

TINCH-POUND

MIL-S-9419E
10 March 1989
SUPERSEDING
MIL-S-9419D
15 January 1971

MILITARY SPECIFICATION

SWITCH, TOGGLE, MOMENTARY, FOUR-POSITION ON, CENTER OFF, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers a four-position, momentary on, center off, positive action switch with free return to the off position.

1.2 Classification. Switches covered by this specification shall be classified by type as indicated herein (see 3.1).

- Type I - Snap action, positive break operation
- Type II - Nonpositive break operation.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

MILITARY

- MIL-W-5088 - Wiring, Aerospace Vehicle.
- MIL-S-9419/1 - Switches, Toggle, Four Position On, Center Off (.623 DIA).
- MIL-S-9419/2 - Switches, Toggle, Four Position On, Momentary, Center Off (.600 DIA).
- MIL-S-28786 - Switches, Packaging of.
- MIL-I-81023 - Inductor, 28V, D.C. Laboratory Test, General Specification for.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Electronic Support Division AFLC, 2750 ABW/ES, Gentile AF Station, Dayton, OH 45444-4500 by using the self-addressed Standardization Document Improvement Proposal (DD Form 142b) appearing at the end of this document or by letter.

AMSC N/A FSC 5930
DISTRIBUTION STATEMENT A Approved for public release, distribution is unlimited

1 of 16

MIL-S-9419E

STANDARDS

MILITARY

- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
- MIL-STD-454 - Standard General Requirements for Electronic Equipment
- MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.
- MIL-STD-831 - Test Reports, Preparation of.
- MIL-STD-45662 - Calibration Systems Requirements
- MS27708 - Switch, Toggle, Four Position On, Center Off.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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

UNDERWRITERS' LABORATORIES (UL), INC

UL94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances

(Application for copies should be addressed to the Underwriters' Laboratories, Inc, 333 Pfingsten Road, Northbrook, IL 60062. Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

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

3.2 Qualification. 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 (4.5 and 6.4).

3.3 Material. Material shall be as specified herein. When a definite material is not specified, a material shall be used which shall enable the switches to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of acceptance of the finished product.

3.3.1 Metals. All metal parts, other than current-carrying parts, shall be of corrosion-resistant material, or shall be suitably plated to resist corrosion.

3.3.1.1 Ferrous material. Ferrous material shall not be used for current carrying parts

3.3.1.2 Dissimilar metals when dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. The use of dissimilar metals which, in contact, tend toward active electrolytic corrosion (particularly brass, copper, or steel used in contact with aluminum or aluminum alloy) is not acceptable. However, metal plating or metal spraying of dissimilar base metals to provide similar or suitable abutting surfaces is permitted. The use of dissimilar metals separated by a suitable insulating material is also permitted. Dissimilar metals are defined in MIL-STD-454, requirement 16.

3.3.2 Insulating material. Molded material shall be used. Cellulose-filled phenolic shall not be used.

3.3.2.1 Plastic. The plastic material used in all external switch parts and enclosures shall be tested in accordance with UL94 and classified as 94V-0, this requirement applies to all materials for external parts and enclosures regardless of whether the material used is procured to a military specification or not.

3.3.3 Protective treatment. Materials that are subject to deterioration when exposed to climatic and environmental conditions likely to occur during service usage shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. The use of any protective coating that will crack, chip or scale with age or extremes of climatic and environmental conditions shall be avoided.

3.4 Design and construction. Switches shall be of sufficiently rugged construction to meet the requirements of this specification. Switches shall be direct acting, normally open type incorporating a positive action to assure good contact and snap feel with quick-make and quick-break circuits. Switches shall be designed to permit manual centering to the "off" position which shall permit breaking of welded contacts. Switches shall be constructed to assure free return of the movable contact member to the neutral "off" position when relieved of any external actuation forces. Switches shall not permit dual contact in any possible position of the lever. Movement of the actuating lever shall close the circuit between the common terminal and each other terminal in the direction of lever travel, as indicated in the circuit diagram of the MS sheet or military specification sheets.

3.4.1 Dimensions. Switches shall conform to the dimensions shown on the MS sheet or military specification sheets.

3.4.2 Mounting. Switch shall be operable when mounted in any attitude.

3.4.3 Stationary contact members and terminals. Stationary contact members and terminals shall be of such construction to meet the requirements of this specification. When terminals and contact members are separate pieces they shall be joined in a secure manner. All terminals shall be external and shall be treated to facilitate soldering. Silver plating shall not be used. Gold plating is allowable up to a thickness of .000030 inch to .000100 inch.

3.4.4 Cap. A cap of insulating material shall be fixed on the end of the actuating lever so that it cannot be readily removed and shall not rotate relative to the switch.

MIL-S-9419E

3.4.5 Electrical ratings. As specified (see 3.1).

3.4.6 Screw threads. Screw threads shall be as specified on the specification sheet.

3.5 Performance.

3.5.1 Actuating force When switches are tested as specified in 4.7.3, the actuating force shall be within the limits specified (see 3.1).

3.5.2 Actuating lever travel. When switches are tested as specified in 4.7.4, the actuating lever travel shall be as specified.

3.5.3 Strength of actuating lever pivot, lever stop and cap. When switches are tested as specified in 4.7.5, there shall be no breakage of the cap or body, loosening or rotation of terminals or other damage to the switch.

3.5.4 Strength of terminals. When switches are tested as specified in 4.7.6, there shall be no short circuit, breakage, loosening, rotation of terminals or other damage to the switch.

3.5.5 Electrical overload. When switches are tested as specified in 4.7.7, there shall be no electrical or mechanical damage.

3.5.6 Electrical endurance. When switches are tested as specified in 4.7.8, switch contacts under test shall open and close the circuit in proper sequence during each cycle of the switch actuating member.

3.5.7 Temperature rise. When switches are tested as specified in 4.7.9, the temperature rise shall not exceed 30°C.

3.5.8 Dielectric withstanding voltage. When switches are tested as specified in 4.7.10, the switches shall withstand the application of the specified voltages without arcing, flashover, breakdown of insulation, or damage; there shall be no current leakage in excess of 1 milliamperes.

3.5.9 Vibration. When switches are tested as specified in 4.7.11, there shall be no separation of closed contacts or closure of open contacts having a duration exceeding 10 microseconds. There shall be no evidence of damage.

3.5.10 Shock. When switches are tested as specified in 4.7.12, the opening or closing of contacts shall not exceed 10 microseconds.

3.5.11 Acceleration. When switches are tested as specified in 4.7.13, there shall be no closure of open contacts.

3.5.12 Moisture resistance. When switches are tested as specified in 4.7.14, there shall be no electrical or mechanical failures and the switches shall meet dielectric withstanding voltage test specified herein.

3.5.13 Thermal shock. When switches are tested as specified in 4.7.15, there shall be no electrical or mechanical damage.

3.5.14 Altitude. When switches are tested as specified in 4.7.16, there shall be no electrical or mechanical damage.

3.5.15 Salt spray. When switches are tested as specified in 4.7.17, there shall be no electrical failures, or breaking, spalling, cracking, or loosening of terminals.

3.5.16 Fungus. When switches are tested as specified in 4.7.16, there shall be no electrical or mechanical damage. This test may be waived by the preparing activity provided suitable evidence is provided that all materials used are non-nutrient, i.e., fungus inert or treated.

3.5.17 Solderability (applicable to solderable terminations).

3.5.17.1 When switches with solid wire terminations of .045 maximum diameter or stranded wire terminations of number 18 AWG or smaller are tested as specified in 4.7.19, the dipped surface of the termination.

- a. Shall be at least 95 percent covered by a continuous new solder coating
- b. Shall not have pinholes or voids that are concentrated in one area or that exceed 5 percent of the total area.

3.5.17.2 When switches with solder terminals, solid wire terminations greater than .045 diameter, and stranded wire terminations larger than number 18 AWG are tested as specified in 4.7.19, the dipped surface of the termination

- a. Shall have 95 percent of the total length of the filet, which is between the standard wire wrap and the termination, tangent to the surface of the termination being tested and shall be free from pinholes and voids.
- b. Shall not have a ragged or interrupted line at the point of tangency between the filet and the termination under test.

3.5.18 Resistance to soldering heat (applicable to switches with solderable terminals) (not applicable to switches with integral lead wire terminals). When switches are tested as specified in 4.7.20, switches shall meet the switch resistance requirement, and there shall be no deformation or other damage at the conclusion of the test sequence.

3.5.19 Switch resistance. When measured as specified in 4.7.21, the switch resistance shall not exceed 25 milliohms initially and 40 milliohms after the mechanical endurance test. After electrical endurance, the switch resistance shall not exceed 1 percent of the load impedance using the electrical parameters of the electrical endurance test load. For switches with integral lead wires, the switch resistance shall be as specified (see 3.1).

3.6 Marking. Switches shall be marked in accordance with the following:

- a. MS part number of Military Specification sheet part number
- b. Switch manufacturer's name, trademark or code symbol
- c. Switch manufacturer's part number.
- d. Date of manufacture, i.e., day, month, year.

3.7 Workmanship. Switches shall be processed in such a manner as to be uniform in quality and free from cracked or displaced parts or other defects which effect life, serviceability, or appearance. Switches shall have an all over smooth, high finish surface and shall be free from warpage, checks, blisters, projecting ridges or chips. Gate marks shall not be considered a defect.

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.

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

4.2 Test equipment and inspection facilities. The contractor shall establish and maintain a calibration system in accordance with MIL-STD-45662.

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

- a. Qualification inspection (see 4.5)
- b. Quality conformance inspection (see 4.6).

4.4 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.5 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.4)

4.5.1 Test routine. Sample units shall be subjected to the qualification inspection specified in table I, in the order shown.

4.5.2 Failure Failure in any examinations or test shall be cause for refusal to grant qualification.

4.5.3 Retention of qualification. To retain qualification, the contractor shall forward after initial qualification, at the conclusion of each succeeding 12 month period, a summary of the results of group A test performed during that period, indicating as a minimum the number of lots which have passed and the number which failed, and a summary of the group B test performed during that period. The contractor shall forward for each 36 month interval the complete results of group C test which shall be performed during the last 12 months of the interval. If the test results indicate nonconformance with specification requirements, action shall be taken to remove the failing product from the qualified products list. Failure to submit the summaries and test data shall result in loss of qualification of that product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity anytime during the applicable interval that the inspection data indicates failure of the product to meet the requirements of this specification. In the event that no production occurred during the 12 month reporting interval, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If the item has not been produced for 36 months, the product must be requalified.

TABLE 1 : Qualification inspection sequence

Inspection	Requirement paragraph	Test method paragraph	Number of sample units to be tested
<u>Group I</u>			
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1	All
Resistance to soldering heat 1/	3.5.18	4.7.20	
Dielectric withstanding voltage	3.5.8	4.7.10	
Switch resistance	3.5.19	4.7.21	
Switching characteristics	3.1	4.7.2	
Actuating force	3.5.1	4.7.3	
Actuating lever travel	3.5.2	4.7.4	
<u>Group II</u>			
Solderability	3.5.17	4.7.19	4 Samples
Strength of terminals	3.5.4	4.7.6	
Strength of actuating lever pivot and lever stop	3.5.3	4.7.5	
Thermal shock	3.5.13	4.7.15	
Shock	3.5.10	4.7.12	
Acceleration	3.5.11	4.7.13	
Vibration	3.5.9	4.7.11	
Moisture resistance	3.5.12	4.7.15	
Dielectric withstanding voltage	3.5.8	4.7.10	
Visual and mechanical examination	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1	
Switching characteristics	3.1	4.7.2	
<u>Group III</u>			
Salt spray	3.5.15	4.7.17	2 Samples
Visual and mechanical examination	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1	
Switching characteristics	3.1	4.7.2	
<u>Group IV</u>			
Electrical overload	3.5.5	4.7.7	4 Samples
Electrical endurance 2/	3.5.6	4.7.8	
Temperature rise	3.5.7	4.7.9	
Switch resistance	3.5.19	4.7.21	
Dielectric withstanding voltage	3.5.8	4.7.10	
Visual and mechanical examination	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1	
Switching characteristics	3.1	4.7.2	
<u>Group V</u>			
Altitude	3.5.14	4.6.16	2 Samples
Dielectric withstanding voltage	3.5.8	4.7.10	
Visual and mechanical examination	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1	
Switching characteristics	3.1	4.7.2	

1/ Four samples units only

2/ Two sample unit for normal electrical endurance and two sample units for high speed electrical endurance

4.5.4 Test reports. Test reports shall

- a. Be in accordance with MIL-STD-883
- b. Include all original data and charts as recorded in the laboratory
- c. Identify the plastic material used as well as conformance to specification requirements as required herein.
- d. Be validated by the local DCASMA-QAR before submission to the qualifying activity.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery Inspection of product for delivery shall consist of groups A and B inspection. Delivery of products which have passed group A shall not be delayed pending the results of group B inspection.

4.6.1.1 Group A inspection Each switch shall be subjected to examination and test specified in table II.

4.6.1.2 Group B inspection. One switch shall be selected at random from each 1,000 switches produced and shall be subjected to the normal endurance test (see 4.7.8.1).

4.6.1.2.1 Disposition of sample units Sample units which have been subjected to group B shall not be delivered on the contract or order.

4.6.1.2.2 Action in case of failure. The manufacturer shall immediately investigate the cause of failure and take corrective action to insure that subsequent switches do not contain the same defects.

TABLE II. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph	AQL	
			Maj	Min
Visual and mechanical examination	3.1,3 3,3 4, 3.6,3.7	4 7.1	1.0	4.0
Actuating force	3.5.1	4.7.3		
Actuating level travel	3.5.2	4.7 4	1.0	
Dielectric with-standing voltage	3 5 8	4.7.10		
Switching resistance	3.5.19	4.7.21		

4.6.2 Group C inspection Group C inspection shall consist of the tests specified in table I in the order shown and shall be made on sample units produced with production tools and processes

4.6.2.1 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on a contract or order.

4.6.2.2 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and 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 with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstated; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.6.3 Inspection of packaging. The sampling and inspection of the preservation, packing and container marking shall be in accordance with the requirements of MIL-S-28786.

4.7 Methods of examination and test.

4.7.1 Visual and mechanical examination. Switches shall be examined to verify that the design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1).

4.7.2 Switching characteristics. Each switch shall be cycled by hand five times through all positions, while carrying the rated inductive load. The test fixture shall have suitable provisions to show that the proper circuit is being closed and opened. The switch shall return to the center off position upon removal of the external actuating force.

4.7.3 Actuating force (see 3.5.1). The switch shall be horizontally mounted by its normal mounting means with the actuating mast in the horizontal plane and with a stationary contact down. Weight shall be hung on the cap. For group A inspection a suitable spring loaded fixture may be used. Unless otherwise specified (see 3.1), the switch shall actuate between 21 and 36 ounces and there shall be no short circuiting, breakage or damage to the switch. All four switch positions shall be measured.

4.7.4 Actuating lever travel (see 3.5.2). Switches shall be tested in a suitable fixture with an accuracy of at least $1/4^\circ$. The actuating lever travel of 3° to 7° shall be required to make contact in each position and a minimum of 2° overtravel shall be required beyond the point of contact make. On the return stroke there shall be a minimum of 2° of lever travel between the point of breaking contact and the center off position. The differential between the point of make or break of the contacts and the snap feel shall not exceed $1/4^\circ$ for any one of the four directions of travel.

4.7.5 Strength of actuating lever pivot, lever stop and cap (see 3.5.3). Switches shall be electrically and mechanically operable after the following test and there shall be no breakage of the cap or body, loosening or rotation of terminals or other damage to the switch:

- a. A minimum of 10 inch-pounds of torque shall be applied to the cap around the major axis of the switch.
- b. A 90-pound load minimum shall be applied to the outer edge of the cap at an angle of 45° to the major axis of the switch in each of the four directions of travel.
- c. A 90-pound load minimum shall be applied to the top of the cap coaxial with the major axis of the switch toward the actuating lever pivot.
- d. A 2-pound load minimum shall be dropped from a minimum height of 8 inches and shall strike the cap. The switch shall be mounted with its major axis at an angle of 30° from vertical (see figure 1).

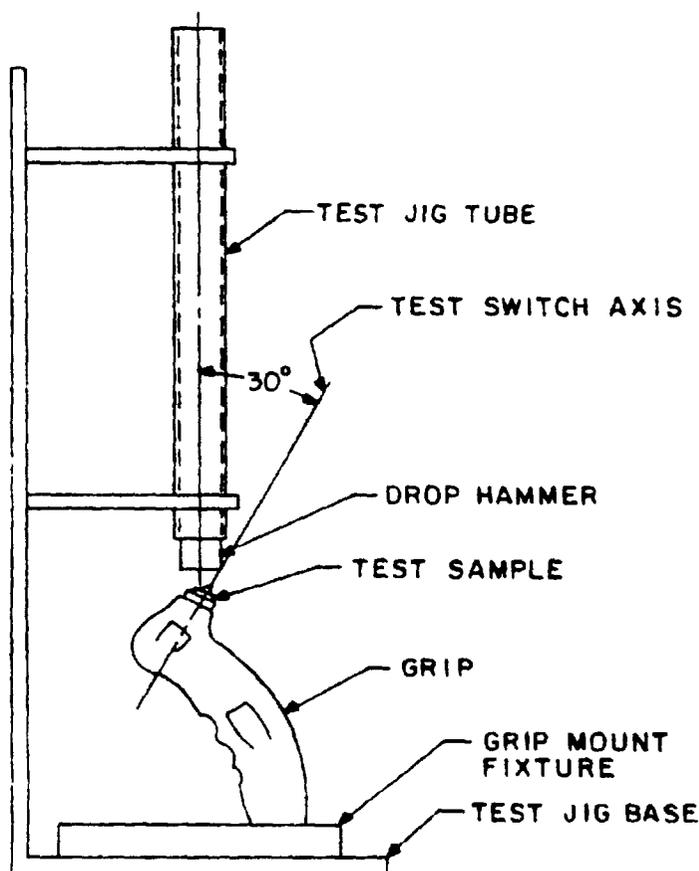


FIGURE 1 Suggested fixture. impact test

4.7.6 Strength of terminals (see 3.5.4). A load of 30 pounds shall be applied to each terminal, perpendicular to each terminal, perpendicular to the mounting plane of the switch, for one minute. Upon completion of the test, switches shall be electrically and mechanically operable.

4.7.7 Electrical overload (see 3.5.5) Each switch to be tested for electrical endurance shall first be tested for overload cycling at room ambient conditions using the same voltage, electrical frequency, and the same pairs of contacts that will subsequently be used for the electrical endurance test. The switches shall close and open the overload current of a circuit equal to 150 percent of the load rating at the particular voltage and electrical frequency (see 3.1). The cycling rate shall be 5 to 6 cycles of operation per minute. 100 cycles of operation shall be performed. The duty cycle shall be approximately 50 percent on, and 50 percent off.

4.7.8 Electrical endurance (see 3.5.6) Inductors shall be in accordance with MIL-I-81023.

4.7.8.1 Normal. The switches shall be operated to make and free break the inductive load specified, (see 3.1) for 250,000 cycles at a rate of between 28 and 32 operations per minute. The maximum ratio of the "time on" to "time off" shall be 1:3. Operating force following endurance testing shall be between 12 and 50 ounces. The actuation lever travel shall be within limits except that the 1/4" differential may not be measurable due to the degradation of the snap feel. The following conditions shall apply, switches shall be continuously monitored and recorded to determine whether any contact has failed to open or close its individual circuit in the proper sequence. The monitoring circuit shall not shunt inductive components of inductive loads or switch contacts.

4.7.8.2 High speed Switches shall be operated to make and free break the inductive load specified herein for 1,000 cycles at a rate of between 60 and 80 operations per minute. At all times during and at completion of the endurance test, switches shall be capable of making and free breaking the inductive circuit and returning to center off by its own action. Following the test the operating force and the actuation lever travel shall be within limits except that the 1/4" differential may not be measurable due to the degradation of the snap feel.

4.7.9 Temperature rise (see 3.5.7). Switches shall be equipped with suitable thermocouples and leads which shall be in accordance with MIL-W-5088. While carrying the inductive current specified herein, the temperature shall not rise more than 30°C for one hour. Thermocouples shall not be placed on the common terminal.

4.7.10 Dielectric withstanding voltage (see 3.5.8). Switches shall be tested in accordance with method 301 of MIL-STD-202. The following details and exceptions shall apply.

- a. Magnitude of test voltage. 1,000 volts.
- b. Nature of potential. AC root mean square (rms).
- c. Duration of application of test voltage: For group A inspection, at the option of the contractor, the test voltage may be applied for period of 5 seconds.
- d. Points of application of test voltage: Between all unconnected terminals and between all load terminals connected together and common with the switch in the off position.
- e. Measurements during test. Leakage current.

4.7.11 Vibration (see 3.5.9). Switches shall be tested in accordance with method 201 of MIL-STD-202. The following details and exceptions shall apply:

- a. Test and measurements prior to vibration: Not applicable.
- b. Method of mounting. Switches shall be mounted in the normal manner on a rigid metal panel. The mounting fixture shall be free from resonance over the frequency range.
- c. Electrical load conditions: The test circuit shall be in accordance with method 310 of MIL-STD-202 and all contact positions shall be monitored.
- d. Test and measurements during vibration: Switch-contact stability shall be continuously monitored during vibration by means of a test circuit in accordance with method 310 of MIL-STD-202.
- e. Measurements after vibration: After the test, switches shall be examined for change in shaft position, and evidence of broken, deformed, displaced, or loose parts, and switches shall be electrically and mechanically operative.

4.7.12 Shock (see 3.5.10). Switches shall be tested in accordance with method 213 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting means. Switches shall be mounted in the normal manner.
- b. Test condition A
- c. Electrical load conditions: Monitor circuit only.
- d. Measurements during shock: Switch-contact stability shall be continuously monitored during shock by means of a test circuit in accordance with method 310 of MIL-STD-202, and all contacts shall be monitored

4.7.13 Acceleration (see 3.5.11). Switches shall be subjected to an acceleration force of 10g attained within 2 minutes and shall be maintained for 1 minute in the plane most likely to cause malfunction. Switch contacts shall be monitored for closing with a circuit such as a pilot lamp.

4.7.14 Moisture resistance (see 3.5.12). Switches shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply.

- a. Mounting: By normal mounting means on a corrosion-resistant metal panel extending beyond the switch, positioned 15° from vertical and uninsulated. Half of the units shall be tested with the actuator in the upper side of the panel and the other half of the units shall be tested with the actuator on the under side of the panel.
- b. Polarization. During steps 1 to 6 inclusive, a polarizing voltage of 100 volts dc shall be applied between all terminals tied together and the metal panel. The negative polarity shall be applied to the metal panel. Steps 7a and 7b are not applicable.
- c. Load voltage Not applicable.
- d. Final measurements: At the end of the drying period, dielectric withstanding voltage shall be measured as specified herein.
- e. Examinations during final measurement and after test: Switches shall be examined for evidence of corrosion, breaking, cracking, or spalling. Hardware shall be removable at the end of the test.
- f. Water: Steam, distilled or de-ionized water shall be used for this test.
- g. Switches shall make and free break the rated inductive load for 500 cycles after completion of this test.

4.7.15 Thermal shock (see 3.5.13). Switches shall be subjected to a temperature of $-65^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 12 hours after which the temperature shall be raised to $-55^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and maintained for 2 hours. While at -55°C switches shall be mechanically cycled for 10 cycles. The temperature shall then be raised to $+85^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 36 hours. While at $+85^{\circ}\text{C}$, the switches shall be subjected to the overload test specified herein.

4.7.16 Altitude (see 3.5.14). Switches shall be operated to make and free-break the inductive load specified (see 3.1) for 20,000 cycles at a rate of not less than 12 operations per minute at a pressure altitude of 60,000 feet. There shall be no mechanical or electrical failure or damage which would affect proper operation. The duty cycle shall be approximately 50 percent on and 50 percent off for resistive, inductive and motor loads. The duty cycle shall be approximately 30 percent on and 70 percent off for lamp loads.

4.7.17 Salt spray (corrosion)(see 3.5.15). Switches shall be tested in accordance with method 101 of MIL-STD-202. The following details shall apply

- a. Test condition A.
- b. Measurements after exposure: Not applicable.
- c. Switches shall make and free-break rated inductive load for 500 cycles after the completion of this test.

4.7.18 Fungus (see 3.5.16). Switches shall be subjected to procedure I of MIL-STD-810. At the conclusion of the test, after allowing a 24 hour drying period, switches shall be subjected to the dielectric withstanding voltage and then examined for electrical and mechanical damage and electrical continuity.

4.7.19 Solderability (see 3.5.17). Solder type terminations shall be tested in accordance with method 208 of MIL-STD-202. Minimum of two terminals per unit shall be tested

MIL-S-9419E

4.7.20 Resistance to soldering heat (see 3.5.18) (applicable to switches with solderable terminals) (not applicable to switches with integral lead wire terminals). Switches shall be tested in accordance with method 210 of MIL-STD-202. The following details shall apply:

- a. Depth of immersion: Terminals shall be immersed to within 0.05 inch of the switch body.
- b. Test condition B.
- c. Cooling time: Not applicable.
- d. Inspections and measurements:
 - (1) Before: None.
 - (2) After: Subsequent to all applicable test of group I of table I, the switches shall be opened and inspected for deformation or other damage.

4.7.21 Switch resistance (see 3.5.19). Switch contacts shall be tested in accordance with method 307 of MIL-STD-202. The following details shall apply:

- a. Measurements shall be made between the terminals, forming a switching circuit. Measurements shall be made for all poles in a switch at each of the actuators extreme positions.
- b. Test current: 0.1 amperes. After electrical endurance, use the electrical parameters of electrical endurance test load (this also applies to 4.7.21c).
- c. Open-circuit test voltage: 6 ± 1 V dc.
- d. Number of actuations prior to measurement: Three.
- e. Number of test actuations: Three.
- f. Number of measurements per actuation: One.

5. PACKAGING

5.1 Packaging requirements. The requirements for the packaging of switches shall be in accordance with MIL-S-28786 (see 4.6.3).

6. NOTES

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

6.1 Intended use. The switch covered by this specification is intended for mounting in aircraft control wheels and grips and serves as the electrical trim tab control. However, it may be used in other applications, provided the parameters set forth herein are not exceeded.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Military specification sheet part number.

6.3 Definitions.

6.3.1 Operation. An operation consists of a mechanical actuation of the toggle lever from the "center off" to one "on" position and free return of toggle lever to "center off".

6.3.2 Cycle. A cycle consists of mechanical actuation of the toggle lever from the "center off" after each "on" position in consecutive rotation, in order that contact is made in each of the four positions during each cycle.

6.3.3 Free break. After mechanical actuation to make the circuit, the toggle lever shall return to "center off" position by its own action, thus breaking the circuit.

NOTE Any sticking of the lever in "on" position constitutes failure.

6.3.4 Direct acting and positive action. The use of these terms in this specification shall mean the direct attachment to the actuator lever or direct manual control of the common contact rather than dependence upon an intermediate spring or toggling member between the actuator and moving contact to effect opening or closing of the circuit.

6.3.5 Snap/Tactile feel force characteristic. The switch assembly shall incorporate an actuator travel dependent-actuation restraining force characteristic which provides both a positive tactile feedback to the user when electrical activation of the switch has been achieved and a restraining force threshold to prevent unintentional activation.

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 Qualified Products List (QPL 9419) 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Electronic Support Division AFLC, 2750 ABW/ES, Gentile AF Station, Dayton, OH 45444-4500, and information pertaining to qualification of products may be obtained from that activity.

6.4.1 Provisions Governing Qualification. Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.

6.5 Subject term (key word) listing.

- Switch, toggle, center off
- Switch, toggle, four position on
- Switch, toggle, momentary

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

MIL-S-9419E

CONCLUDING MATERIAL

Custodians.
Navy - AS
Army - AV
Air Force - 85

Review activity:
Air Force - 11

Preparing activity:
Air Force - 85

Agent:
DLA - ES

(Project 5930-1347)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> 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)	

(TO DETACH THIS FORM, CUT ALONG THIS LINE)

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (**DO NOT STAPLE**), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered

NOTE. This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE AIR FORCE
2750 ABW/ES
Gentile AF Station
Dayton, OH 45444



OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300



POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE AIR FORCE

Electronic Support Division AFLC
2750 ABW/ES
Gentile AF Station
Dayton, OH 45444

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

