MIL-S-55433C
7 July 1980
SUPERSEDING
MIL-S-55433B
6 May 1974

MILITARY SPECIFICATION

SWITCHES, REED,

GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 This specification covers the general requirements for dry reed switches, hermetically sealed in glass, capable of being magnetically actuated, for use in communications, electrical, and electronic equipment (see 6.1).

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

MILITARY

MIL-S-28786 - Switches, Preparation for Delivery of.
MIL-C-45662 - Calibration System Requirements

(See supplement 1 for list of associated specification sheets.)

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.

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

3 REQUIREMENTS

3 1 Specification sheets The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern (see 6.2).

3.2 First article. Switches furnished under this specification shall be products which have been tested and passed the first article inspection specified in 4.4. The applicable information specified in 6.2 shall be furnished with the sample, together with any other pertinent information as required by the Government (see 6.3).

3.3 Design and construction Reed switches shall be of the design, construction, and physical dimensions specified (see 3.1).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to US Army Electronics Research Development Command, ATTN DELET-R-S, Fort Monmouth, NJ 07703, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3.3.1 Glass-to-metal seal area. The glass-to-metal seal area shall have a minimum length of 1-1/2 times the length of the lead diameter. Minimum seal length shall not contain individual bubbles larger than one wire diameter or frothy bubbles extending outward through the seal perpendicular to the lead. All chips or cracks of any kind in the capsule between the minimum seal length shall be cause for rejection. Cracks or chips are acceptable at outer extremity of seals as long as they do not extend inward beyond minimum seal length limits.

3.3.2 Reed alinement. Lateral reed misalinement, in the overlapping contact area, along the longitudinal switch axis, shall not exceed one-half blade width. With the switch actuated, there shall be no point in the overlapping contact area where the contact surfaces are separated by more than one blade thickness, measured in a plane perpendicular to the plane of the reed blades.

3.3.3 Glass capsule Evidence of any magnetic particles or loose foreign material of any kind within the capsule or of any burrs or particles in the contact area is cause for rejection. Any moisture or condensation within the reed switch is cause for rejection. Contamination of any kind visible to the naked eye is cause for rejection. Interior reed plating shall be free from corrosion, peeling, and flaking. Discoloration or stains are not rejectable unless severe in the contact area.

3.3.4 Terminal leads. Terminal leads shall be as specified (see 3 1).

3.4 Solderability. When switches are tested as specified in 4 6 2, 95 percent of the total length of fillet between the standard wrap wire and the terminal shall be tangent to the surface of the terminal being tested. There shall be no pinholes or voids. A ragged or interrupted line at the point of tangency between the fillet and the terminal under test shall be considered a failure At the conclusion of the test there shall be no evidence of fracture, loosening of parts or any other mechanical failure.

3.5 Electrical characteristics. The switches are tested as specified in 4 6.3, the electrical characteristics shall meet the following requirements

3.5 1 Contact resistance. When switches are tested as specified in 4 6.3 1 the contact resistance shall not exceed the value specified (see 3 1)

3.5.2 Operate and release ampere-turns When switches are tested as specified in 4.6.3.2, the operate and release ampere-turns shall be within the limits specified (see 3.1)

3.5.3 Contact bounce. When switches are tested as specified in 4 6.3 3, the duration of contact bounce shall not exceed the value specified (see 3 1)

3.5.4 Contact noise (when specified, see 3.1). When switches are tested as specified in 4 6 3 4, the contact noise shall have decayed to less than 0.05 mV peak-to-peak in less than 10 milliseconds (ms).

3.5.5 Contact sticking. When switches are tested as specified in 4 6 3 5, the contacts shall release in the time specified (see 3.1).

3.5.6 Operate and release time. When switches are tested as specified in 4.6.3 6, the operate and release time shall be as specified (see 3 1) and shall not include any contact bounce.

3.6 Dielectric withstanding voltage. When switches are tested as specified in 4.6.4, there shall be no evidence of damage, arcing, or breakdown, nor leakage current in excess of 100 microamperes, unless otherwise specified (see 3.1).

3.7 Insulation resistance When switches are tested as specified in 4.6 5, the insulation resistance shall be not less than 1,000 megohms, unless otherwise specified (see 3 1)

3.8 Thermal shock. When switches are tested as specified in 4 6 6, there shall be no mechanical or electrical failures or cracking of the glass After the test, switches shall meet the requirements of contact resistance (see 3 5 1) and operate and release ampere-turns (see 3.5.2).

3 9 Terminal strength When switches are tested as specified in 4.6 7, there shall be no breaking, loosening, or rotation of terminals, nor damage to the switches

3.10 Vibration, high frequency When switches are tested as specified in 4 6.8, there shall be no opening of closed contacts or closing of open contacts in excess of 10 µs, unless otherwise specified (see 3 1), nor any evidence of broken, displaced, deformed, or loose parts.

3.11 Shock (specified pulse) When switches are tested as specified in 4.6.9, there shall be no closing of open contacts or opening of closed contacts in excess of 10 µs, unless otherwise specified (see 3.1), nor any evidence of mechanical or electrical damage After the test, switches shall meet the requirements of contact resistance (see 3.5 1) and operate and release ampere-turns (see 3 5.2).

3.12 Life. When switches are tested as specified in 4 6 10, there shall be no welding or sticking of the contacts and the contact resistance shall not exceed the following

Type I loads	- 10 percent of load resistance
Type II loads	- 5 percent of load resistance
Type III loads	- 2 percent of load resistance or 2 ohms, whichever is greater
Type IV loads	- 2 percent of load resistance or 2 ohms, whichever is greater

Following the cycling, the contact resistance and operate and release ampere-turns shall be as specified (see 3 1).

3 13 Seal When switches are tested as specified in 4 6 11, the leakage current shall exceed 100 microamperes.

3 14 Marking. The following information shall be marked on the unit package in accordance with MIL-STD-1285. Marking shall be compatible with the size of the component

a Part number
b. Contractor's name or code symbol and date code

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection Unless othererwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein Except as otherwise specified in the contract 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 Test equipment and inspection facilities Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the contractor The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-C-45662.

* 4 2 Classification of inspections The inspections specified herein are classified as follows

a First article inspection (see 4 4)
b Quality conformance inspection (see 4 5)

4.3 Inspection conditions and standard test coil.

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

4.3.2 Standard test coil. Tests requiring the standard test coil (see figure 1) shall be performed at least 6 inches from any ferromagnetic material or magnetic influence. The magnetic gap shall be at the midpoint of the standard test coil The centerline of the standard test coil and the switch shall coincide. The magnetic field of the test coil shall be normal to the earth's field, so as to minimize the effect of the earth's field in different locations. There shall be minimum torque or stress on the switch terminals. A failure of the standard test coil shall not be considered a switch failure. In the event of standard test coil failure, the standard test coil shall be replaced and testing shall be continued Unless otherwise specified, the standard test coil shall be energized with 125 percent of pull-in or pull-in plus 10 ampere-turns, whichever is greater.

* 4.4 First article inspection. First article inspection shall be performed by the contractor, after award of contract and prior to production, at a location acceptable to the Government. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract under which it is granted, unless extended by the Government to other contracts.

* 4.4.1 Sample size Unless otherwise specified (see 3.1), the number of sample units shall be 10 for each electrical load specified (see 3.1).

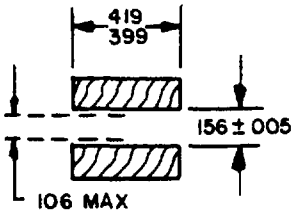
* 4.4.2 Inspection routine. The samples shall be subjected to the inspections specified in table I, in the order shown A detailed report showing results of first article inspection and testing along with all sample units shall be forwarded to the procuring activity for approval prior to production.

TABLE I. First article inspection.

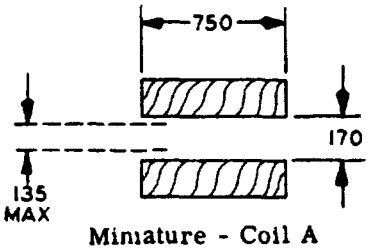
Inspections	Requirement paragraph	Test method paragraph	Maximum failures permitted
Group I (All sample units)			
Visual examination - - - - - -	3.1 and 3.3	4.6 1	1
Solderability 1/ - - - - - - -	3.4	4 6.2	
Electrical characteristics - -	3.5.1 and 3.5.2	4.6.3 1 and 4.6 3.2	
Group II (10 sample units)			
Electrical characteristics - -	3.5.3 thru 3 5 6	4 6.3	1
Dielectric withstanding voltage	3 6	4.6.4	
Insulation resistance - - - -	3.7	4.6.5	
Thermal shock - - - - - - - -	3.8	4 6.6	
Terminal strength 2/ - - - - -	3.9	4.6 7	
Vibration, high frequency- - -	3.10	4.6.8	
Shock (specified pulse)- - - -	3.11	4.6.9	
Group III 3/			
Life - - - - - - - - - - - - - -	3 12	4.6 10	1
Seal - - - - - - - - - - - - - -	3 13	4.6.11	0

1/ Two units only.
2/ Samples which have not been subjected to solderability.
3/ Ten sample units for each electrical load specified (see 3 1).

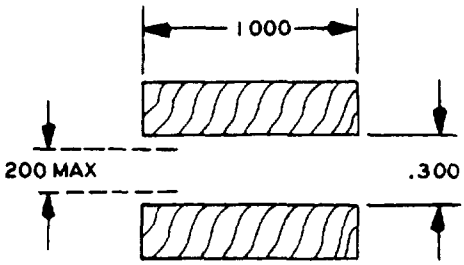
* 4.4.3 Failures. Failures exceeding those allowed in table I shall be cause for refusal to grant first article approval.



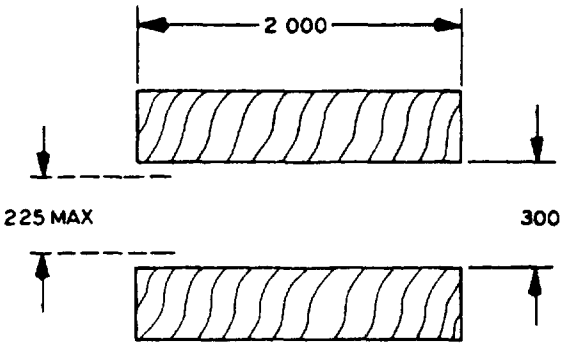
Micro-Miniature - Coil B
5, 000 ± 5 turns No. 46



Miniature - Coil A
10, 000 ± 10 turns No. 48



Intermediate - Coil C
10, 000 ± 10 turns No 41



Large - Coil D
10, 000 ± 10 turns No. 39

INCHES	MM
005	13
.106	2 69
135	3 43
156	3 96
170	4 32
200	5.08
225	5 72
300	7 62
399	10 13
419	10.64
750	19 05
1 000	25 40
2 000	50 80

NOTES
1 Dimensions are in inches
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25 4 mm
3 Unless otherwise specified, tolerance is ± 010 (.25 mm)
4 Coil (wire) dimensions after winding not to scale
5 Sleeves may be used to center the capsules in the coils

FIGURE 1 Standard test coils (single insulation 130°C wire)

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection.

4.5.1.1 Inspection lot. An inspection lot shall consist of all switches covered by a single specification sheet, produced under essentially the same conditions and offered for inspection at one time.

4.5.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table II, in the order shown.

4.5.1.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality levels (AQL) shall be as specified in table II. Major and minor defects shall be as defined in MIL-STD-105.

TABLE II. Group A inspection.

Inspections	Requirement paragraph	Test method paragraph	AQL (percent defective) Major	Minor
Visual examination - - - -	3.1 and 3.3	4.6.1	2.5	4.0
Electrical characteristics	3.5 1 and 3.5.2	4.6 3.1 and 4 6.3.2	1.0	---

4.5.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.5.1.2.3 Disposition of sample units. Sample units which have been subjected to group A inspection may be delivered on the contract or purchase order, if the lot is accepted.

* 4.5.2 Periodic inspection. Periodic inspection shall consist of group B inspection. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.2.1.4), delivery of products which have passed group A inspection shall not be delayed pending the results of these periodic inspections.

TABLE III. Group B inspection.

Inspections	Requirement paragraph	Test method paragraph
Electrical characteristics		
Contact bounce - - - - - - - - - - -	3.5.3	4.6.3.3
Contact noise - - - - - - - - - - -	3.5.4	4 6.3.4
Contact sticking - - - - - - - - - -	3.5.5	4.6.3.5
Operate and release ampere-turns -	3.5.6	4.6.3.2 and 4.6.3.6
Dielectric withstanding voltage- - -	3.6	4.6.4
Insulation resistance- - - - - - - -	3.7	4 6.5
Seal - - - - - - - - - - - - - - - - -	3 13	4.6 11

* 4.5.2.1.1 Sampling plan. Ten sample units shall be selected from those covered by a single specification sheet 12 months after the date of notification of first article approval and after each subsequent 12-month period if the duration of the contract is 12 months or longer, and the product has been in continuous production on that contract for the preceding 12 months. If one or more sample units failed to pass group B inspection, the sample shall be considered to have failed.

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

* 4.5.2.1.4 Noncompliance. If a sample fails to pass group B 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 under essentially the same conditions, with essentially the same materials, processes, etc, 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 B inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the qualifying activity). Group A inspection may be reinstituted, however, final acceptance and shipment shall be withheld until the group B 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.

4.5.3 Inspection of packaging. Inspection of packaging shall be in accordance with MIL-S-28786

4.6 Methods of examination and test

4.6.1 Visual examination. Switches shall be examined to verify that the design, construction, and physical dimensions are in accordance with the applicable requirements (see 3.1 and 3.3). Ten power (10X) magnification shall be used in examining reed alinement (see 3.3 2) and glass capsule (see 3.3.3).

4.6.2 Solderability (see 3 4). Switches shall be tested in accordance with method 208 of MIL-STD-202. The following details and exceptions shall apply

a. Number of terminals to be tested - A minimum of one terminal per switch.
b. Dipping machine - Need not be used.

4.6.3 Electrical characteristics (see 3.5). The electrical characteristics shall be determined with the switch mounted in a standard test coil (see figure 1). The switch shall be subjected to a magnetic soak by energizing the coil with "soak-value" for at least 1 minute Soak-value is 125 percent of pull-in ampere-turns or pull-in plus 10 ampere-turns, whichever is greater. The switch shall then be tested as specified in 4 6.3.1 through 4.6.3 6 inclusive, the sequence shall be optional with the manufacurer.

4 6.3 1 Contact resistance (see 3.5.1) Switches shall be tested in accordance with method 307 of MIL-STD-202. The following details shall apply

a. Method of connection - As specified on figure 2
b. Test current - 10 mAdc ±1 for low level type switches, 10-100 mA for all other type switches
c. Maximum open-circuit test voltage - 50 mVdc ±5 for low level switches, 6-12 Vdc for all other type switches.
d Points of measurement - Between terminals (see 3 1)
e. Number of activations prior to measurement - One, of sufficient strength to magnetically saturate the switch.
f. Number of test activations - One.
g. Number of measurements per activation - One

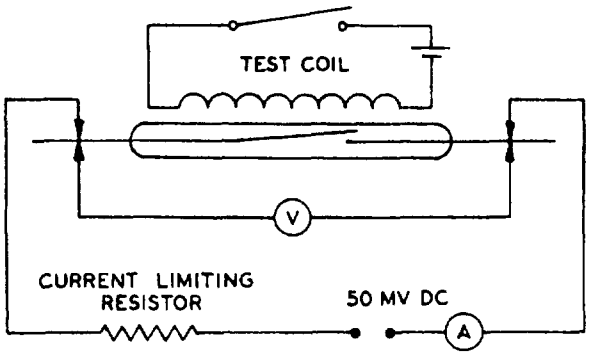
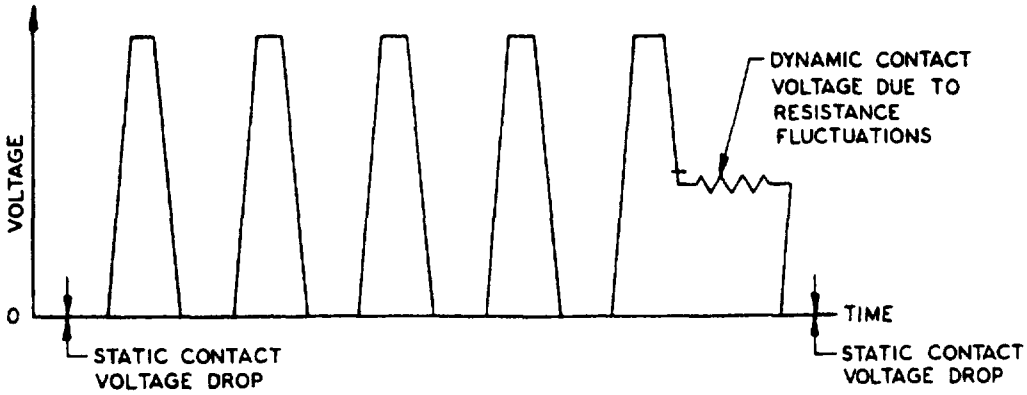


FIGURE 2 Contact resistance test circuit

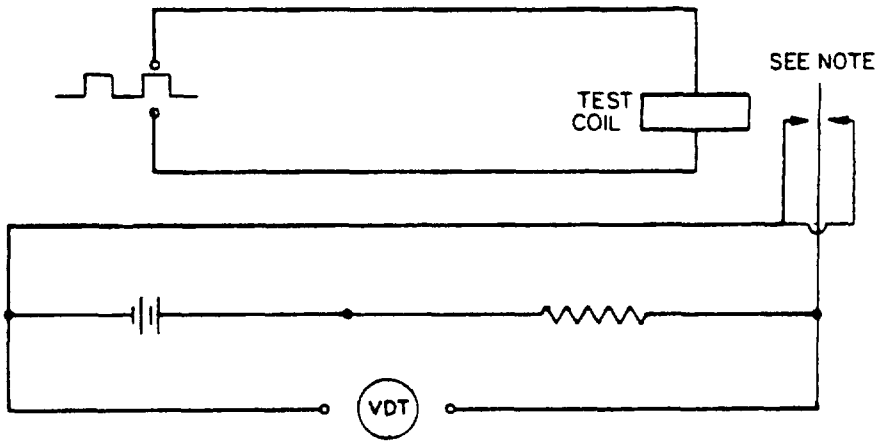
* 4.6.3.2 Operate and release ampere-turns (see 3.5.2). The coil power supply shall be a ripple-free variable-voltage dc source. The switch contacts shall be connected in a circuit with a suitable closure indicator. The circut shall have an open-circuit voltage of 50 mV ±5 and a current of 10 mA ±1 with the switch closed. The values of ampere-turns for operate and for release shall be determined as specified herein. Starting with the switch unoperated, the coil current shall be gradually increased until the switch operates. The current shall then be increased to soak-value and gradually reduced until the switch releases. For first article inspection, the ampere-turn value determined for operate and release conditions shall be recorded.

* 4 6.3.3 Contact bounce (see 3.5.3). Contact bounce shall be measured using the test circuit in figure 3, or other equivalent means such as Teradyne K147 relay evaluation instrument or equivalent. If the Teradyne relay evaluation instrument is used, a test coil simulating the ampere-turn effects of the standard test coils shall be used. The simulated ampere-turn effects shall be correlated to the effects when the standard test coils are used. For first article inspection, a photographic record shall be made of an oscilloscope trace showing the "make" of the contacts when the standard test coil is energized or de-energized Current through the contacts shall be 10 mA ±1 at 50 mVdc ±5 open-circuit voltage. Switch "off" time shall be 45 ms, minimum The cycling rate shall not exceed 5 Hz. The test coil shall be driven by a fast-rise, bounce free source.

4.6.3.4 Contact noise (when specified, see 3 5 4). Each switch shall be placed in a standard test coil and contact noise shall be measured using the test cirucit in figure 4 The test coil shall be pulsed at a rate not to exceed 5 Hz with "on" and "off" time approximately equal. The input filter bandwidth of the oscilloscope shall be set at 600 Hz to 100 kHz. An oscilloscope, such as Tektronix, Inc., Type 561A with Type 2A61 plug-in or equal, shall be used with its time scale adjusted to 2 ms per cm and its gain control adjusted for adequate deflection The peak-to-peak voltage shall be determined at 10 ms. The oscilloscope trace shall be recorded using an oscilloscope record camera.



Typical recording of contact bounce



Test circuit for contact bounce

NOTE Disconnect the fixed normally closed contact for measurement during pickup and disconnect the fixed normally open contact for measurement during release

FIGURE 3. Contact bounce test circuit

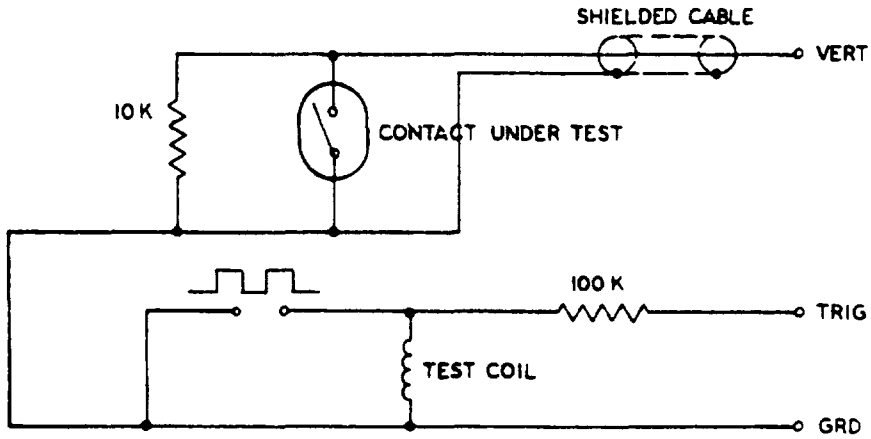


FIGURE 4 Procedure for observing contact noise on closing.

4.6.3.5 Contact sticking (see 3.5.5) Contact sticking shall be performed in accordance with 4.6.3.5.1, 4.6.3.5.2, or 4.6 3.5 3 at the option of the manufacturer.

4.6.3.5.1 Method A. Magnetostrictive stick testing. The test fixture used must be capable of energizing and closing the test switch and holding the switch closed at the drop-out value plus 1 ampere-turn The fixture must also provide the capability of subjecting the switch to an additive pulsing magnetic field, the additive field shall be variable in amplitude from zero to twice the pull-in value having a pulse repetitive rate of approximately 1,000 Hz. Place the switch in the test fixture, measure the drop-out value, close again, then adjust the coil-drive to the dropout value plus 1 ampere-turn. Adjust the additive magnetic field to pull-in value plus 100 percent, then apply to test switch for 5 seconds, ±1 remove additive magnetic field from test switch, measure drop-out value and compute the decrease in drop-out, if any.

4.6.3.5.2 Method B. High temperature stick testing - coil actuation. Place the switch in the test coil with the magnetic gap centered. The switch contact load shall be .050 Vdc, 10 mA for low level type switches, and 6-12 Vdc, 10-100 mA for all other types., The test fixture shall have provisions to adjust coil drive, to connect oscilloscope vertical input terminals to each switch contact without disturbing them, and to connect oscilloscope external trigger input to each test coil. Switching shall be provided to enable each test coil to be energized or de-energized individually. Place the test coil fixture in a temperature controlled chamber capable of controlling to ±5°C. Temperature for test shall be 100°C. Exposure time shall be 24 hours. After a sufficient time to stabilize the temperature of test coils and switches, energize the test coils and adjust the coil drive to pull-in plus 25 percent. At the conclusion of the 24-hour exposure time, adjust the oscilloscope to trigger the sweep on the test coil turn-off and measure the initial contact release time for each switch.

4.6.3.5.3 Method C. High temperature stick testing magnet actuation. Place the switch directly on the surface of a fully saturated Alnico 5 magnet, .25 x .25 x 1.0 inch. Place the test fixture in a temperature-controlled chamber capable of controlling to ±5°C. Temperature for test shall be 100°C. Exposure time shall be 24 hours. After placing the switches on the magnets and before starting the high temperature conditioning, determine the drop-out point and record to establish a reference value for the switch. With a continuity indicator connected to the switch leads, the switch shall be slowly withdrawn from the influence of the magnetic field. During withdrawal, care must be exercised to prevent disturbance of the contacts. The distance from the magnet surface at which the contacts open or fail to open shall be noted. Then place the test fixture in the chamber for the high temperature conditioning. At the conclusion of the correct exposure time, remove the fixture from the chamber and cool to room temperature. With a continuity indicator connected to the switch leads, slowly remove the switch from the influence of the magnetic field. The distance at which the switch contacts open or fail to open shall be noted.

4.6.3.6 Operate and release time (see 3.5.6). The operate and release time shall be measured using an oscilloscope. Current through contacts shall be 10 mA ±1 at 50 mVdc ±5, open-circuit voltage.

4.6.4 Dielectric withstanding voltage (see 3.6). Switches shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply

a. Magnitude of test voltage - As specified (see 3.1).
b. Nature of potential - ac
c Duration of application of test voltage - 1 to 5 seconds for quality conformance inspection.
d. Points of application of test voltage - Across the normally open contacts with the switch de-energized and across the normally closed contacts with the switch energized and across adjacent contacts
e. Pre-ionizing radiation shall be sufficient strength to stabilize the dielectric strength.

During the test, switches shall be examined for evidence of damage, arcing, or breakdown and leakage current shall be measured. Following the test, the voltage shall be gradually increased across normally open contacts until the leakage current exceeds 100 microamperes The voltage at which the leakage current exceeds 100 microamperes shall be recorded and used as the standard breakdown voltage for leak detection

4 6 5 Insulation resistance (see 3.7) Switches shall be tested in accordance with method 302 of MIL-STD-202. The following details shall apply·

a. Test-condition letter - A
b. Points of measurement - The test voltage shall be applied across the normally-open contacts with the switch de-energized and across the normally-closed contacts with the switch energized, and across adjacent contacts.

4 6 6 Thermal shock (see 3.8). Switches shall be tested in accordance with method 107 of MIL-STD-202. The following details shall apply

a. Test-condition letter - B, unless otherwise specified (see 3.1)
b. Examination during tests - Normally closed switches shall be energized with rated pull-in value during the last cycle of step one Normally open switches shall not be energized during the last cycle of step one. At the end of the last thermal cycle of step one and while in the chamber, each switch shall be checked for contact resistance as specified in 4.6 3 1, except prior to measurement there shall be no contact actuations.
c. Examinations after test - Group A inspection

4 6 7 Terminal strength (see 3 9) The terminals of switches shall be tested in accordance with method 211 of MIL-STD-202 The following details shall apply

a Test-condition letter - A
b. Applied force - As specified (see 3 1)
c. Unformed leads only to be tested

4.6.8 Vibration, high frequency (see 3.10). Switches shall be tested in accordance with method 204 of MIL-STD-202. The following details shall apply

a. Mounting of specimens - Mounting fixture design shall be as lightweight and resonance-free as possible; an aluminum cube with the test coil encapsulated into a cavity is ideal. Switch mounting in the test coil shall be by means of rubber spacers to force glass reed switches securely against either top or bottom of coil bobbin. Switch leads shall be firmly attached to insulated support terminals by soldering or other suitable method as close as practical to the body of the switch. Switches shall be oriented in a position such that vibration will tend to open or close the contacts.
b. Electrical-load conditions - Switch contact stability shall be continuously monitored during vibration using any suitable circuit capable of detecting false operations of 10 µs or longer duration.
c. Test-condition letter - As specified (see 3.1). Vibration shall be normal to the contact movement in one plane only.
d. Test and measurements during vibration - Switches shall be continuously monitored to detect contact opening or closing greater than 10 µs using method 310 of MIL-STD-202. All open and closed circuits shall be monitored. Half of the units shall be tested in the open position and the other half of the units shall be tested in the closed position. Open circuits may be connected in parallel and monitored for closing, and closed circuits may be connected in series and monitored for opening With the circuits so wired, if there is an indication of failure, the test shall be modified by successive testing with the contacts monitored switch by switch to determine whether any contacts are defective If one or more contact fails singularly, the switch shall be considered to have failed.
e. Coil drive for normally closed contacts shall be 125 percent of pull-in or pull-in plus 10 ampere-turns, whichever is greater.
f. Tests and measurements after vibration - Not applicable.
g. Examinations after test - Switches shall be examined for evidence of broken, displaced, deformed, or loose parts.
h. Adequate precautions should be taken to shield the switch from the magnetic field of the vibration table.

4.6.9 Shock (specified pulse) (see 3.11). Switches shall be tested in accordance with method 213 of MIL-STD-202. The following details shall apply

a. Mounting method - As specified in 4.6.8a.
b. Test-condition letter - G.
c. Number of shocks - 10 blows in the direction to the contact movement
d. Measurements during test - Monitored for evidence of contact closure or opening in accordance with 4 6.8d.
e. Measurements after test - Examined in accordance with group A requirements.

4.6.10 Life (see 3.12).

a. Switches shall be tested at room ambient operating temperature, unless otherwise specified (see 3.1), using the test circuit in figure 5. The connecting wiring and measuring equipment shall not affect the current and the voltage being switched by the contact. The duty cycle shall be 50 percent ±5. The test coil shall be driven by a square wave voltage with an amplitude of approximately 150 percent pull-in for reed switch type being tested. The pulsing rate shall be 20 to 100 Hz for types I, II, and III test loads. The pulsing rate for type IV test loads shall be 5 to 60 Hz.

b. Switches shall be monitored for opening or closing of contacts or welding or sticking of contacts at intervals of 18,000, 36,000, 54,000, 72,000, 90,000, 1 x 10^6, 5 x 10^6 and every 5 x 10^6 operations thereafter. Monitoring and scanning may be performed more frequently, at the option of the manufacturer. At the option of the manufacturer, the equipment may be automatic or manually operated. Any automatic equipment used shall be capable of either recording a fault or automatically shutting down in the event of a fault. Equipment manually operated by an operator, or an oscilloscope manually operated by an operator may be used. Contact resistance shall be measured as a voltage drop across the switch while the contacts are held closed by the test coil and while the test load current is being carried by the switch. The contact loads and number of switching operations shall be as specified in table IV. Following the cycling, contact resistance, and operate and release, ampere-turns shall be measured as specified in 4.6.3.1 and 4.6.3.2, respectively.

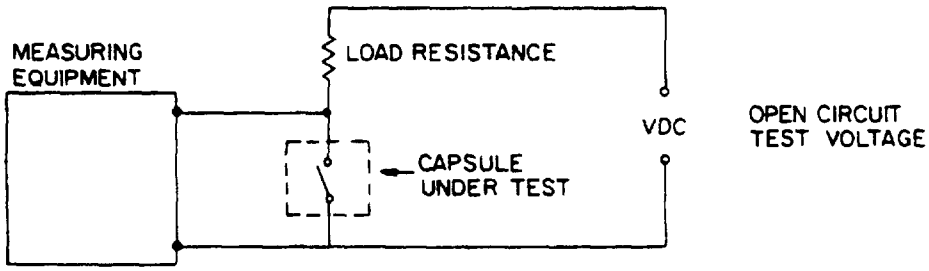


FIGURE 5 Test circuit for observing life

TABLE IV. Load life

Loads (resistive)	Voltage (Vdc)	Current (mA)	Operations (in millions)
Type I	.05	10	100
Type II	5	10	50
	10	100	50
	24	100	50
Type III	50	100	20
	50	250	20
Type IV	24	2,000	20
	50	1,000	20
	100	500	20

4.6.11 Seal (see 3.13). The dielectric withstanding voltage test shall be repeated, except the open-circuit voltage shall be 110 percent of the standard breakdown voltage determined in 4.6.4 The point of application shall be across the normally open contacts only.

5. PACKAGING

5.1 Packaging requirements The requirements for packaging shall be in accordance with MIL-S-28786.

6. NOTES

6.1 Intended use. Dry reed switches covered by this specification are intended for use in communication, electrical and electronic equipment, and other component parts such as switches and relays.

6.2 Ordering data. Procurement documents should specify the following

a Title, number, and date of this specification.
b Title, number, and date of the applicable specification sheet, and the complete part number (see 3 1)

* 6.3 First article The first article shall be tested and approved under the appropriate provisions of 7-104 55 of the Armed Services Procurement Regulation. The first article should be a sample selected from the first production item or it may be a standard production item from the contractor's current inventory as specified in 4.4 The contracting officer should include specific instructions in all procurement instruments, regarding arrangements for examinations, test and approval of the first article

* 6 4 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 document based on the entire content irrespective of the marginal notations and relationship to the last previous issue

Custodians
Army - ER
Navy - EC
Air Force - 11

Review activities
Army - AR
Air Force - 17, 85, 99
DLA - ES

User activities
Navy - MC
Air Force - 14, 19

Preparing activity
Army - ER

Agent
DLA - ES

(Project 5930-1114)