2 Class 2 switches. Class 2 switches shall withstand vibration as specified in 3.5.6.1, except amplitude, frequency, and conditions shall be as specified in test condition A, method 204 of MIL-STD-202 (see 4.8.6.2).

3.6 Endurance. Switches shall evidence no malfunction after being cycled 10,000 times from 0 psi to twice the actuation pressure specified on the applicable MS standard or drawing, then back to 0 psi. The changes in the pressure at which the switch contacts open and close shall be no more than 8 percent of the actuation pressure specified on the applicable MS standard or drawing (see 4.9).

3.7 Marking. The switch shall be marked in accordance with MIL-STD-130 and as specified on the applicable military drawing or standard. Marking shall include the following information, in the order shown (see 4.7.2):

Switch, pressure
Military part number
Type, grade and class
Actuating pressure limits
Manufacturer's part number
Manufacturer's name.
US

3.8 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should 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.

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3.9 Workmanship. Switches shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance (see 4.7.2).

4. VERIFICATION

4.1 Classification of inspections:

a. Qualification inspection (see 4.3).

b. Conformance inspections (see 4.4).

(1) Examination (see 4.4.2).

(2) Tests (see 4.4.3).

4.2 Test equipment and inspection facilities. The manufacturer shall establish and maintain a calibration system in accordance with ANSI/NCSL Z540-1, ISO 10012-1, or equivalent system as approved by the qualifying activity.

4.3 Inspection conditions and precautions.

4.3.1 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

a. Air temperature 77°F + 15°F (25°C + 80°C).

b. Barometric pressure 28.5 + 2, - 3 inches mercury (725 + 50 - 75 mm Hg).

c. Relative humidity 50 percent + 30 percent.

4.3.2 Precautions. Adequate precautions should be taken during inspection to prevent condensation of moisture on the switch. Precautions shall also be taken to prevent damage by heat when soldering terminals.

4.3.3 Voltage. Calibration and endurance tests shall be conducted at a source voltage of 28 + 0.5 V dc.

4.4 Qualification. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample size. Four sample units shall be subjected for qualification inspection.

4.4.2 Inspection routine. Four sample units shall be subjected to the qualification inspections specified in table II, in the order shown.

4.4.3 Defective. Failure of any qualification sample to pass any of the inspections specified herein may be cause, at the option of the Government, for refusal to conduct additional inspections until the faults revealed by the inspection have been corrected.

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TABLE II. Qualification inspection.

Inspection	Requirements paragraph	Method paragraph	Number of sample	Number of defects
Visual and mechanical examination	3.3, 3.3.1, 3.5.1, 3.7, and 3.9 inclusive.	4.7.1		
Calibration	3.4.1	4.7.3		
Terminal strength	3.4.2	4.7.4		
Pressure overload	3.4.3	4.7.5		
High voltage	3.4.4	4.7.6	4	0
Corrosion resistance	3.5.1	4.8.1		
Fungus resistance	3.5.2	4.8.2		
Immersion	3.5.3	4.8.3		
Extreme temperature resistance	3.5.4	4.8.4		
Shock	3.5.5	4.8.5		
Vibration, high frequency	3.5.6	4.8.6		
Endurance	3.6	4.9		

4.5 Retention of qualification. Every 12 months, the manufacturer shall verify the retention of qualification to the qualifying activity. In addition, the manufacturer shall immediately notify the qualifying activity whenever the group B inspection results indicate failures of the qualified product to meet the requirements of this specification. Verification shall be based on meeting the following requirements:

a. The manufacturer has not modified the design of the item.

b. The specification requirements for the item have not been amended so far as to affect the character of the item.

c. Lot rejection for group A inspection does not exceed the group A sampling plan.

d. The requirements for group B inspection are met.

When group B requirements were not met and the manufacturer has taken corrective action satisfactory to the Government, group B inspection retesting shall be instituted.

4.6 Conformance inspections.

4.6.1 Inspection of product for delivery. Inspection of packaging shall consist of group A

4.6.1.1 Inspection lot. An inspection lot, as far as practicable, shall consist of all switches produced in a period not to exceed 30 days, produced under essentially the same conditions, and offered for inspection at one time.

4.6.1.2 Group A inspection. Group A inspection shall consist of the examination and tests specified in table III and shall be made on the same set of sample units, in the order shown.

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TABLE III. Group A inspection.

Inspection	Requirements paragraph	Method paragraph	Sampling plan
Visual and mechanical examination 1/	3.3, 3.3.1, 3.5.1, 3.7 and 3.9 inclusive.	4.7.1	4.6.1.2.1
Calibration	3.4.1	4.7.3	
Endurance	3.6	4.9	

1/ Marking defects shall be charged only for illegible, incomplete, or incorrect marking. Incorrect resistance, and resistance marking shall be determined by and shall be charged to the total resistance test (4.7.2).

4.6.1.2.1 Sampling plan. A sample of parts from each inspection lot shall be randomly selected in accordance with table IV. If one or more defects are found, the lot shall be screened and defectives removed. After screening and removal of defectives a new sample of parts shall be randomly selected in accordance with table IV. If one or more defects are in the second sample, the lot shall be rejected and shall not be supplied to this specification.

TABLE IV. Group A sampling plan.

Lot size	Sample size
1 to 8	All
9 to 150	13
151 to 280	20
281 to 500	29
501 to 1,200	34
1,201 to 3,200	42
3,201 to 10,000	50
10,001 to 35,000	60
35,001 to 150,000	74
150,001 to 500,000	90
500,001 and over	102

4.6.1.3 Group B inspection. Group B inspection shall consist of the tests specified in table V, in the order shown.

4.6.1.3.1 Sampling plan. A sample of parts shall be randomly selected from parts that have passed Group A within 36 months after the date of qualification and within each subsequent 36-month period. The sample units shall be selected either from stock or current production lots. Switches selected from stock shall have been produced after the date of notification of qualification or subsequent to the date code of the previous Group B inspection sample units. Group B inspection shall be performed on sample units produced using the same manufacturing facilities and processes as units normally offered for acquisition. When there has been no production for 36 months or more, sample units shall be selected from the next production lot presented for acceptance and for each subsequent 36-month period. Contact the qualifying activity if this occurs.

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TABLE V. Group B inspection. 1/

Inspection 2/	Requirements paragraph	Method paragraph	Sampling plan	Number of defects
Visual and mechanical examination 1/	3.3, 3.3.1, 3.5.1, 3.7 and 3.9 inclusive	4.7.1	4	0
Terminal Strength	3.4.2	4.7.4		
Pressure overload	3.4.3	4.7.5		
High voltage	3.4.4	4.7.6		
Corrosion resistance	3.5.1	4.8.1		
Fungus resistance 3/	3.5.2	4.8.2		
Immersion	3.5.3	4.8.3		
Extreme temperature	3.5.4	4.8.4		
Shock resistance	3.5.5	4.8.5		
Vibration	3.5.6	4.8.6		
Endurance	3.6	4.9		

1/ If the manufacturer can demonstrate that this test has been performed 5 consecutive times with zero failures, the frequency of this test, with approval of the qualifying activity, can be performed on an annual basis. If the design, material, construction or processing of the part is changed, or if there are any quality problems or failure, the qualifying activity may require resumption of the original test.

2/ Failure of a switch in one or more tests shall be charged as a single defective.

3/ Suspended with Qualifying Activity approval.

4.6.1.4 Failures. If one or more sample units fail to pass group B inspection, the sample shall be considered to have failed.

4.6.1.5 Disposition of sample units. Sample units which have been subjected to group B inspection shall not be delivered on the contractor order, but shall be kept on hand until the next inspection period for submittal to the qualifying activity if so requested.

4.6.2 Noncompliance. If a sample fails to pass group B inspection, the supplier shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group B inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Group A inspections may be reinstituted; however, final acceptance shall be withheld until group B reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to cognizant inspection activity and the qualifying activity.

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4.7 Methods of inspection.

4.7.1 Materials and construction. Conformance to 3.2, 3.2.1, and 3.3 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.7.2 Defects. Conformance to 3.3 through 3.3.2, 3.7, and 3.9 shall be determined by examination for the defects listed in table V. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.7.3 Calibration.

4.7.3.1 Type I switches. To determine conformance to 3.4.1.1, type I switches shall be subjected to the following procedure: Starting at a pressure 10 psi above the upper actuation pressure specified on the applicable MS standard or drawing, the pressure shall be gradually decreased to a point 10 psi below the lower actuation pressure specified. For switches where minimum operating pressure is 10 psi or less, the lower test pressure shall be zero psi. The pressure shall then be increased to the point 10 psi above the upper pressure specified. During both phases of the operational cycle, a light tapping of the switch, to cause actuation, is permissible. The point at which the switch opens and closes shall be recorded.

4.7.3.2 Type II switches. To determine conformance to 3.4.1.2, type II switches shall be subjected to the following procedure: Starting at a pressure 10 psi below the lower actuation pressure specified on the applicable MS or drawing, the pressure shall be gradually increased to a pressure 10 psi above the upper actuation pressure specified. The pressure shall then be decreased to the point 10 psi below the lower actuation pressure specified. For switches where the minimum actuation pressure is 10 psi or less, the lower test pressure shall be zero psi. During both phases of the operational cycle, a light tapping of the switch, to cause actuation, is permissible. The point at which the switch closes and opens shall be recorded.

4.7.4 Terminal strength. To determine conformance to 3.4.2, the switch shall be securely mounted. A cable with a suitable mating connection shall be attached to each switch terminal. The force, specified in 3.4.2, shall be applied to each cable in a direction perpendicular to the terminal connector pin. Confirm that no damage to the switch body is evidenced and that there is not more than .062 inch (1.57 mm) deformation to the terminals. Subsequently the switch shall be subjected to the applicable test of 4.7.3 to verify performance.

4.7.5 Pressure overload. To determine conformance to 3.4.3, the switch shall be subjected to the specified overload for 1 minute. Subsequently, the switch opening and closing pressure shall be determined, and shall be within 8 percent of the specified values.

4.7.6 High voltage. To determine conformance to 3.4.4, with the switch contacts open, 220 V rms at 60 Hz shall be applied for 1 minute between each terminal and the switch body. If there are two terminals, the same voltage shall be applied for 1 minute between each separate terminal and the non-current-carrying part of the switch, with the switch contacts open.

4.8 Environmental conditions.

4.8.1 Corrosion resistance. To determine conformance to 3.5.1, the switch shall be subjected to 200 hours of salt spray in accordance with ASTM B117. Subsequently, the switch shall pass the tests of 4.7.6 and 4.7.3.

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4.8.2 Fungus resistance. Switches shall be tested in accordance with method 508.5 of MIL-STD-810. Subsequently, the switch shall pass the tests of 4.7.6 and 4.7.3. The following details shall apply:

Test duration: The test duration shall be 90 days.

4.8.3 Immersion. Switches shall be tested in accordance with method 104, of MIL-STD-202. The following details shall apply:

a. Test condition: B

b. Examination and test after Immersion: The switch shall be removed from the solution and allowed to drain for a period of five minutes in its normal operating position. It then shall be subjected to 15 hours of dry operation (three 5 hour periods) at full rated current and voltage and results compared with pre-immersion data.

4.8.3.1 Immersion for quality conformance. To determine conformance to 3.5.3, switches shall be immersed in the salt water solution specified in method 104, of MIL-STD-202 and observed for leakage. Leakage will be indicated by air bubbles escaping from the interior of the compartment. Bubbles that are the result of entrapped air on the various exterior surfaces of the component shall not be considered a leak.

4.8.4 Extreme temperatures. To determine conformance to 3.5.4, the switch shall be subjected to the tests specified in a and b, below.

a. Low temperature. Switch shall be conditioned for 4 hours at -60°F+ 5°F and while still in ambient air at that temperature shall be operated for 100 cycles (see definition of 6.5.1) using the load current specified in 3.3.2.

b. High temperature. Switch shall be conditioned for 4 hours at +245°F+ 5°F and while still in ambient air at that temperature shall be operated for 100 cycles (see definition of 6.5.1) using the load current specified in 3.3.2.

4.8.5 Shock. To determine conformance to 3.5.5, the switch shall be mounted as in intended operation, and subjected to the sawtooth waveform shock test described in test condition I, method 213 of MIL-STD-202. An acceleration force of 50 g's shall be applied once in each direction of three mutually perpendicular axes, one of which will be along the centerline of the switch. During the test, the following conditions shall apply: The electrical load shall be a lamp load, as specified in 3.3.2. A pressure of 10 psi above the upper actuation pressure specified on the applicable MS standard or drawing shall be applied to type I switches. A pressure of 10 psi below the lower actuation pressure specified on the applicable MS standard or drawing shall be applied to type II switches. During each impact the indicating lamp shall be observed for evidence of circuit closure. After the test, the switch shall be examined for defects listed in 3.5.5.

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4.8.6 Vibration resistance.

4.8.6.1 Vibration class, 1. To determine conformance to 3.5.6.1, the switch shall be mounted in a test fixture simulating actual mounting in use and shall be connected in a series circuit with a 24 V (nominal) power source and applicable indicating lamp. Care shall be taken to see that the mounting is free of resonance over the frequency range. While energized, the switch shall be subjected to a simple harmonic motion having an amplitude of .03 inch (0.7 mm) or 50 g's peak, whichever is less. Tolerance of + 10 percent is permissible for the amplitude. The vibrational frequency shall be varied over the range from 10 to 3,500 Hz. Rate of frequency shall be logarithmic. When there is no provision for logarithmic cycling, other automatic cycling rates of frequency change may be used. The vibrational cycle from 10 to 3,500 and back to 10 Hz shall be accomplished in 20 + 2 minutes. This scanning cycle shall be repeated, and checked. After the scanning cycles, the switch shall be vibrated at the critical frequency for 2 hours. If there is more than one critical frequency, the 2-hour period shall be divided equally between the critical frequencies. If there are more than three critical frequencies, the three most critical shall be selected and the switch vibrated for 40 minutes at each of the frequencies selected. If no critical frequency is identified, the specimen shall be vibrated at 50 g's acceleration, with frequency cycled from 10 to 3,500 and back to 10 Hz. Rate of change of frequency shall be logarithmic, or where there is no provision for logarithmic cycling, other automatic cycling rates of frequency change may be used. Time for each cycle shall be 20 + 2 minutes. Duration of the test shall be 2 hours (6 complete cycles). The following test conditions shall apply: The load shall be that specified in 3.3.2. A pressure of 10 psi above the upper actuation pressure specified on the applicable MS standard or drawing shall be applied to type I switches. A pressure 10 psi below the lower actuation pressure specified on the applicable MS standard or drawing shall be applied to type II switches. The indicating lamp shall be observed periodically during the test for evidence of circuit closure. After the test, switches shall be examined for defects specified in 3.5.6.1. This test procedure shall be accomplished along each of three mutually perpendicular axes. Total vibrating time shall be 9 hours (3 hours along each axis).

4.8.6.2 Vibration class 2. To determine conformance to 3.5.6.2, the switch shall be mounted in a test fixture simulating actual mounting in use and shall be connected in a series circuit with a 24 V (nominal) power source and applicable indicator. Care shall be taken to see that the mounting is free of resonance over the frequency range. The switch shall then be subjected to the vibration test described in test condition A, method 204 of MIL-STD-202. The following test conditions shall apply: The load shall be that specified in 3.3.2. A pressure of 10 psi above the upper actuation pressure specified on applicable MS standard or drawing shall be applied to type I switches. A pressure of 10 psi below the lower actuation pressure specified on the applicable MS standard or drawing shall be applied to type II switches. The indicating lamp shall be observed periodically during the test for evidence of circuit closure. After the test, switches shall be examined for defects specified in 3.5.6.1.

4.9 Endurance. To determine conformance to 3.6, the switch shall be connected to the lamp load current specified in 3.3.2 and to a variable pressure fluid supply line. The switch shall then be cycled, 10,000 times, from 0 psi to twice the upper actuation pressure specified on the applicable MS standard or drawing, and back to 0 psi. During the test, the switch shall be observed periodically for evidence of malfunction.

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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 personnel or in-house contractor 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 command. Packaging data retrieval is available from the managing Military Departments 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. Pressure switches covered by this specification are intended primarily to actuate warning lamps or other warning devices to indicate abnormal oil pressures in internal combustion engines, changes of air pressure in brake systems and hydraulic brake stoplight switches. The switches may also be used with other fluids to monitor torque converters, lubricating systems, and control mechanism of automatic and semi-automatic transmissions.

6.2 Ordering data. Acquisition documents should specify the following:

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

b. Type and class of switch required (see 1.2).

c. Applicable MS standard or drawing (see 3.3).

d. If responsibility for inspection equipment should be other than as specified (see 4.1.2).

e. Selection of applicable level and packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, 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. Information pertaining to qualification of products may be obtained from (insert name, mailing address, and email of qualifying activity). An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at http://assist.daps.dla.mil.

6.4 Classes. Class 1 switches are provided for high load vibration requirements (50 g's at 3,400 Hz) most often encountered in tracked vehicles. Class 2 switches are provided for low vibration load environments (10 g's at 500 Hz) and are generally adequate for wheeled vehicles.

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6.5 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.6 Definitions.

6.6.1 Cycling. Cycling, as used herein, will mean opening and subsequent closing of contacts. Switch cycling frequency shall be the maximum that will allow the electrical contacts to open and close, with the contacts open during half of each cycle.

6.7 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmentally Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals is available on their website at http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm. Further information is available at the following EPA site: http://www.epa.gov/epaoswer/hazwaste/minimize/. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of the materials on the list should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.8 Subject term (key work) listing.

Instrumentation, automotive, safety
Lamps, warning instruments
Warning device, waterproof

6.9 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes 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 document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - AT
Navy - EC
Air Force - 85
DLA - CC

Preparing activity:
DLA - CC

(Project 5930-2008-043)

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 http://assist.daps.dla.mil/.