MILITARY SPECIFICATION

SWITCHES, WAVEGUIDE
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 the general requirements for waveguide switches, either manually or electromechanically operated, designed to connect and disconnect one or more waveguide sections to other waveguide sections. Detail requirements and specific characteristics of switches shall be specified in the applicable specification sheet.

1.2 Military part number. The military part number shall consist of the letter "M", the basic number of the specification sheet, an assigned dash number (see 3.1), and the letter N or S; where N indicates a nonscreened item and S indicates a screened item.

EXAMPLE:

M55041/3- 01 N or S

Military designator and specification sheet number

Dash number

Nonscreened

Screened

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

L-P-378	-	Plastic Sheet and Strip, Thin Gauge, Polyolefin.
NN-P-71	-	Pallet, Material Handling, Wood, Stringer Construction, 2 Way and 4 Way (Partial).
QQ-A-200/9	-	Aluminum Alloy Bar, Rod, Shapes, Tube, and Wire, Extruded, 6063.
QQ-A-250/11	-	Aluminum Alloy 6061, Plate and Sheet.
QQ-A-591	-	Aluminum Alloy Die Castings.
QQ-A-596	-	Aluminum Alloy Permanent and Semi-permanent Mold Castings.
QQ-A-601	-	Aluminum Alloy Sand Castings.
QQ-B-613	-	Brass, Leaded and Nonleaded: Flat Products (Plate, Bar, Sheet and Strip).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Electronics Systems Command, Department of the Navy, Washington, DC 20360, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

QQ-S-763 - Steel Bars, Wire, Shapes and Forgings, Corrosion-Resisting.
QQ-S-766 - Steel Plate, Sheet and Strip-Corrosion Resisting.
QQ-S-781 - Strapping, Steel, and Seals.
UU-P-268 - Paper, Kraft, Wrapping.
PPP-B-566 - Boxes, Folding, Paperboard.
PPP-B-585 - Boxes, Wood, Wirebound.
PPP-B-601 - Boxes, Wood, Cleated-plywood.
PPP-B-621 - Boxes, Wood, Nailed and Lock-corner.
PPP-B-636 - Boxes, Shipping, Fiberboard.
PPP-B-676 - Boxes, Set-up.

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MIL-P-116 - Preservation, Methods of.
MIL-P-1144 - Pipe, Corrosion Resistant Stainless Steel, Seamless or Welded.
MIL-F-3922 - Flanges, Waveguide, General Purpose, General Specification for.
MIL-S-4043 - Steel, Corrosion-resisting.
MIL-C-5015 - Connectors, Electrical, Circular Threaded, AN Type, General Specification For.
MIL-C-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
MIL-S-13282 - Silver and Silver Alloy.
MIL-C-22750 - Coating, Epoxy Polyamide.
MIL-C-22751 - Coating System, Epoxy-Polyamide, Chemical and Solvent Resistant, Process for Application of.
MIL-P-23377 - Primer Coating, Epoxy-Polyamide, Chemical and Solvent Resistant.
MIL-C-26482 - Connectors, Electric, (Circular, Miniature, Quick Disconnect, Environment Resisting), Receptacles and Plugs, General Specification for.
MIL-C-38999 - Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect, Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for.
MIL-F-39000 - Flanges, Waveguide, Ridge, General Specification for.
MIL-T-55155 - Terminals, Feedthru (Insulated) and Terminals, Stud (Insulated and Noninsulated), General Specification for.
MIL-C-81511 - Connector, Electrical, Circular, High Density, Quick Disconnect, Environment Resisting, and Accessories, General Specification for.
MIL-C-83723 - Connectors, Electrical, (Circular, Environment Resisting), Receptacles and Plugs, General Specification for.

(See supplement 1 for list of associated specifications.)

STANDARDS

FEDERAL

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

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-147 - Palletized Unit Loads.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-454 - Standard General Requirements for Electronic Equipment.
MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-889 - Dissimilar Metals.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.
MIL-STD-45662 - Calibration Systems Requirements.

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

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

B46.1 - Surface Texture.

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

(Industry 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 specification and the references cited herein, the text of this specification shall take precedence.

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 Qualification. Waveguide switches furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.5 and 6.3).

3.3 Material. The material for each part shall be as specified herein; however, when a definite material is not specified, a material shall be used which will enable the waveguide switches to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product. The material shall be selected from the following:

a. Aluminum alloy plates and sheets shall conform to composition 6061 of QQ-A-250/11; extruded aluminum alloy shall conform to composition 6063 of QQ-A-200/9 or composition 6061 of QQ-A-250/11.

b. Corrosion-resisting steel plates, sheets, and strips shall conform to QQ-S-766 and MIL-S-4043.

c. Corrosion-resisting forgings shall conform to QQ-S-763 and corrosion-resisting steel pipe shall conform to MIL-P-1144.

d. Copper alloy sheet shall conform to QQ-B-613.

e. Aluminum alloy castings shall conform to alloy A360 of QQ-A-591, class 8 of QQ-A-596, or alloy 40E of QQ-A-601.

f. Silver alloy shall conform to the chemical composition requirements for grade C of MIL-S-13282.

g. Silver-lined copper or copper alloy shall be laminated with a minimum of 0.005 inch of fine silver in accordance with grade A of MIL-S-13282.

3.3.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall be as specified in MIL-STD-889.

3.3.2 Fungus. Materials used in the construction of switches shall be fungus inert in accordance with requirement 4 of MIL-STD-454.

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

3.4.1 Operating frequency range. The frequency range shall be as specified (see 3.1).

3.4.2 Operation. Switches shall be either manually or electromechanically operated.

3.4.2.1 Operating voltage. When applicable, the nominal operating voltage shall be as specified (see 3.1).

3.4.3 Configuration. Switches shall be furnished with the number of positions specified (see 3.1).

3.4.4 Threaded parts. All threaded parts shall be in accordance with FED-STD-H28. Inserts shall be provided when added thread strength and life is needed for mounting holes.

3.4.5 Diode suppression. When a diode is used for radio frequency (RF) noise suppression, it shall be protected by another diode such that applying a reverse polarity to the actuating circuit does not cause an excessive current to flow in the suppressing diode. Unless otherwise specified, all suppressing diodes shall be mounted inside the switch body.

3.4.6 Waveguide and connector cover. The connector and waveguide opening of the switches shall be sealed with covers to prevent damage and the entrance of moisture and foreign material during storage.

3.4.7 Connectors. The connector receptacle shall conform with MIL-C-5015, MIL-C-26482, MIL-C-38999, MIL-C-81511, or MIL-C-83723. All connectors shall have their metallic shells grounded to the switch metallic casing.

3.4.8 Waveguide flanges. The waveguide flange faces and mounting holes shall mate with waveguide flanges conforming with MIL-F-3922 or MIL-F-39000.

3.4.9 Solder terminals. Solder terminals shall be in accordance with MIL-T-55155.

3.4.10 Indicating circuits (see 6.4). When specified (see 3.1), switches shall be designed with separate contacts and terminals to operate a pilot light or other device which shall indicate each position of the switch.

3.4.11 Interlock circuit. When specified (see 3.1), switches shall be designed with separate contacts and terminals to operate or control the output of a transmitter or other RF power source, during switching or at any one of the switch positions. Interlocks shall be activated before rotor has traveled less than 6 degrees across the waveguide opening.

3.4.12 Finish. Unless otherwise specified (see 3.1), the finish shall be as specified in 3.4.12.1 and 3.4.12.2.

3.4.12.1 Waveguide flange face surface. The flange face surface of the switch shall be finished to 63 root-mean-square microinches in accordance with publication ANSI B46.1. Aluminum flange face shall be coated with a chromate-type conversion coating in accordance with MIL-C-5541, class 1A.

3.4.12.2 Exterior surface. All exterior surfaces of the switch, except flange faces and connectors, shall be painted in accordance with MIL-C-22751, MIL-P-23377, and MIL-C-22750.

3.4.13 Temperature range. The temperature range shall be as specified (see 3.1).

3.4.14 Weight. The weight shall not exceed the limit specified (see 3.1).

3.5 Screening. All screened switches produced to this specification shall be screened in accordance with table III. After screening, the switch shall be subjected to Group A inspection.

3.6 Run-in. All electromechanically operated switches produced to this specification shall be run-in in accordance with 4.7.3.

3.7 Pull-in voltage (see 6.4). When electromechanically operated switches are tested as specified in 4.7.4, the pull-in voltage value shall not exceed the value specified (see 3.1). The measured pull-in voltage at the highest operating temperature shall not exceed the maximum specified value (see 3.1) by more than 10 percent.

3.8 Dropout voltage (see 6.4). When fail-safe electromechanically operated switches are tested as specified in 4.7.5, the dropout voltage value shall be not less than the value specified (see 3.1).

3.9 Operating current. When electromechanically operated switches are tested as specified in 4.7.6, the maximum operating current shall not exceed the value specified (see 3.1). The measured operating current at the lowest operating temperature shall not exceed the maximum specified value by more than 25 percent.

3.10 Holding current (see 6.4). When fail-safe electromechanically operated switches are tested as specified in 4.7.7, the holding current value shall not exceed the value specified (see 3.1). The measured holding current at the lowest operating temperature shall not exceed the maximum specified value (see 3.1) by more than 25 percent.

3.11 Rotor motion delay (when specified) (see 6.4 and 3.1). When electromechanically operated switches are tested as specified in 4.7.8, the rotor motion delay time shall not exceed the time specified (see 3.1).

3.12 Dielectric withstanding voltage. When electromechanically operated switches are tested as specified in 4.7.9, there shall be no evidence of voltage breakdown.

3.13 Transient interference (RFI) (when specified) (see 3.1). When electromechanically operated switches are tested as specified in 4.7.10, the switch shall not conduct or radiate RF noise to a degree greater than the following limiting values:

a. DC switches +50 percent or -150 percent of nominal line voltage (28 V dc limit is ±42 V peak).

b. AC switches ±2 x nominal RMS line voltage (115 V ac limit is ±230 V peak).

3.14 Isolation. When switches are tested as specified in 4.7.11, the isolation between the activated and any other ports shall be not less than the value specified (see 3.1).

3.15 Voltage standing wave ratio (VSWR). When switches are tested as specified in 4.7.12, the input VSWR shall not exceed the value specified (see 3.1).

3.16 Insertion loss. When switches are tested as specified in 4.7.13, the insertion loss shall not exceed the value specified (see 3.1).

3.17 Switching time (see 6.4). When electromechanically operated switches are tested as specified in 4.7.14, the time required to switch from one position to an adjacent position shall not exceed the time specified (see 3.1).

3.18 RF energy leakage (when specified) (see 3.1). When switches are tested as specified in 4.7.15, the RF leakage shall not exceed the value specified (see 3.1).

3.19 RF power handling capability. When switches are tested as specified in 4.7.16, with specified RF power (see 3.1) passing through the switch, no evidence of breakdown, charring, arcing, or overheating shall be evident. Following this test, the switch shall be capable of meeting the specified insertion loss and isolation requirements. Unless otherwise specified (see 3.1), switches shall not be required to switch under power.

3.20 Cycle life. When tested as specified in 4.7.17, the switch shall show no evidence of physical damage or deterioration. Following the test, switching time, insertion loss, and VSWR shall be not greater than and isolation no less than the initial values specified (see 3.1).

3.21 Thermal shock. When electromechanically operated switches are tested as specified in 4.7.18, the switch shall be capable of reliable operation. Following the test, the switch shall be capable of meeting the specified insertion loss, isolation, and switching time requirements.

3.22 Altitude and cold. When electromechanically operated switches are tested as specified in 4.7.19, there shall be no evidence of malfunction. Switches shall operate within the initial switching time specified (see 3.1) and withstand dielectric withstanding voltage without breakdown (see 4.7.9).

3.23 Moisture resistance. When electromechanically operated switches are tested as specified in 4.7.20, the switch shall be capable of reliable operation. Following the test, the switch shall be capable of meeting the specified isolation, VSWR, insertion loss, holding current, pull-in voltage, dropout voltage, switching time and rotor motion delay requirement.

3.24 Pressure (when specified) (see 3.1). When pressurized switches are tested as specified in 4.7.21 at the specified pressure (see 3.1), the leak rate of the switches shall be less than 5.0 standard atmosphere cubic centimeter per minute or shall be such that no stream of bubbles emanates from the switches.

3.25 Vibration. When tested as specified in 4.7.22, there shall be no evidence of displacement or loosening of parts. Following this test, the switch shall be capable of meeting the specified isolation, VSWR, insertion loss, holding current, pull-in voltage, dropout voltage, switching time, and rotor motion delay requirements.

3.26 Shock (specified pulse). When tested as specified in 4.7.23, the switches shall show no evidence of damage or loosening of parts. Following this test, the switch shall be capable of meeting the specified isolation, insertion loss, and switching time requirements.

3.27 Explosion (when specified) (see 3.1). When switches are tested as specified in 4.7.24, there shall be no explosion within the test chamber. Following this test, the switch shall be capable of meeting the switching time requirement.

3.28 Salt spray (when specified) (see 3.1). When tested as specified in 4.7.25, the surfaces of the switch shall exhibit no marked pitting or corrosion. Following this test, the switch shall be capable of meeting the switching time, insertion loss, and dielectric withstanding voltage requirements.

3.29 Sand and dust. When electromechanically operated switches are tested as specified in 4.7.26, there shall be no evidence of sand and dust accumulation within the inclosure.

3.30 Post electrical tests, environmental. Following the environmental tests, pull-in and dropout voltages, operating and holding currents, rotor motion delay, dielectric withstanding voltage, isolation, VSWR, insertion loss and switching time shall meet the specified values.

3.31 Marking. Switches shall be marked in accordance with MIL-STD-1285 with part number and the manufacturer's source code.

a. Electromechanically operated switches shall be marked with the type of supply, the operating voltage, and the frequency in the case of an ac supply.

b. Waveguide ports shall be marked in a logical manner to identify the input and output ports.

The marking shall remain legible after completing all environmental tests specified herein.

3.32 Workmanship. Switches shall be manufactured and processed in such a manner as to be uniform in quality, and the surfaces of the switch shall be free from tool marks, burrs, deep scratches, and other defects that will affect life, serviceability or appearance.

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 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 manufacturer. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

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

a. Materials inspection (see 4.3).

b. Qualification inspection (see 4.5).

c. Quality conformance inspection (see 4.6).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table I, used in fabricating the switches, are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

TABLE I. Materials inspection.

Material	Requirement paragraph	Applicable specification
Aluminum alloy- - - - - - - - - - - -	3.3	QQ-A-200/9, QQ-A-250/11
Corrosion-resisting steel - - - - - -	3.3	QQ-S-766, MIL-S-4043
Corrosion-resisting steel pipe- - - -	3.3	MIL-P-1144
Corrosion-resisting forging - - - - -	3.3	QQ-S-763
Copper alloy sheet- - - - - - - - - -	3.3	QQ-B-613
Aluminum alloy casting- - - - - - - -	3.3	QQ-A-591, QQ-A-596, QQ-A-601
Silver alloy- - - - - - - - - - - - -	3.3	MIL-S-13282
Dissimilar metals - - - - - - - - - -	3.3.1	MIL-STD-889
Fungus- - - - - - - - - - - - - - - -	3.3.2	MIL-STD-454
Connectors- - - - - - - - - - - - - -	3.4.7	MIL-C-5015, MIL-C-26482, MIL-C-38999, MIL-C-81511, MIL-C-83723
Waveguide flanges - - - - - - - - - -	3.4.8	MIL-F-3922, MIL-F-39000
Finishes- - - - - - - - - - - - - - -	3.4.12	ANSI B46.1, MIL-C-5541, MIL-P-23377, MIL-C-22750, MIL-C-22751, FED-STD-595

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.

4.4.1 Test method deviation. Deviation from the specified test methods are allowed provided that it is demonstrated to the preparing activity or their agent that such deviations in no way relax the requirements of this specification and that they are approved before testing is performed. For proposed test deviations, test method comparative error analysis shall be made available to the preparing activity or their agent for review and approval.

4.5 Qualification inspection. 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. Qualification obtained for each group (see appendix) shall constitute qualification for all switches with characteristics for that group.

TABLE II. Qualification inspection.

Inspection	Requirement paragraph	Test method paragraph
Group I (all samples)		
Screened (see table III for screened switches)	3.5	4.7.2
Visual and mechanical inspection (for nonscreened switches)	3.1, 3.4 through 3.4.12, 3.4.14, 3.31 and 3.32	4.7.1
Run-in (for nonscreened switches)	3.6	4.7.3
Pull-in voltage 1/	3.7	4.7.4
Dropout voltage 3/	3.8	4.7.5
Operating current 1/	3.9	4.7.6
Holding current 3/	3.10	4.7.7
Rotor motion delay 1/ 2/	3.11	4.7.8
Dielectric withstanding voltage 1/	3.12	4.7.9
Transient interference (RFI) 1/ 2/	3.13	4.7.10
Isolation	3.14	4.7.11
VSWR	3.15	4.7.12
Insertion loss	3.16	4.7.13
Switching time 1/	3.17	4.7.14
Group II (2 samples)		
RF energy leakage 2/	3.18	4.7.15
RF power handling capability	3.19	4.7.16
Cycle life	3.20	4.7.17
Post electrical tests	3.30	4.7.27
Group III (2 samples)		
Thermal shock 1/	3.21	4.7.18
Altitude and cold 1/	3.22	4.7.19
Moisture resistance 1/	3.23	4.7.20
Pressure 2/	3.24	4.7.21
Vibration	3.25	4.7.22
Shock (specified pulse)	3.26	4.7.23
Explosion 1/	3.27	4.7.24
Salt spray	3.28	4.7.25
Sand and dust 1/	3.29	4.7.26
Post electrical tests 4/	3.30	4.7.27

1/ For electromechanically operated waveguide switches only.

2/ When specified.

3/ For fail-safe electromechanically operated waveguide switches only.

4/ The applicable post electrical tests shall be performed after the last environmental test is completed.

4.5.1 Sample size. The sample size shall be four.

4.5.2 Inspection routine. The sample shall be subjected to the qualification inspection specified in table II, in the order shown. All units shall be subjected to the inspection of group I. The sample shall then be divided into two groups of two units each (see 4.5.1). The sample units shall then be subjected only to the inspections indicated for their particular group.

4.5.3 Failures. One or more failures shall be cause for refusal to grant qualification approval. A failure shall be anything that does not meet the requirements of the specification.

4.5.4 Disposition of qualification sample units. Sample units which have been subjected to qualification testing shall not be delivered on any contract or purchase order. Unless otherwise specified, the contractor shall furnish the sample units with the qualification test report. The samples shall be retained by the government or, at the option of the qualifying activity and with the agreement of the contractor, returned to the contractor for storage. Samples stored by the contractor shall not be disposed of until the product is no longer on the qualified products list.

4.5.5 Retention of qualification. To retain qualification, the contractor shall forward a report at 24-month intervals to the qualifying activity. After two consecutive successful 24-month report periods, a supplier reporting period shall be changed to every 60-months. The qualifying activity shall establish the initial reporting date. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery (group A), indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.

b. A summary of the results of tests performed for periodic inspection (group B), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 24-month period. If the summary of test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 60 days after the end of each 24-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 24-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the switches. If during two consecutive reporting periods there has been no production, the manufacturers may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements and the reason for no production.

TABLE III. Screening.

Inspection	Requirement paragraph	Test method paragraph
Thermal shock- - - - - - - - - - - - - - -	3.5	4.7.2.1
Run-in - - - - - - - - - - - - - - - - - -	3.6	4.7.2.2
Visual and mechanical inspection - - - -	3.1, 3.4 through 3.4.12, 3.4.14, 3.30 and 3.31	4.7.1

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection and when applicable screening.

4.6.1.1 Inspection lot. An inspection lot shall consist of all waveguide switches of the same part number, produced under essentially the same conditions, and offered for inspection at one time.

4.6.1.2 Screening. Screening shall consist of the inspections specified in table III, in the order shown. Switches shall pass screening, before being subjected to group A inspection.

4.6.1.3 Group A inspection. Group A inspection shall consist of the inspections specified in table IV, in the order shown.

4.6.1.4 Sampling plan. All screened switches shall be subjected to screening and group A inspection. All nonscreened switches shall be subjected to group A inspection. Defective units shall be individually rejected.

4.6.1.5 Disposition of sample units. Switches which have passed all the group A inspection shall be delivered on the contract or purchase order.

4.6.1.6 Rejected items. If an inspected item is rejected, the contractor may rework it to correct the defect and resubmit for reinspection. Such items shall be separate from new items, and shall be clearly identified as reinspected items.

TABLE IV. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph
Screened (per table III for screened switches)- - - - - - - - - - - - - - -	3.5	4.7.2
Visual and mechanical inspection (for nonscreened switches)- - - - - - - -	3.1, 3.4 through 3.4.12, 3.4.14, 3.31 and 3.32	4.7.1
Run-in (for nonscreened switches)- - -	3.6	4.7.3
Pull-in voltage 1/ - - - - - - - - - - -	3.7	4.7.4
Dropout voltage 3/ - - - - - - - - - - -	3.8	4.7.5
Operating current 1/ - - - - - - - - - -	3.9	4.7.6
Holding current 3/ - - - - - - - - - - -	3.10	4.7.7
Rotor motion delay 1/ 2/ - - - - - - - -	3.11	4.7.8
Dielectric withstanding voltage 1/ - -	3.12	4.7.9
Transient interference (RFI) 1/ 2/ - -	3.13	4.7.10
Isolation- - - - - - - - - - - - - - - - -	3.14	4.7.11
VSWR - - - - - - - - - - - - - - - - - - -	3.15	4.7.12
Insertion loss - - - - - - - - - - - - - -	3.16	4.7.13
Switching time 1/- - - - - - - - - - - -	3.17	4.7.14

1/ For electromechanically operated waveguide switches only.

2/ When specified.

3/ For fail-safe electromechanically operated waveguide switches only.

4.6.2 Periodic inspection. Periodic inspection shall consist of group B inspection. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.6.2.5), delivery of products which have passed group A shall not be delayed pending the results of the periodic inspection.

4.6.2.1 Group B inspection. Group B inspection shall consist of the inspections specified in table V, in the order shown. Group B inspection shall be made on sample units selected from inspection lots which have passed the group A inspection.

4.6.2.2 Sampling plan. Four sample units (see 4.5.1) shall be selected every 24 months. The first inspection shall be 24 months after the date of notification of qualification.

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

4.6.2.4 Disposition of sample units. Sample units which have been subjected to group B inspection shall not be delivered on any contract or purchase order.

4.6.2.5 Noncompliance. If a sample fails to pass group B inspection, the manufacturer 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, processes, etc., 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 inspection may be reinstituted; however, final acceptance shall be withheld until the group B reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

TABLE V. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph
Cycle life- - - - - - - - - - - - - - - -	3.20	4.7.17
Post electrical test- - - - - - - - - -	3.30	4.7.27

4.6.3 Inspection of packaging. The sampling and inspection of the preservation and interior pack marking shall be in accordance with the group A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129.

4.7 Methods of inspections and tests.

4.7.1 Visual and mechanical inspection. Waveguide switches shall be inspected to verify that the materials, design, construction, physical dimensions, finish, marking and workmanship are in accordance with applicable requirements (see 3.1, 3.4 through 3.4.12, 3.4.14, 3.30 and 3.31).

4.7.2 Screening (see 3.5). Switches shall be screened as specified in 4.7.2.1 through 4.7.2.3.

4.7.2.1 Thermal shock. Switches shall be tested as specified in 4.7.18, except the run-in test of 4.7.3 shall be performed after the thermal shock rather than the electrical post tests.

4.7.2.2 Run-in. Switches shall be tested as specified in 4.7.3.

4.7.2.3 Visual and mechanical inspection. Switches shall be inspected as specified in 4.7.1.

4.7.3 Run-in (see 3.6). "Using the test set-up of figure 1, the switch shall be operated at a rate not to exceed one position per second for 4,800 cycles. One cycle shall consist of switching from the initial position into each other position and returning to the initial position. Switches with externally accessible contacts (such as indicating or interlock circuit contacts) shall have the contact resistance of these contacts measured and recorded both before and after run-in. Any increase in contact resistance greater than 10 percent shall be cause for rejecting these switches."

4.7.4 Pull-in voltage (see 3.7). With the switch at room ambient temperature, connect a voltmeter directly across the input terminals of the selected position. Slowly increase the actuator voltage and note the actual voltage at which the actual switching action occurs. Repeat this test for each position requiring the application of actuator power. Repeat the above procedure with the switch at the lowest and at the highest specified temperatures (see 3.1).

4.7.5 Dropout voltage (see 3.8) (fail-safe type). With the switch at room ambient temperature, connect a voltmeter across the terminals of the selected switch position and apply nominal operating voltage (see 3.1). Gradually reduce the actuator voltage until the switch returns to the deenergized position. The above test shall be repeated for each switch position requiring actuator power.

4.7.6 Operating current (see 3.9). With the switch at room ambient temperature, apply nominal operating voltage (see 3.1) and measure the operating current for each RF position, using the test setup of figure 2. Repeat the above procedure with the switch at the lowest and highest operating temperatures specified (see 3.1).

4.7.7 Holding current (fail-safe and selective type switches (see 3.10). The holding current for each RF position shall be measured using the same procedures and equipment as 4.7.6. The holding current shall be measured at room ambient temperature, at minimum operating temperature and at maximum operating temperature.

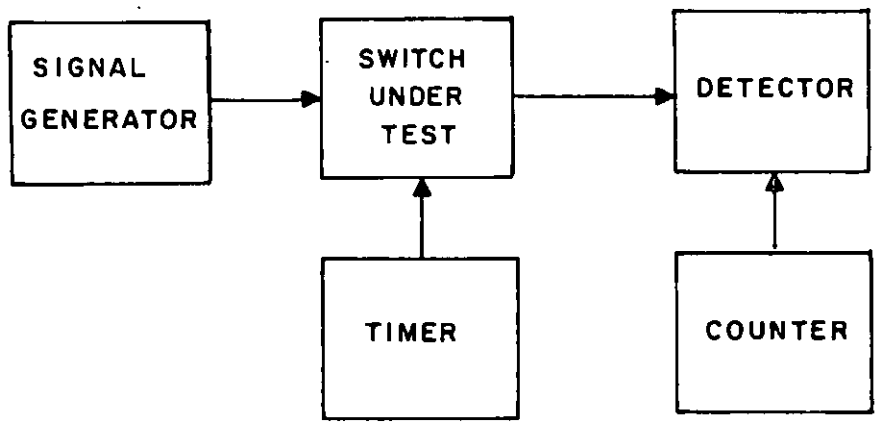


FIGURE 1. Run-in and cycle life test setup.

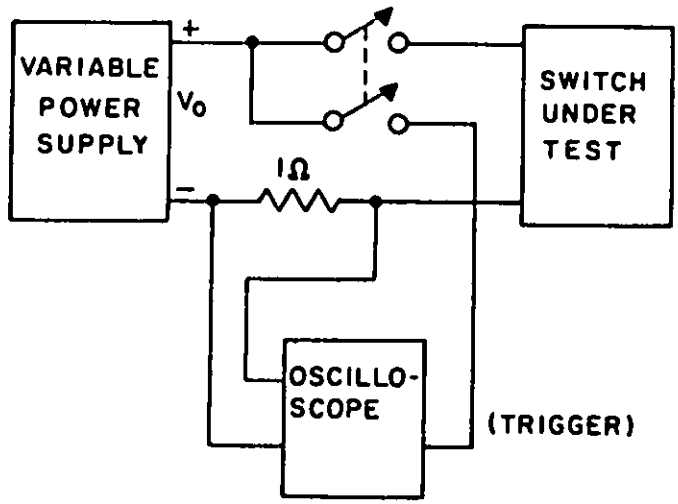


FIGURE 2. Operating and holding current test setup.

4.7.8 Rotor motion delay (see 3.11). With the switch at room ambient temperature, apply nominal operating voltage (see 3.1) and measure the rotor motion delay in both the energized and deenergized position using the test setup of figure 3. Repeat the rotor motion delay measurement for each electrically selected position of the switch.

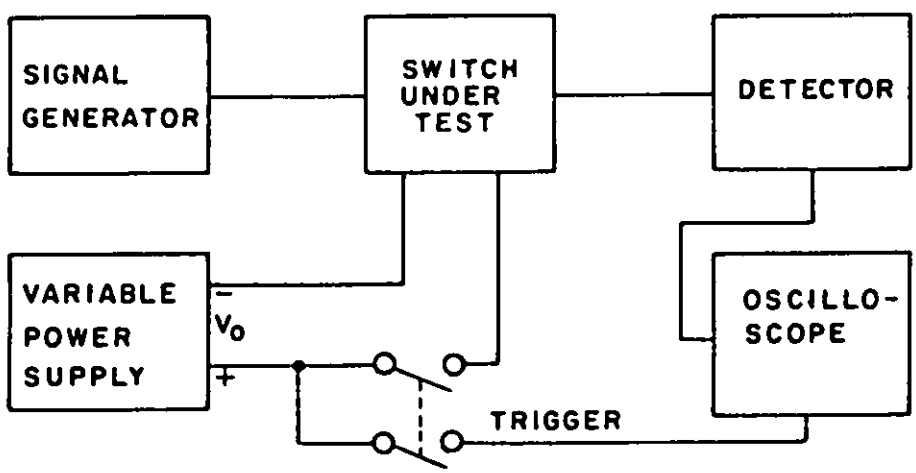


FIGURE 3. Rotor motion delay and switching time test setup.

4.7.9 Dielectric withstanding voltage (see 3.12). Switches shall be tested in accordance with method 301 of MIL-STD-202. The following details apply:

a. Magnitude of test voltage:

(1) AC operated switches - 500 volts RMS plus twice the nominal operating voltage.

(2) DC operated switches - 500 volts dc plus twice the nominal operating voltage.

b. Points of application of test voltage:

(1) Indicator and interlock circuit - The test voltage shall be applied in turn between each separate position indicator and interlock circuit terminal and the switch housing (ground). All open indicator and interlock circuit terminals shall be grounded to the switch housing (ground) for this test.

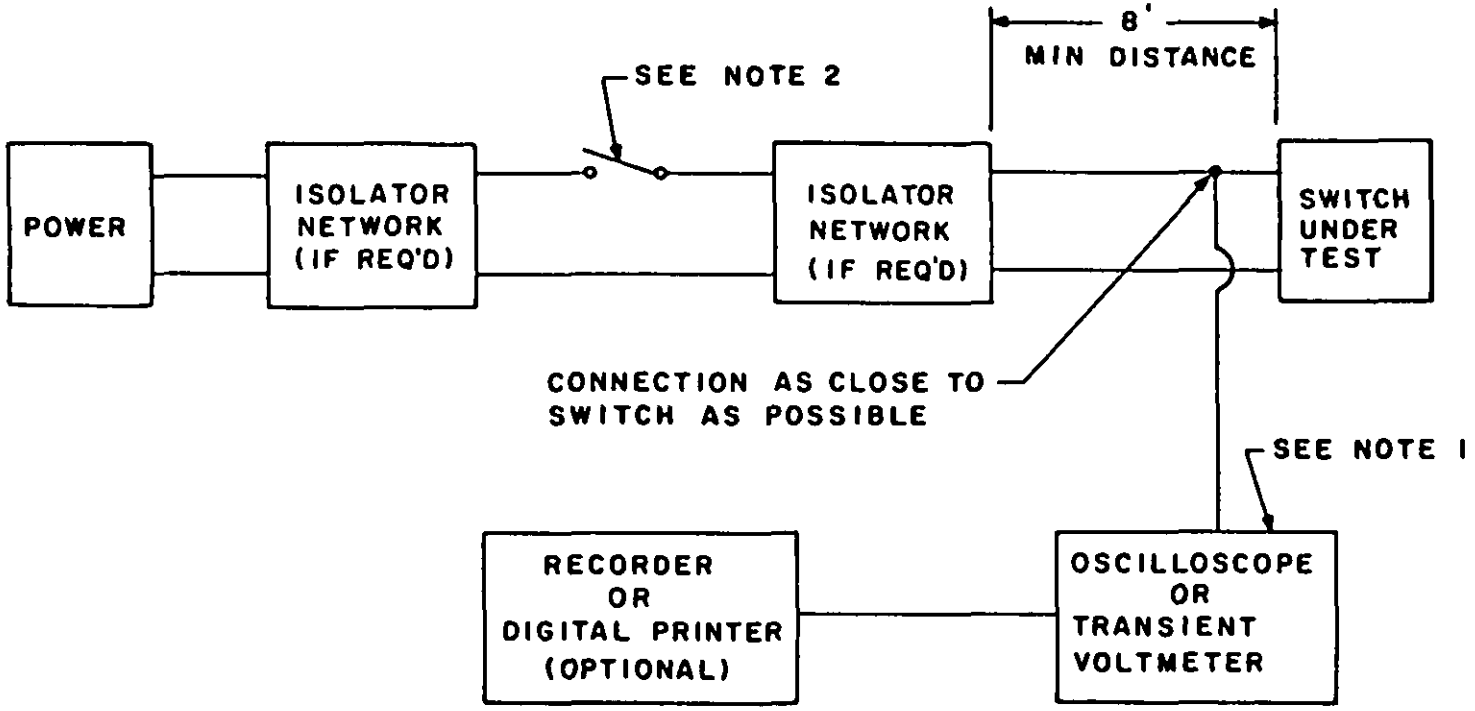
(2) Actuator circuit - The test voltage shall be applied between the actuator terminals and the switch housing (ground). All actuator terminals shall be connected together for this test so that any RFI noise suppression devices are not damaged.

4.7.10 *Transient interference (RFI) (see 3.13).* Transient interference emanating from the switch shall be measured on the power lines using the test procedure of figure 4.

4.7.11 Isolation (see 3.14). Connect the equipment as illustrated in figure 5. The characteristics of the low pass filter shall be such that it will attenuate all harmonics of the RF signal for at least 30 dB. Set the start/stop limits on the sweep oscillator to the specified lowest and highest frequency values, respectively. Connect the calibrated mismatch to the output of the network analyzer. Adjust the horizontal sensitivity of the X-Y recorder for 10 inches of travel and using the sweep oscillator sweep output signal, set the sweep width for the same value. Adjust the RF power level on the sweep oscillator to a level that will provide the best detection efficiency for the detector. With the sweep oscillator adjusted and the network analyzer and X-Y recorder calibrated, draw calibration lines in 1 dB step above and below the specified isolation value of the switch on the X-Y recorder. Remove the calibrated mismatch and insert the switch under test. Terminate all unused ports with matched loads. With the switch at room ambient temperature, apply the nominal operating voltage and record the isolation versus frequency on the recorder. The frequency shall be labled and recorded at not less than 5 equally spaced points evenly distributed across the frequency band. Repeat the above procedures for any other adjacent ports. If the test must be made at fixed frequencies, the test shall be made at not less than 7 equally spaced points evenly distributed across the band width of the switch. The overall inaccuracy of isolation measurements shall be no greater than 5 percent. A means shall be provided for producing a permanent record of the switch's isolation versus frequency if fixed frequencies or other than the above test setup is used..

4.7.12 Voltage standing wave ratio (see 3.15). With the switch at room ambient temperature, apply nominal operating voltage and measure the VSWR for each RF path across the specified range, using the test setup of figure 6. Relatively low RF input power shall be used for this test. Each unused port shall be terminated in a matched load. A means shall be provided for producing a permanent record of the switch's VSWR versus frequency. The VSWR shall be recorded in increments of 0.05 between VSWR limits of 1.02:1 and 1.5:1 and 0.1 above 1.5:1. If the test must be made at fixed frequencies, the test shall be made at not less than 7 equally spaced points evenly distributed across the bandwidth of the switch. If VSWR is not directly measured; that is, if return loss is measured and VSWR calculated from that measurement, the permanent record shall indicate the worst case VSWR numerically and shall provide the calculation used to obtain the calculated VSWR. The measurement system and permanent record shall provide a minimum accuracy of .04 over the frequency ranges below 26.5 GHz and a minimum accuracy of .08 over the frequency ranges 26.5 GHz and above.

4.7.13 *Insertion loss (see 3.16).* With the switch at room ambient temperature, apply nominal operating voltage (see 3.1) and measure the insertion loss for each RF path, using the general test procedures and test setup of 4.7.11. The calibration lines on the recorder shall be .02 dB step above and below the specified insertion loss value. The measurement system and permanent record shall provide a minimum accuracy of .04 dB over the frequency ranges below 26.5 GHz and a minimum accuracy of .08 dB over the frequency ranges 26.5 GHz and above.



NOTES:

1. Oscilloscope or transient volmeter should be of the memory storage type and be capable of detecting and measuring.

Magnitude:	±1 volt to ±1,000 volts
Width	50 nanoseconds to 100 milliseconds
Pulse repetition frequency	single shot to 500 pps

2. Use of a low noise mercury switch is recommended to activate the waveguide switch.
   Procedure:
   a. Activate switch at least 20 times.
   b. Highest reading obtained is to be recorded for both make and break.

FIGURE 4. RFI transient test arrangement and test procedure.

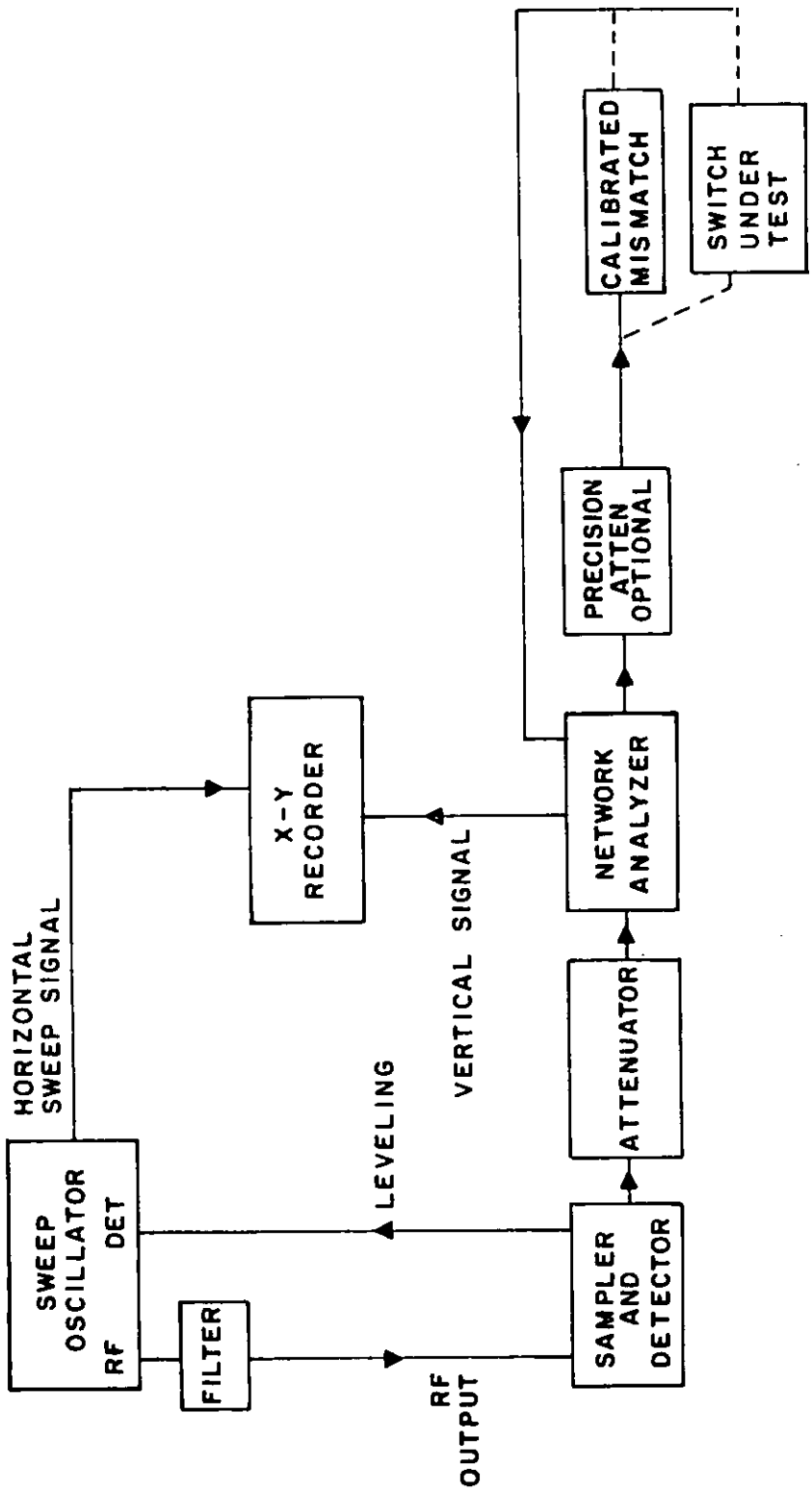


FIGURE 5. Isolation test setup.

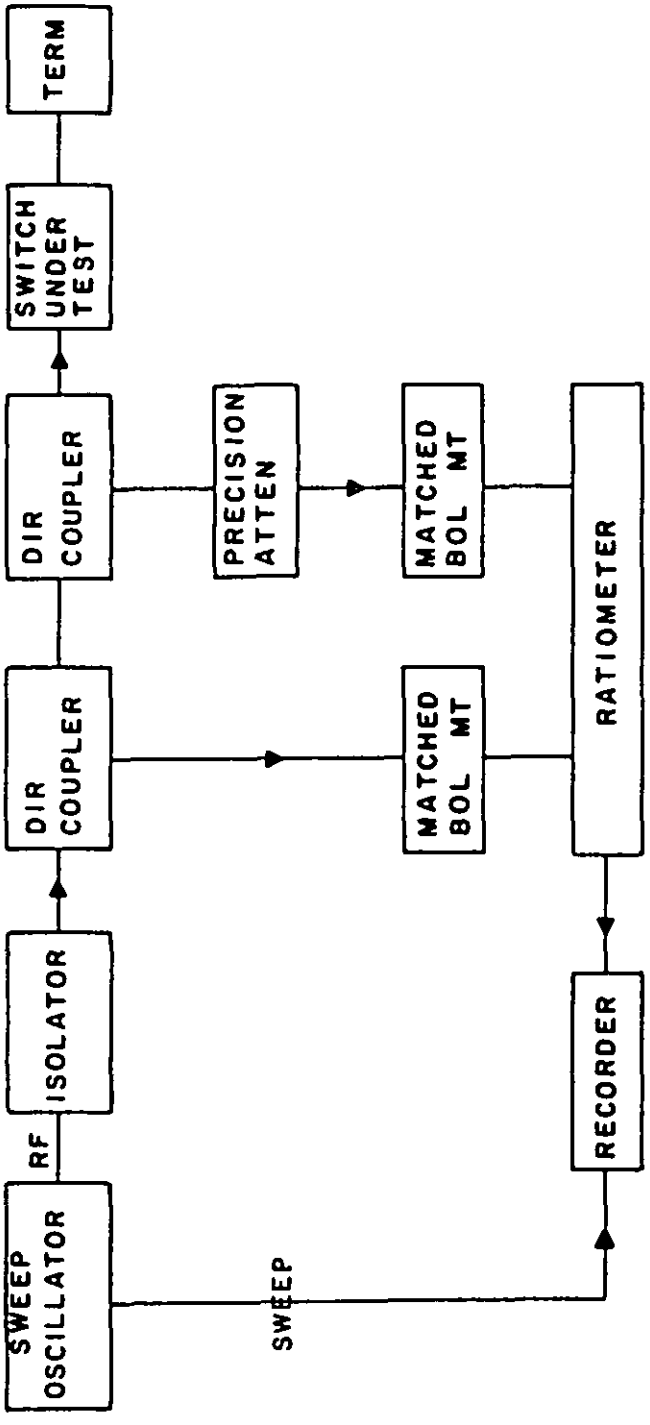


FIGURE 6. Voltage standing wave ratio measurement test setup.

4.7.14 Switching time (see 3.17). For electrically operated switches, the switching time from both the energized and deenergized positions shall be measured, using the test setup of figure 3. With the switch at room ambient temperature, apply RF and dc power and measure the time lapse between application of dc actuator power and final positioning of the RF portion of the switch for the position selected. Measure the time lapse for the switch to go from an energized position to a deenergized position. Repeat these tests for each electrically selected position of the switch.

4.7.15 RF energy leakage (see 3.18). Using the test setup shown in figure 7, the input of the switch shall be furnished with a minimum of 10 milliwatts of RF power at the center frequency of the switch pass band. Each output port shall be terminated in a matched load. The entire external surface of the switch shall be explored for maximum RF leakage. This test shall be repeated for each switch position. The maximum RF leakage shall be no higher than specified (see 3.1).

4.7.16 RF power handling capability (see 3.19). The RF power sources shall be capable of furnishing the specified average and peak power to the input of the switch. The output of the switch shall be terminated into a matched dummy load. When specified (see 3.1), the RF section shall be pressurized; otherwise, the RF section shall be vented to atmospheric pressure (30 ±2 inches mercury) during the test. The power source shall be adjusted to the lowest specified frequency and the specified average power. Apply this power to the input of the switch for at least 1 hour. At the end of this time, remove the average power and apply the specified peak power (at the same frequency) to the input of the switch for at least 5 minutes. Repeat these procedures at the middle frequency and at the highest specified frequency. The above procedure shall be repeated for each position of the switch. If required to switch under power and if the switch design includes interlock circuits used to interrupt the RF power source during switching (see 3.1), the circuits shall be used to do so during this test. During and following the test, the switches shall be examined for evidence of breakdown, charring, arcing or overheating.

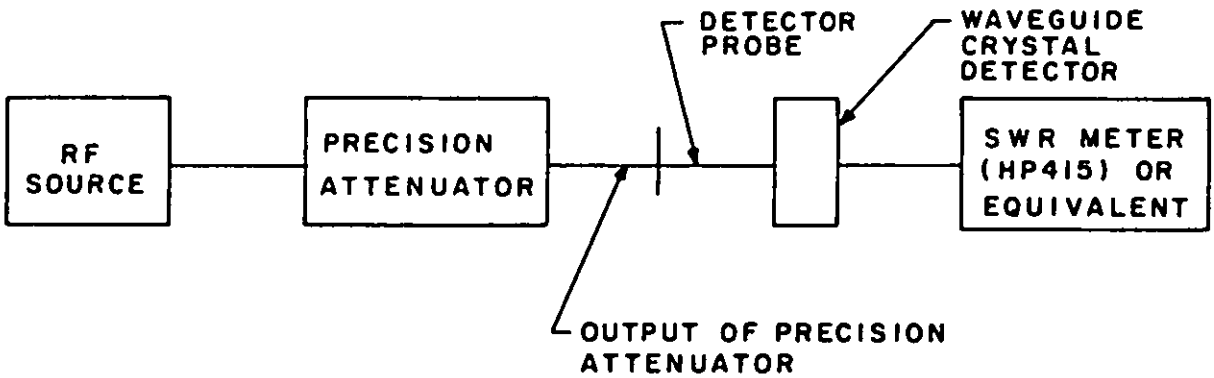
4.7.17 Cycle life (see 3.20). The switch shall be securely mounted on a block weighing not less than 5 times the weight of the switch; the switch temperature shall be allowed to stabilize at room ambient temperature for not less than 1 hour before the beginning of the test. Unless specified, RF power need not be applied to the switch. The switch shall then be operated, at a rate not to exceed one position per second, for the specified number of cycles (see 3.1). One cycle shall consist of switching from the initial position into each other position and returning to the initial position. The operating voltage shall be nominal (+10, -0) percent). When indicator or interlock circuits are included in the design, they shall be energized with the specified current and voltage (see 3.1) during this test. The contact resistance of these circuits shall be measured at the switch connector terminals before and after this test. Following this test, switching time, VSWR, insertion loss and isolation shall be measured as specified in 4.7.14, 4.7.12, and 4.7.11, respectively.

4.7.18 Thermal shock (see 3.21). The switch shall be tested in accordance with test method 107 of MIL-STD-202. Test condition B applies unless otherwise specified (see 3.1). The waveguide ports shall be covered during this test.

4.7.19 Altitude and cold (see 3.22). Switches shall be placed in a pressure chamber maintained at a temperature of -55 +0, -5°C for 24 hours. After temperature stabilization, the switching time shall be measured as specified in 4.7.14 (except the temperature shall be maintained at -55°C). The pressure shall then be reduced from standard barometric pressure to 1.3 inches of mercury (approximately 70,000 feet elevation) and then allowed to stabilize. At this reduced pressure and during the last 4 hours of the 24 hour holding period, the switches shall be tested for dielectric withstanding voltage and switching time as specified in 4.7.9 and 4.7.14, respectively (the reduced pressure and temperature of -55°C shall be maintained). Only one half the voltage specified in 4.7.9 need be applied for the dielectric withstanding voltage test.

4.7.20 Moisture resistance (see 3.23). The switch, with the waveguide ports sealed, shall be tested in accordance with test method 106 of MIL-STD-202 except that steps 7a and 7b may be omitted. The following details apply:

a. Initial measurements - Not applicable.



Test set-up for calibration for RF leakage detector. The calibration sensitivity of the test position shall be 90 dB relative to the power output of the RF source.

FIGURE 7. Test setup for RF leakage.

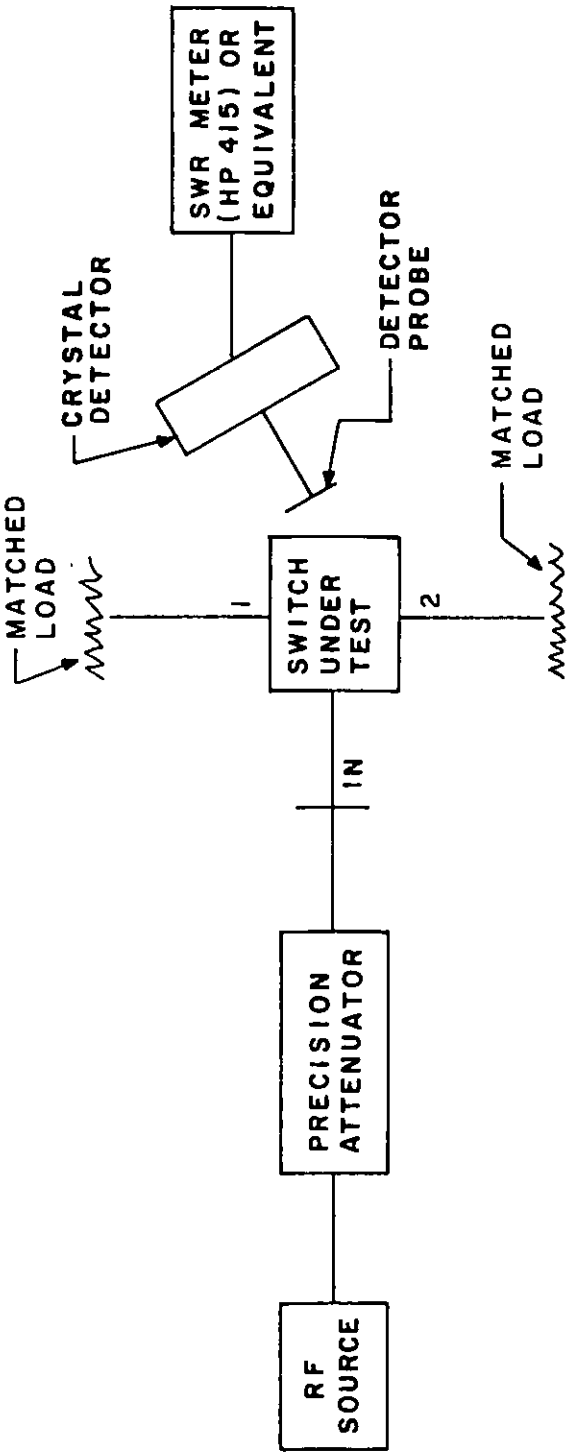


FIGURE 7. Test setup for RF leakage - Continued.

b. Polarization voltage - Not applicable.

c. Loading voltage - Not applicable.

4.7.21 Pressure (see 3.24). With the switch at room ambient temperature, the RF portion shall be capped and then pressurized at the pressure specified (see 3.1). The applied pressure shall be measured at the switch, not at the pressure source. The switch shall then be submerged for one minute in fresh tap water that is at 25 ±5°C. Repeat the test with the switch at the lower temperature extreme.

4.7.22 Vibration (see 3.25). The switch shall be tested in accordance with method 201 of MIL-STD-202 except that the motion shall be applied for a period of 10 minutes in each of the 3 mutually perpendicular directions (a total of 30 minutes). The switch shall be firmly secured to the vibration platform without the use of shock isolators. Unless otherwise specified, the switch need not be energized for this test.

4.7.23 Shock (specified pulse) (see 3.26). The switch shall be securely mounted, without isolators, and subjected to the shock test in accordance with condition K of method 213, MIL-STD-202.

4.7.24 Explosion (see 3.27). The switch shall be tested in accordance with test method 109 of MIL-STD-202. Indicator and interlock circuits shall be energized at rated voltage and current (see 3.1). Unless otherwise specified (see 3.1), switches that are pressurized and are designed so that the switching mechanism is completely isolated from the RF path need not have RF power applied. However, all other switches shall be tested with full RF power applied.

4.7.25 Salt spray (see 3.28). The switch shall be tested in accordance with test condition B of method 101, MIL-STD-202. The waveguide ports shall be sealed during this test.

4.7.26 Sand and dust (see 3.29). The switch shall be tested in accordance with step 1 only of test method 110, MIL-STD-202. The air velocity shall be between 100 and 500 feet per minute. Unless otherwise specified (see 3.1), protective caps shall be used to cover the waveguide ports.

4.7.27 Post electrical tests, environmental. Following the environmental tests, pull-in and dropout voltages, operating and holding currents, rotor motion delay (when specified), dielectric withstanding voltage, isolation, VSWR, insertion loss, and switching time shall be measured as specified in 4.7.4 through 4.7.9 and 4.7.11 through 4.7.14, respectively.

5. PACKAGING

5.1 Preservation. Preservation shall be level A or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Waveguide switches shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Waveguide switches shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. Contact preservatives shall not be used.

5.1.1.4 Unit packs. Waveguide switches shall be individually unit packed in accordance with submethod IIe of MIL-P-116 insuring compliance with the applicable requirements of that specification. The container shall conform to PPP-B-566, PPP-B-676 or PPP-B-636. For waveguide switches exceeding five pounds in weight, the unit pack shall be overwrapped with kraft paper conforming to UU-P-268.

5.1.1.5 Intermediate packs. Intermediate packs are not required.

5.1.2 Level C. The level C preservation for waveguide switches shall conform to the MIL-STD-794 requirements for this level.

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

5.2.1 Level A. The packaged waveguide switches shall be packed in wood boxes conforming to PPP-B-601, overseas type; PPP-B-621, class 2 or PPP-B-585, class 3. Closure and strapping shall be in accordance with the applicable container specification.

5.2.2 Level B. The packaged waveguide switches shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. The requirements for box closure, waterproofing and reinforcing shall be in accordance with method V of the PPP-B-636 appendix.

5.2.3 Level C. The level C packing for waveguide switches shall conform to the MIL-STD-794 requirements for this level.

5.2.4 Unitized loads. Unitized loads, commensurate with the level of packing specified in the contract or purchase order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

5.2.4.1 Level A. Waveguide switches, packed as specified in 5.2.1, shall be unitized on pallets in conformance with MIL-STD-147, load type I, with a wood cap (storage aid 5) positioned over each load.

5.2.4.2 Level B. Waveguide switches, packed as specified in 5.2.2, shall be unitized as specified in 5.2.4.1 except that weather resistant fiberboard caps (storage aid 4) shall be used in lieu of wood caps.

5.2.4.3 Level C. Waveguide switches, packed as specified in 5.2.3, shall be unitized as specified in MIL-STD-794 except that conformance to MIL-STD-147 is not required.

5.3 Marking. In addition to any special or other identification marking required by the contract (see 6.2), each unit, and exterior container and unitized load shall be marked in accordance with MIL-STD-129. The complete military or contractor's type or part number (including the FSCM), as applicable, shall be marked on all unit and intermediate packs in accordance with the identification marking provisions of MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2 and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Packaging inspection. The inspection of these packaging requirements shall be in accordance with 4.6.3.

5.4.3 Army acquisitions.

5.4.3.1 Level A packing. In addition to that specified in 5.2.1, metal strapping shall conform to QQ-S-781, type I, finish A. When the gross weight exceeds 200 pounds or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, 3 x 4 inch skids (laid flat) shall be applied in accordance with the requirements of the container specification. If not described in the container specification, the skids shall be applied in a manner which will adequately support the item and facilitate the use of material handling equipment.

5.4.3.2 Level A and B unitization. Unitization (see 5.2.4) shall be necessary when skids are not required (see 5.4.3.1), when quantities per destination exceed either a total of 250 pounds (excluding the pallet), or when the volume equals 20 cubic feet or more and the container size permits the use of one of the pallet patterns of MIL-STD-147. A quantity of containers, packed as specified in 5.4.3.2, except that the container strapping may be omitted, shall be placed on a pallet, load

type I, conforming to MIL-STD-147. The pallet shall conform to NN-P-71, type IV, using group I or II woods. The loads shall be bonded to the pallet by strapping conforming to QQ-S-781, type I, finish A, or shrink film conforming to L-P-378, type IV. Stretch wrap in accordance with MIL-STD-147 is authorized for shipments within the continental U.S. and for all containerized shipments.

6. NOTES

6.1 Intended use. Waveguide switches covered by this specification are intended for use in waveguide transmission lines for the switching of transmitters, receivers, antennas, etc., in a waveguide connected system.

6.2 Ordering data. Acquisition documents should specify the following:

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

b. Title, number, and date of the applicable specification sheet and part number.

c. Levels of preservation and packing required (see 5.1 and 5.2).

d. If special or other identification marking is required (see 5.3).

6.3 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 applicable qualified products list, whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts for the products covered by this specification. The activity responsible for the qualified products list is the Naval Electronic Systems Command, ELEX 8111, Department of the Navy, Washington, DC 20363 however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), Dayton, OH 45444.

6.3.1 Copies of "Provisions Governing Qualification" SD-6 may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 Definitions. For the purpose of this specification, the following definitions shall apply:

6.4.1 Dropout voltage. The dropout voltage is defined as the minimum operating voltage at which the switch return to the deenergized position.

6.4.2 Fail-safe switch. A fail-safe switch is defined as a switch with an actuator that contains a spring return mechanism that provides RF connection to one selected position when no dc or ac voltage is applied to the switch. This type of switch requires continuous voltage to maintain RF connection to any other position.

6.4.3 Holding current. The holding current is defined as the current required to hold the switch in position after the RF contacts have completely transferred.

6.4.4 Indicating circuit. An indicating circuit is a circuit that remotely indicates the switch position. This is normally done with indicator lights. The indicating circuit is a set of contacts that is controlled by the same shaft as the RF switch.

6.4.5 Latching switch. A latching switch is defined as a switch that contains a mechanism, either mechanical or magnetic, that will maintain a chosen RF position. This is with or without voltage being maintained after the switching action is completed.

6.4.6 Pull-in voltage. The pull-in voltage is defined as the minimum operating voltage at which the switch contacts assume the energized position.

6.4.7 Rotor motion delay. The rotor motion delay is defined as the time between application of the switching voltage and the beginning of rotor motion.

6.4.8 Switching time. The switching time is defined as beginning when the dc operating voltage is first applied and ending when the switch RF signal reaches its steady-state value. Switching time consists of the following time elements:

a. Inductive delay time in the actuator coil.

b. Transfer time of the RF contacts.

c. Bounce time of the RF contacts.

6.4.9 Transfer switch. A transfer switch is defined as a switch with four-port and provides two independent pairs of RF paths. These pairs are actuated simultaneously.

6.4.10 Operating current. The operating current is that current required for satisfactorily operation of the switch. The value of the current is normally specified for operation at room ambient temperature.

6.4.11 Interlock circuits. A interlock circuit is design into a latching type of switch. The switch will remain in the last position, until the switch is re-energized.

6.5 Occupation Safety and Health Administration (OSHA). OSHA review completed; no further review required.

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.

Custodians:
Army - ER
Navy - EC
Air Force - 85

Review activities:
Army - MI, SM
Navy - OS, SH
Air Force - 11, 17, 99
DLA - ES

User activities:
Army - AV
Navy - AS, MC
Air Force - 19

Agent:
DLA - ES

Preparing activity:
Navy - EC

(Project 5985-0975)

APPENDIX

GROUP QUALIFICATION

10 SCOPE

10.1 Scope. This appendix provides manufacturers a grouping that can be used to obtain qualification for a number of items by qualifying one item in a group. The grouping shall be in accordance with the following table. Manufacturers may qualify at a lower frequency range than listed in the table. This will qualify switches with the stated characteristics in a group from this frequency range down to the lowest frequency range specified.

10.2 Group qualification. Group qualification of switches having requirements for interlock circuit, rotor motion delay, transient interference, RF energy leakage, pressure, explosion or salt spray is not permitted unless these tests are performed on the qualifying switch.

TABLE VI. Grouping for qualification.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
1	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 1.7-2.6 GHz Screened DC or AC energizing voltage 1P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency range 1.7-2.6 GHz to .32-.49 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
2	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 1.7-2.6 GHz Nonscreened DC or AC energizing voltage 1P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
3	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 1.7-2.6 GHz Screened DC or AC energizing voltage 1P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
4	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 1.7-2.6 GHz Nonscreened DC or AC energizing voltage 1P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T

TABLE VI. Grouping for qualification - Continued.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
5	Rectangular waveguide Cover face Manual Frequency range 1.7-2.6 GHz Screened 1P2T	Rectangular waveguide Cover face Manual Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Screened or nonscreened 1P2T
6	Rectangular waveguide Cover face Manual Frequency range 1.7-2.6 GHz Nonscreened 1P2T	Rectangular waveguide Cover face Manual Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Nonscreened 1P2T
7	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 1.7-2.6 GHz Screened DC or AC energizing voltage 2P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Screened or nonscreened DC or AC energizing voltage 2P2T
8	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 1.7-2.6 GHz Nonscreened DC or AC energizing voltage 2P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Nonscreened DC or AC energizing voltage 2P2T
9	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 1.7-2.6 GHz Screened DC or AC energizing voltage 2P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Screened or nonscreened DC or AC energizing voltage 2P2T
10	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 1.7-2.6 GHz Nonscreened DC or AC energizing voltage 2P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 1.7-2.6 GHz to .32-.49 GHz Nonscreened DC or AC energizing voltage 2P2T

TABLE VI. Grouping for qualification - Continued.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
11	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 18-26.5 GHz Screened DC or AC energizing voltage 1P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
12	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 18-26.5 GHz Nonscreened DC or AC energizing voltage 1P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
13	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 18-26.5 GHz Screened DC or AC energizing voltage 1P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
14	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 18-26.5 GHz Nonscreened DC or AC energizing voltage 1P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
15	Rectangular waveguide Cover face Manual Frequency range 18-26.5 GHz Screened 1P2T	Rectangular waveguide Cover face Manual Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Screened or nonscreened 1P2T
16	Rectangular waveguide Cover face Manual Frequency range 18-26.5 GHz Nonscreened 1P2T	Rectangular waveguide Cover face Manual Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Nonscreened 1P2T

TABLE VI. Grouping for qualification - Continued.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
17	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 18-26.5 GHz Screened DC or AC energizing voltage 2P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Screened or nonscreened DC or AC energizing voltage or manual 2P2T
18	Rectangular waveguide Choke face Fail-safe With indicator Frequency range 18-26.5 GHz Nonscreened DC or AC energizing voltage 2P2T	Rectangular waveguide Choke or cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Nonscreened DC or AC energizing voltage or manual 2P2T
19	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 18-26.5 GHz Screened DC or AC energizing voltage 2P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Screened or nonscreened DC or AC energizing voltage or manual 2P2T
20	Rectangular waveguide Cover face Fail-safe With indicator Frequency range 18-26.5 GHz Nonscreened DC or AC energizing voltage 2P2T	Rectangular waveguide Cover face Fail-safe or latching With or without indicator Frequency ranges 18-26.5 GHz to 2.2-3.3 GHz Nonscreened DC or AC energizing voltage 2P2T
21	Rectangular waveguide Choke or contact face Fail-safe With indicator Frequency range 220-325 GHz Screened DC or AC energizing voltage 1P2T	Rectangular waveguide Choke, cover, or contact face Fail-safe or latching With or without indicator Frequency ranges 220-325 GHz to 22-33 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P2T or 1P1T
22	Rectangular waveguide Choke or contact face Fail-safe With indicator Frequency range 220-325 GHz Nonscreened DC or AC energizing voltage 1P2T	Rectangular waveguide Choke, contact, or cover face Fail-safe or latching With or without indicator Frequency ranges 220-325 GHz to 22-33 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T

TABLE VI. Grouping for qualification - Continued.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
23	Rectangular waveguide Cover or contact face Fail-safe With indicator Frequency range 220-325 GHz Screened DC or AC energizing voltage 1P2T	Rectangular waveguide Cover or contact face Fail-safe or latching With or without indicator Frequency ranges 220-325 GHz to 22-33 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
24	Rectangular waveguide Cover or contact face Fail-safe With indicator Frequency range 220-325 GHz Nonscreened DC or AC energizing voltage 1P2T	Rectangular waveguide Cover or contact face Fail-safe or latching With or without indicator Frequency ranges 220-325 GHz to 22-33 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
25	Rectangular waveguide Cover or contact face Manual Frequency range 220-325 GHz Screened 1P2T	Rectangular waveguide Cover or contact face Manual Frequency ranges 220-325 GHz to 22-33 GHz Screened or nonscreened 1P2T
26	Rectangular waveguide Cover or contact face Manual Frequency range 220-325 GHz Nonscreened 1P2T	Rectangular waveguide Cover or contact face Manual Frequency ranges 220-325 GHz to 22-33 GHz Nonscreened 1P2T
27	Rectangular waveguide Choke or contact face Fail-safe With indicator Frequency range 220-325 GHz Screened DC or AC energizing voltage 2P2T	Rectangular waveguide Choke, contact, or cover face Fail-safe or latching With or without indicator Frequency ranges 220-325 GHz to 22-33 GHz Screened or nonscreened DC or AC energizing voltage 2P2T
28	Rectangular waveguide Choke or contact face Fail-safe With indicator Frequency range 220-325 GHz Nonscreened DC or AC energizing voltage 2P2T	Rectangular waveguide Choke, contact, or cover face Fail-safe or latching With or without indicator Frequency ranges 220-325 GHz to 22-33 GHz Nonscreened DC or AC energizing voltage 2P2T

TABLE VI. Grouping for qualification - Continued.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
29	Rectangular waveguide Cover or contact face Fail-safe With indicator Frequency range 220-325 GHz Screened DC or AC energizing voltage 2P2T	Rectangular waveguide Cover or contact face Fail-safe or latching With or without indicator Frequency ranges 220-325 GHz to 22-33 GHz Screened or nonscreened DC or AC energizing voltage 2P2T
30	Rectangular waveguide Cover or contact face Fail-safe With indicator Frequency range 220-325 GHz Nonscreened DC or AC energizing voltage 2P2T	Rectangular waveguide Cover or contact face Fail-safe or latching With or without indicator Frequency range 220-325 GHz to 22-33 GHz Nonscreened DC or AC energizing voltage 2P2T
31	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 18-40 GHz Screened DC or AC energizing voltage 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Fail-safe or latching With or without indicator Frequency ranges 18-40 GHz to 1.4-5.0 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
32	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 18-40 GHz Nonscreened DC or AC energizing voltage 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Fail-safe or latching With or without indicator Frequency ranges 18-40 GHz to 1.4-5.0 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
33	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 1.5-3.6 GHz Screened DC or AC energizing voltage 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Fail-safe or latching With or without indicator Frequency ranges 1.5-3.6 GHz to .108-.39 GHz Screened or nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T
34	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 1.5-3.6 GHz Nonscreened DC or AC energizing voltage 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Fail-safe or latching With or without indicator Frequency ranges 1.5-3.6 GHz to .108-.39 GHz Nonscreened DC or AC energizing voltage or manual 1P1T or 1P2T

TABLE VI. Grouping for qualification - Continued.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
35	Double ridge waveguide 2.4:1 ratio Manual Frequency range 18-40 GHz Screened 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Manual Frequency ranges 18-40 GHz to 1.4-5.0 GHz Screened or nonscreened 1P2T
36	Double ridge waveguide 2.4:1 ratio Manual Frequency range 18-40 GHz Nonscreened 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Manual Frequency ranges 18-40 GHz to 1.4-5.0 GHz Nonscreened 1P2T
37	Double ridge waveguide 2.4:1 ratio Manual Frequency range 1.5-3.6 GHz Screened 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Manual Frequency ranges 1.5-3.6 GHz to .108-.39 GHz Screened or nonscreened 1P2T
38	Double ridge waveguide 2.4:1 ratio Manual Frequency range 1.5-3.6 GHz Nonscreened 1P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Manual Frequency ranges 1.5-3.6 GHz to .108-.39 GHz Nonscreened 1P2T
39	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 18-40 GHz Screened DC or AC energizing voltage 2P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Fail-safe or latching With or without indicator Frequency ranges 18-40 GHz to 1.4-5.0 GHz Screened or nonscreened DC or AC energizing voltage 2P2T
40	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 18-40 GHz Nonscreened DC or AC energizing voltage 2P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Fail-safe or latching With or without indicator Frequency ranges 18-40 GHz to 1.4-5.0 GHz Nonscreened DC or AC energizing voltage 2P2T
41	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 1.5-3.6 GHz Screened DC or AC energizing voltage 2P2T	Double or single ridge waveguide 2.4:1 or 3.6:1 ratio Fail-safe or latching With or without indicator Frequency ranges 1.5-3.6 GHz to .108-.39 GHz Screened or nonscreened DC or AC energizing voltage 2P2T

TABLE VI. Grouping for qualification - Continued.

Group number	Characteristics of qualifying switch	Characteristics of switches qualified
42	Double ridge waveguide 2.4:1 ratio Fail-safe With indicator Frequency range 1.5-3.6 GHz Nonscreened DC or AC energizing voltage 2P2T	Double or single ridge waveguide 2.4:1 ratio Fail-safe or latching With or without indicator Frequency ranges 1.5-3.6 GHz to .108-.39 GHz Nonscreened DC or AC energizing voltage 2P2T

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-S-55041C	Switches, Waveguide General Specification For

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

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

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

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