

INCH-POUND
MIL-DTL-5423E
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SUPERSEDING
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## DETAIL SPECIFICATION

### BOOTS, DUST AND MOISTURE SEAL (FOR TOGGLE AND PUSH-BUTTON SWITCHES, CIRCUIT BREAKERS, AND ROTARY-ACTUATED PARTS), 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 molded silicone rubber boots which can be used on component parts such as toggle and pushbutton switches, circuit breakers, and rotary-actuated parts such as rotary switches, variable resistors, capacitors, inductors, and transformers. The boots protect the component parts-actuating mechanism from sand, dust, water and other contaminants, and seal the panel on which the component parts are mounted.

1.2 Classification. The boots covered by this specification be one of the types and styles as shown below. The applicable information will be as shown on the individual specification sheet (see [3.1](#)).

Type A - For panel mounted toggle switches and circuit breakers.

- Style 1 - One-hole mounting, enclosed.
- Style 3 - One-hole mounting, through.
- Style 4 - Three-hole mounting, through.
- Style 6 - One-hole mounting, miniature, enclosed.
- Style 7 - One-hole mounting, subminiature, enclosed.
- Style 8 - One-hole mounting, subminiature, through.
- Style 9 - Five-hole mounting, through.
- Style 10 - Panel bushing seal only.

Type B - For bushing mounted pushbutton switches.

- Style 1 - One-hole mounting adapter type.
- Style 2 - One-hole mounting drilled panel.
- Style 3 - One-hole mounting through.
- Style 4 - One-hole mounting miniature, drilled panel.
- Style 5 - Three-hole mounting (for telephone handset switches).

Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to <a href="mailto:switch@dla.mil">switch@dla.mil</a> . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <a href="http://www.assist.daps.dla.mil/">http://www.assist.daps.dla.mil/</a> .
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Type C - For bushing mounted rotary actuated parts.

Type D - For use as seals for lever operated circuit breakers.

Style 1 - Panel mounted without mounting frame.

Style 2 - Panel mounted complete with mounting frame.

1.2.1 Military Part or Identifying Number (PIN). The term Part or Identifying Number (PIN) is equivalent to the term part number which was previously used in this specification. The military PIN (when applicable) will consist of the letter "M", the basic number of the specification sheet, an assigned dash number (see [3.1](#)).

<u>M</u>	<u>5423/07</u>	<u>-06</u>
Military designator	Specification sheet number	Dash number

## 2 APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections [3](#) and [4](#) of this specification. This section does not include document cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections [3](#) and [4](#) of this specification, whether or not they are listed.

### 2.2 Governments documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

#### FEDERAL STANDARDS

[FED-STD-H28](#) - Screw Thread Standards for Federal Services.

#### COMMERCIAL ITEM DESCRIPTIONS

[A-A-59588](#) - Rubber, Silicone.

#### DEPARTMENT OF DEFENSE SPECIFICATIONS

[MIL-DTL-7703](#) - Guard, Switch.

#### DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-202](#) - Test Methods for Electronics and Electrical Component Parts.

[MIL-STD-1285](#) - Marking of Electrical and Electronic Parts.

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

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2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

[SAE-AMS-QQ-N-290](#) - Nickel Plating (Electrodeposited).

(Copies of these documents are available online at <http://www.sae.org> or from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania, 15096-0001)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3.0 REQUIREMENTS

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

3.2 First article and quality conformance inspections. When specified (see [6.2](#)), a sample shall be subjected to first article inspection in accordance to [4.3](#)

3.3 Materials. The materials shall be as specified herein. However, when definite materials are not specified, materials shall be used which will enable the boots 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 (see [4.2](#)).

3.3.1 Silicone rubber. Boots shall be molded of silicone rubber in accordance with [A-A-59588](#), class 3a, grades 25, 50, or 60 as specified (see [3.1](#)). Unless otherwise specified (see [6.2](#)), the color shall be gray.

3.3.2 Metals. Metals shall be of corrosion resistant material, or shall be suitably protected to resist corrosion. Alternative protective finishes, as approved by the qualifying activity. For additional information and guidance on plating, see [6.4](#).

3.3.3 Lubricant. Sealing portions of the boot which come in intimate contact with the actuating lever or shaft of the component part on which it is mounted, shall be lubricated as specified (see [3.1](#)) with a transparent permanent lubricant. The lubricant shall not cause deleterious effects in the physical properties of the rubber; i.e., deterioration of the rubber, embrittlement, softening or swelling of the rubber, and shall in no manner prevent the boots from complying with any other requirements of this specification.

3.3.4 Pure tin. The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of switch components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see [6.4.2](#)).

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3.4 Design and construction. Boots shall be of the design, construction, and physical dimensions specified (see [3.1](#)). For boots having metal inserts, design of the insert shall provide for mechanical (metal-to-panel) stop against the panel to which the boot is mounted. The purpose of the stop is to prevent over-tightening of the boot and to avoid damage to the sealing member. Unless otherwise specified, all threaded parts shall be in accordance with [FED-STD-H28](#).

3.5 Restoring force (torque) (applicable only to type A boots without shielding). When boots are tested in accordance with [4.6.2](#), the force required to restore the boot to either extreme position shall not exceed 5 inch-ounces unless otherwise specified (see [3.1](#)). The time to complete the switch actuator movement a minimum of 20 degrees shall not exceed 5 seconds in either direction.

3.6 Watertightness. When boots are tested as specified in [4.6.3](#) through [4.6.3.2](#), as applicable, there shall be no evidence of water leakage into the test enclosure, or a continuous stream of air bubbles through or around the component-part mounting bushing, if applicable.

3.7 Durability.

3.7.1 Operation of guards (applicable only to type A styles used with hinged-type guards (see [3.1](#))). When boots are tested as specified in [4.6.4.1](#), type A boots suitable for use with hinged-type guards, such as those in accordance with [MIL-DTL-7703](#), shall not interfere with the satisfactory operation of the guard. There shall be no evidence of damage to the boot.

3.7.2 Installation. When boots are tested as specified in [4.6.4.2](#), there shall be no evidence of tearing of the boot.

3.8 Sand and dust. When boots are tested as specified in [4.6.5](#), there shall be no evidence of entrance of sand or dust from the front of the switch panel.

3.9 Vibration. When boots are tested as specified in [4.6.6](#), there shall be no evidence of loosening of the boot.

3.10 Salt Atmosphere (corrosion) (applicable only to boots with threaded inserts or metal frames). As a result of the test specified in [4.6.7](#), there shall be no evidence of excessive corrosion. Excessive corrosion shall be construed as any corrosion which exposes the base metal.

3.11 Endurance. When boots are tested as specified in [4.6.8](#) through [4.6.8.3](#), there shall be no evidence of brittleness or cracking. The boot shall not cause the switch actuator to bind or malfunction during the test.

3.12 Lubricant. When tested as specified in [4.6.9.1](#), the lubricant shall show no signs of flow, creep, or spread, nor shall the lubricant sink into the rubber thicken, evaporate, or leave a dry, opaque film or residue. The lubricant shall not have congealed to a point where it no longer functions as a lubricant when tested as specified in [4.6.9.2](#).

3.13 RFI shielding (applicable only to boots having an RFI shielding rating - "S"). When boots are tested in accordance [4.6.10](#), the resistance value shall not exceed 1 ohm before the endurance test and 1.5 ohms following the endurance test.

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3.14 Marking. The unit package shall be marked in accordance with method I of [MIL-STD-1285](#). The marking shall include as a minimum:

- a. Military Part or Identifying Number (PIN)
- b. Manufacturer's name, trademark, or federal supply code for manufacturers.
- c. Date code.

3.15 Workmanship. Boots shall be processed in such a manner as to permit them to meet all the requirements of this specification. Flash shall be kept to a minimum consistent with good molding practice, and in no case shall rubber prevent the proper installation of the boot on the applicable switch or test plug.

## 4. VERIFICATION

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

- a. Materials inspection (see [4.2](#)).
- b. First article inspection (see [4.4](#)).
- c. Conformance inspection (see [4.5](#)).

4.2 Materials inspection. Materials inspection shall consist of certification, supported by verifying data, that the materials listed in [table I](#) that are used in fabricating the boots are in accordance with the applicable referenced specifications or requirements prior to such fabrication (see [3.3](#)).

TABLE I. Materials inspection.

Material	Requirement Paragraph	Applicable specification
Silicon rubber	<a href="#">3.3.1</a>	<a href="#">A-A-59588</a>
Material/plating	<a href="#">3.3.2</a>	<a href="#">SAE-AMS-QQ-N-290</a> <sup>1/</sup>

<sup>1/</sup> Alternative protective finishes, as approved by the qualifying activity, may be utilized. For additional information on plating see [6.4](#).

4.3 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](#).

4.3.1 Test plugs. The installation, sand and dust, vibration, endurance, and watertightness inspections of type C boots shall be made while the boots are mounted on test plugs which shall be assembled from interchangeable shafts and bushings in accordance with [figure 1](#). The details of shafts and bushings to be used in the assembly of the applicable test plugs shall be as specified (see [3.1](#)). Fifty percent of the boots shall be tested with the applicable maximum shaft-size test plug and fifty percent of the boots shall be tested with the applicable minimum shaft-size test plug

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4.4 First article inspection. First article 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 (see [3.2](#)).

4.4.1 Sample size. Ten sample boots of each military PIN shall be subjected to qualification inspection as specified in [table II](#) or [III](#), as applicable.

4.4.2 Test slab. A 6-inch by 6-inch by 0.075-inch thick slab of rubber as the same grade (see [3.1](#) and [3.3.1](#)) as the boots under test shall be submitted for the lubricant test.

4.4.3 Failures. One or more failures shall be cause for refusal to grant qualification approval.

4.4.4 Verification of Qualification. Every 12 months, the manufacturer shall provide verification of qualification to the qualifying activity. Continuation is based on meeting the following requirements:

- a. Design of switch has not been modified (every 12 months).
- b. Verification of group A lot acceptance (every 12 months).
- c. Verification of group B lot acceptance (every 12 months).

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspections.

4.5.1.1 Inspection lot. An inspection lot shall consist of all of the boots of the same type, style, and size 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 IV](#).

4.5.1.2.1 Sampling plan. Samples shall be randomly selected in accordance with [table V](#), group A inspection sampling plan. For acceptance of the lot there shall be zero occurrences of defects.

4.5.1.2.2 Rejected lots. If an inspection lot is rejected, the lot shall be 100 percent inspected for the defects noted. The contractor may correct all of the defects or remove all of the defective units from the lot. The lot shall then be sampled and inspected again in accordance with [tables II](#) and [V](#). For acceptance, there shall be zero occurrences of defects. 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 passed all the group A inspection shall be delivered on a contract or purchase order if the lot is accepted.

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TABLE II. First article inspection (non-RFI shielded boots).

Inspection	Requirement paragraph	Test method paragraph
<u>Group I</u> All sample units (10)		
Visual and mechanical inspection	<a href="#">3.1</a> , <a href="#">3.3</a> , <a href="#">3.4</a> , <a href="#">3.14</a> , <a href="#">3.15</a>	<a href="#">4.6.1</a>
Restoring force (type A only)	<a href="#">3.5</a>	<a href="#">4.6.2</a>
Watertightness (preliminary)	<a href="#">3.6</a>	<a href="#">4.6.3.1</a>
<u>Group II</u> 6 sample units		
Durability		
Operation of guards <u>1/</u>	<a href="#">3.7.1</a>	<a href="#">4.6.4.1</a>
Installation	<a href="#">3.7.2</a>	<a href="#">4.6.4.2</a>
Sand and dust	<a href="#">3.8</a>	<a href="#">4.6.5</a>
<u>Group III</u> 4 sample units		
Vibration	<a href="#">3.9</a>	<a href="#">4.6.6</a>
Salt Atmosphere (corrosion) <u>2/</u>	<a href="#">3.10</a>	<a href="#">4.6.7</a>
<u>Group IV</u> All sample units		
Endurance	<a href="#">3.11</a>	<a href="#">4.6.8</a> through <a href="#">4.6.8.3</a>
Watertightness (final)	<a href="#">3.6</a>	<a href="#">4.6.3.2</a>
<u>Group V</u> <u>3/</u>		
Lubricant	<a href="#">3.12</a>	<a href="#">4.6.9</a>

1/ Applicable only to type A boot styles used with hinged-type guards.

2/ Applicable to boots with metal inserts or metal frames.

3/ Test to be conducted on sample slab.

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TABLE III. First article inspection (RFI shielded boots).

Inspection	Requirement paragraph	Test method paragraph
<u>Group I</u> All sample units (10) Visual and mechanical inspection Watertightness (preliminary)	<a href="#">3.1</a> , <a href="#">3.3</a> , <a href="#">3.4</a> , <a href="#">3.14</a> , <a href="#">3.15</a> <a href="#">3.6</a>	<a href="#">4.6.1</a> <a href="#">4.6.3.1</a>
<u>Group II</u> 6 sample units Installation Sand and dust RFI shielding (3 samples only)	<a href="#">3.7.2</a> <a href="#">3.8</a> <a href="#">3.13</a>	<a href="#">4.6.4.2</a> <a href="#">4.6.5</a> <a href="#">4.6.10</a>
<u>Group III</u> 4 sample units Vibration Salt Atmosphere (corrosion) <u>1/</u>	<a href="#">3.9</a> <a href="#">3.10</a>	<a href="#">4.6.6</a> <a href="#">4.6.7</a>
<u>Group IV</u> 7 sample units <u>2/</u> Endurance Watertightness (final) RFI shielding	<a href="#">3.11</a> <a href="#">3.6</a> <a href="#">3.13</a>	<a href="#">4.6.8</a> through <a href="#">4.6.8.3</a> <a href="#">4.6.3.2</a> <a href="#">4.6.10</a>
<u>Group V</u> <u>3/</u> Lubricant <u>4/</u>	<a href="#">3.12</a>	<a href="#">4.6.9</a>

1/ Applicable only to type A boot styles used with hinged-type guards.

2/ Applicable to boots with metal inserts or metal frames.

3/ Test to be conducted on sample slab.

4/ Test not required if conducted under [table II](#).

TABLE IV. Group A inspection.

Inspection	Requirement paragraph	Method Paragraph
Visual and mechanical inspection Marking Workmanship	<a href="#">3.1</a> , <a href="#">3.3</a> , <a href="#">3.4</a> <a href="#">3.14</a> <a href="#">3.15</a>	<a href="#">4.6.1</a>



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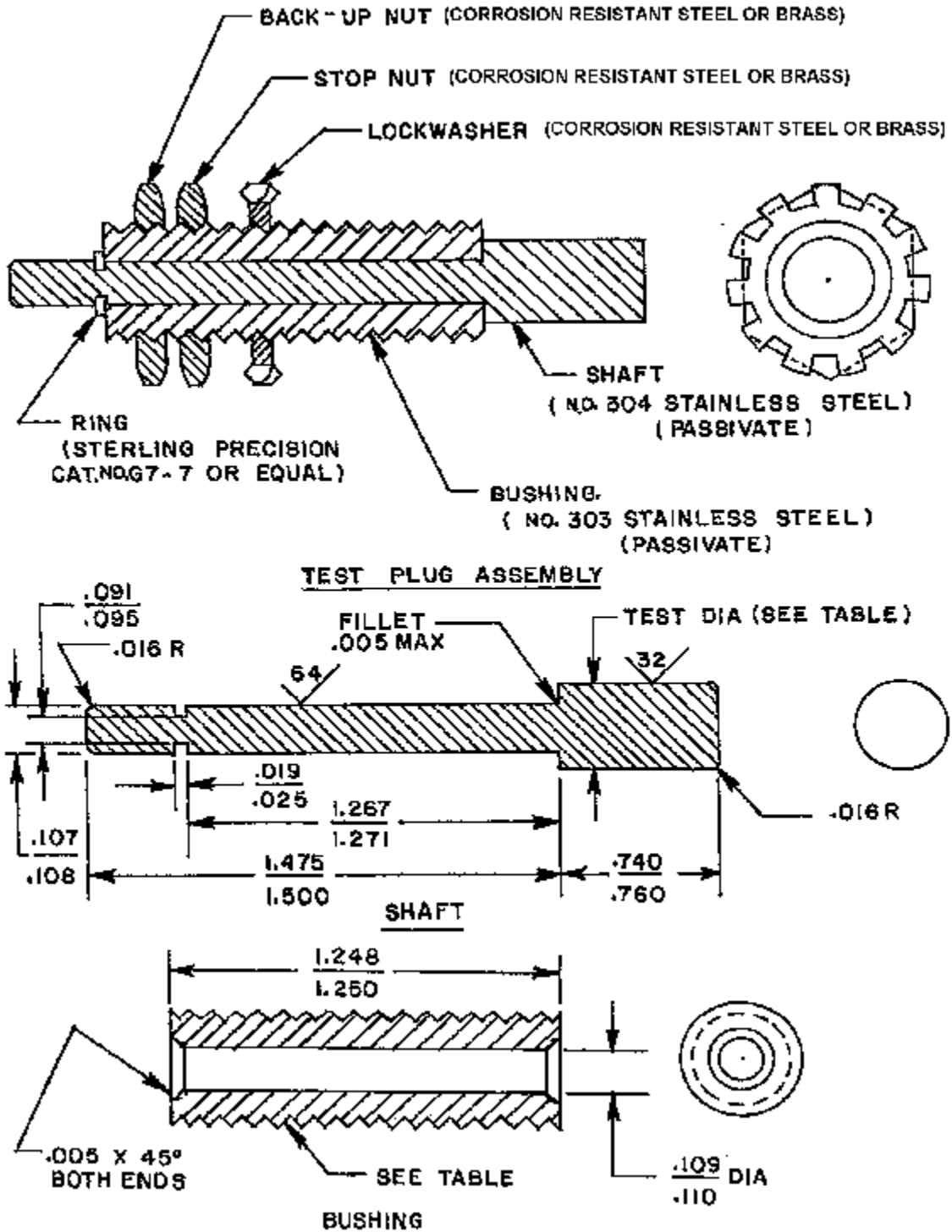


FIGURE 1. Test plugs for inspection of type C boots

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SHAFT DETAILS

Shaft letter	Shaft size	Shaft test diameter, $\pm$ .001
A	.125 Min	0.121
B	.125 Max	0.128
C	.250 Min	0.246
D	.250 Max	0.253
E	.375 Min	0.371
F	.375 Max	0.378

BUSHING DETAILS

Bushing number	Thread
1	.250 -32 NEF-2A
2	.375 -32 NEF-2A
3	.469 -32 NS-2A
4	.500 -32 NS-2A
5	.625 -24 NEF-2A

Inches	mm	Inches	Mm	Inches	mm
0.001	0.03	0.109	2.77	0.76	19.3
0.005	0.13	0.11	2.79	1.248	31.7
0.016	0.41	0.121	3.07	1.25	31.75
0.019	0.48	0.125	3.18	1.267	32.18
0.025	0.64	0.25	6.35	1.271	32.28
0.091	2.31	0.375	9.53	1.475	37.47
0.095	2.41	0.469	11.91	1.5	38.1
0.107	2.72	0.5	12.7	0.76	19.3
0.108	2.74	0.74	18.8		

## NOTES:

1. Dimensions are in inches.
2. Alternative base metals and protective finishes, as approved by the qualifying activity, may be utilized for lock washer. Dimensions shall be in accordance with the referenced hardware specification.

FIGURE 1. Test plugs for inspection of type C boots – continued

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TABLE V. Zero defect sampling plan.

Lot size	Number of switches to be tested <sup>1/</sup>	
	Group A inspection	Group B inspection
1 - 2	All	All
3 - 5	All	2
6 - 15	5	2
16 - 25	5	3
26 - 50	5	5
51 - 90	7	5
91 - 150	11	6
151 - 280	13	7
281 - 500	16	9
501 - 1,200	19	11
1,201 - 3,200	23	13
3,201 - 10,000	29	15
10,001 - 35,000	35	15

<sup>1/</sup> For lot sizes that are less than required sample size, all switches shall be tested.

4.5.1.3 Group B inspection. Group B inspection shall consist of the inspections specified in [table VI](#) in the order shown, and the sample shall be selected from inspection lots that have passed group A inspection.

4.5.1.3.1 Sampling plan. Samples shall be randomly selected in accordance with [table V](#), group B inspection sampling plan. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. For acceptance of the lot there shall be zero occurrences of defects.

4.5.1.3.2 Rejected lots. If an inspection lot is rejected, the lot shall be 100 percent inspected for the defects noted. The contractor may correct all of the defects or remove all of the defective units from the lot. The lot shall then be sampled and inspected again in accordance with [tables VI](#) and [V](#). For acceptance, there shall be zero occurrences of defects. Such lots shall be separate from new lots and shall be clearly identified as reinspected lots.

4.5.1.3.3 Disposition of sample units. Sample units which have passed all of the group B inspection shall be delivered on a contract or purchase order if the lot is accepted; however, RFI shielded boots that are of enclosed style (type A or type B) and constructed with the RFI shield molded within the boot shall not be delivered.

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TABLE VI. Group B inspection.

Inspection	Requirement paragraph	Method paragraph
Restoring force (type A only) <u>1/ 3/</u>	<u>3.5</u>	<u>4.6.2</u>
Durability (installation)	<u>3.7.2</u>	<u>4.6.4.2</u>
Watertightness (preliminary)	<u>3.6</u>	<u>4.6.3.1</u>
RFI shielding <u>2/ 3/</u>	<u>3.13</u>	<u>4.6.10</u>

1/ Not required for RFI shielded boots.

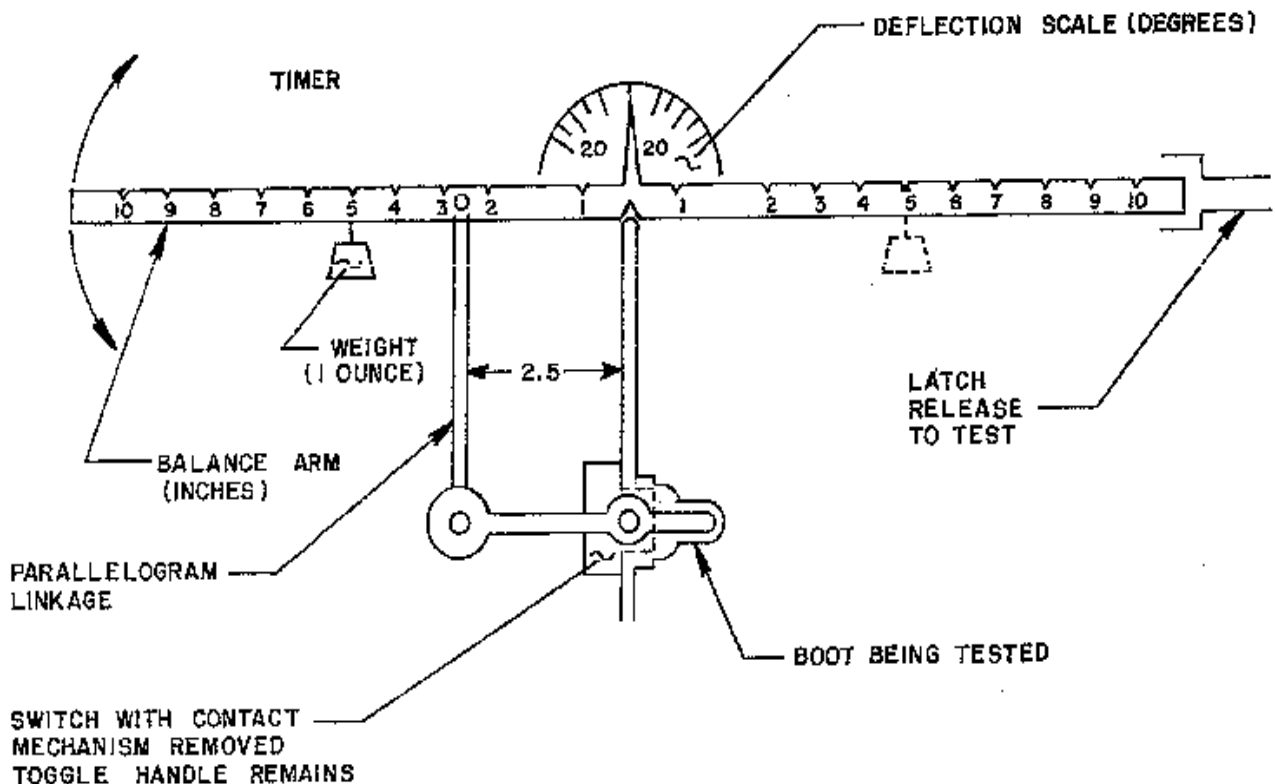
2/ Required for RFI shielded boots only.

3/ Only 4 sample boots from each inspection lot are required.

4.6 Methods of inspection.

4.6.1 Visual and mechanical inspection. Boots shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements and that there is lubricant present in the applicable portions of the boots (see [3.1](#), [3.3](#), [3.4](#), [3.14](#) and [3.15](#).)

4.6.2 Restoring force (torque) (applicable only to type A boots). The restoring force shall be measured using equipment similar to that shown on [figure 2](#) (see [3.5](#)).

FIGURE 2. Restoring force test fixture.

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4.6.2.1 Procedure. The following details shall apply.

- a. Sample boots shall not have been flexed or operated for at least 24 hours prior to the test.
- b. With the latching device in place so that the operating arm cannot move, the boot shall be mounted on an appropriate toggle actuator. Normal switch mounting means shall be used to secure the boot to the actuator.
- c. The 1 ounce weight shall be mounted to the left side of the operating arm in the 5-inch position.
- d. The latch shall be released and the time measured for the switch to complete a 20-degree movement (minimum) as shown on the dial.
- e. With the boot still mounted, the arm shall be returned to horizontal position and the latching device secured. The 1-ounce weight shall be mounted to the right side of the operating arm in the 5-inch position.
- f. The latch shall be released and the time measured for the switch to complete a 20-degree movement (minimum) as shown on the dial.

4.6.3 Watertightness.

4.6.3.1 Preliminary. Boots shall be mounted on the applicable switches, dummy switches, circuit breakers, or test plugs, (all without an internal bushing seal) (see [4.3.1](#)) and installed on a test enclosure. Boots shall be submerged in water to a depth of  $6 \pm 2$  inches and subjected to an increasing internal pressure at a rate of 1 pound force per square inch gage ( $\text{lb}_F/\text{in}^2(\text{gage})$ ) per minute, until a pressure of 15 pounds-force per square inch gage is reached, at which time the switches, circuit breakers, or test plugs shall be operated for twenty-five cycles. The boots shall again be submerged in water to a depth of  $6 \pm 2$  inches and subjected to an increasing external pressure at a rate of 1 pound-force per square inch gage per minute, until a pressure of 15 pound-force per square inch gage, unless otherwise specified (see [3.1](#)), is reached, at which time the switches or test plugs, as applicable, shall again be operated for twenty-five cycles. Cycles of operation shall be as specified in [4.6.8](#). During the test, boots shall be observed for evidence of water leakage into the test enclosure, or a continuous stream of air bubbles (see [3.6](#)).

4.6.3.2 Final. Boots shall be tested as specified in [4.6.3.1](#), except that the internal pressure shall be increased at a rate of 1 pound-force per square inch gage every two minutes until a pressure of 15 pounds-force per square inch gage is reached, and maintained at that pressure for 30 minutes. The external pressure shall be similarly applied, except that the pressure of 15 pounds-force per square inch gage, unless otherwise specified (see [3.1](#)), shall be maintained for 1 1/2 hours. During these periods of maximum pressure, the switches or test plugs, as applicable, shall be operated for twenty-five cycles at the maximum internal pressure and for twenty-five cycles at the maximum external pressure. Cycles of operation shall be as specified in [4.6.8](#). During the test, boots shall be observed for evidence of water leakage into the test enclosure, or a continuous stream of air bubbles (see [3.6](#)). For boots with an inner constriction feature (see [3.1](#)) one-half of the samples for qualification and group C inspections shall have the rubber portion removed just above the inner constriction before performing the test.

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4.6.4 Durability.

4.6.4.1 Operation of guards (applicable only to type A styles with hinged-type guards). Boots shall be mounted on a panel, together with an appropriate hinged-type guard and appropriate switch. The guard shall be opened and closed at a minimum rate of ten operations per minute. For qualification inspection, the number of operations shall be five hundred, and for group C inspection, the number of operations shall be fifty. No restraining force shall be applied to the guard during the closing operation. During the test, there shall be no interference with the satisfactory operation of the guard. After the test, boots shall be examined for evidence of damage (see [3.7.1](#)).

4.6.4.2 Installation. Boots shall be installed and removed from an applicable switch, circuit breaker, or test plugs (see [4.3.1](#)) fifty times during qualification inspection and five times during group B inspection. After the test, boots shall be examined for evidence of tearing (see [3.7.2](#)).

4.6.5 Sand and dust (see 3.8). Boots shall be tested in accordance with [method 110 of MIL-STD-202](#). The following details shall apply:

- a. Mounting conditions: Applicable switches without an internal bushing seal, applicable circuit breakers, or applicable test plugs (see [4.3.1](#)) shall be installed on a test enclosure comprising a sealed container, with only the front of the switch, circuit breaker, or test plug exposed to the environment, prior to mounting of the boot.
- b. Operation: During steps 1 and 2 the applicable switches, circuit breakers, or test plugs, with mounted boots, shall be subjected to 2,500 cycles of operation (see [4.6.8](#) at a rate of 10 to 12 cycles per minute (cpm).
- c. Measurements: Not applicable.

After the test, the test enclosure shall be examined for evidence of sand and dust.

4.6.6 Vibration (see 3.9). Boots shall be tested in accordance with [method 201 of MIL-STD-202](#). The following details shall apply:

- a. Method of mounting: Boots shall be mounted on applicable switches, circuit breakers, or applicable test plugs (see [4.3.1](#)), which, in turn, shall be mounted on a stainless steel panel.
- b. Measurements: Not applicable.

After the test, boots shall be examined for evidence of loosening.

4.6.7 Salt Atmosphere (corrosion) (applicable only to boots with threaded inserts or exposed metal frames) (see 3.10). Boots shall be tested in accordance with [method 101 of MIL-STD-202](#). The following details shall apply:

- a. Special mounting: Boots shall be suspended from the top of the chamber.
- b. Test condition letter: B.
- c. Measurements after exposure: Not applicable.

After the test, boots shall be examined for evidence of any corrosion of the base metal.

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4.6.8 Endurance. Boots shall be mounted on applicable switches, circuit breakers, or test plugs (see [4.3.1](#)) and subjected to the cycles of operation and temperature specified in [4.6.8.1](#) through [4.6.8.3](#). For types A, B, and D boots, a cycle of operation shall be a movement of the switch or circuit breaker actuator from one extreme position to the other extreme position, and return to the original position. For type A boots, a minimum angle of excursion of 30° (15° each side of center) shall be applied. For type C boots, a cycle of operation shall be one 360 ±5 degree-movement of the rotating shaft in a clockwise direction, and return 360 ±5 degrees in the counterclockwise direction. For qualification inspection, cycling shall be at a rate of 10 to 12 cpm. Faster cycling during group C inspection is optional. During the test, there shall be no binding or malfunctioning of the switch actuator. After the test, boots shall be examined for evidence of brittleness or cracking (see [3.11](#)).

4.6.8.1 At room ambient temperature. Boots shall be subjected to 30,000 cycles of mechanical operation (see [4.6.8](#)), unless otherwise specified (see [3.1](#)).

4.6.8.2 At -65° ±2°C. The temperature of the test chamber shall be maintained at -65° ±2°C for 24 hours. During the last 2 hours, boots shall be subjected to 1,000 cycles of mechanical operation (see [4.6.8](#)).

4.6.8.3 At 85° ±5°C. The temperature of the test chamber shall be maintained at 85° ±5°C for 24 hours. During the last 2 hours, boots shall be subjected to 1,000 cycles of mechanical operation (see [4.6.8](#)).

4.6.9 Lubricant (see [3.12](#)).

4.6.9.1 At high temperature. Three stripes of lubricant, each approximately 1/4-inch by 1-inch shall be applied to a 6- by 6- by 0.075-inch slab of rubber of the same grade (see [3.1](#) and [3.3.1](#)) as the boots under test. The rubber slab shall be subjected to a temperature of 255° ±5°C for 4 hours, and then allowed to cool to room ambient temperature for 1 hour. The rubber slab shall be examined for evidence of flow, creep, or spread of the stripes of lubricant, sinking of the lubricant into the rubber, thickening or evaporation of the lubricant, presence of a dry, opaque film or residue at the stripes on the rubber slab where the lubricant was applied, or deleterious effects on the rubber. The lubricant shall be transparent at the end of the test.

4.6.9.2 At low temperature. After completion of the test specified in [4.6.9.1](#), the rubber slab shall be subjected to a temperature of -65° ±2°C for 1 hour. The stripes of lubricant shall then immediately be manipulated with a test stick to determine whether the lubricant has congealed to the point where it no longer functions as a lubricant.

4.6.10 RFI shielding (applicable only to boots having an RFI shielding rating - "S"). (See [3.13](#).)

4.6.10.1 For types A and B enclosed style boots with nonmolded RFI mesh and for boots using conductive rubber (see [3.1](#)). The test sample boot shall be assembled to the test fixture using a minimum of 5 threads (as shown on [figure 3](#)). The spring shall force the dome shaped test pin against the internal mesh (for nonmolded type) or against the boot interior (for conductive rubber boots). The shape of the test pin shall accommodate the boot shape and size. The maximum current used during the measurement of resistance, using a milliohm meter (or other equivalent method) shall be 100 milliamperes. The resistance between the test pin and the connection lug shall be measured. The values of resistance measured shall not exceed that specified by [3.13](#).

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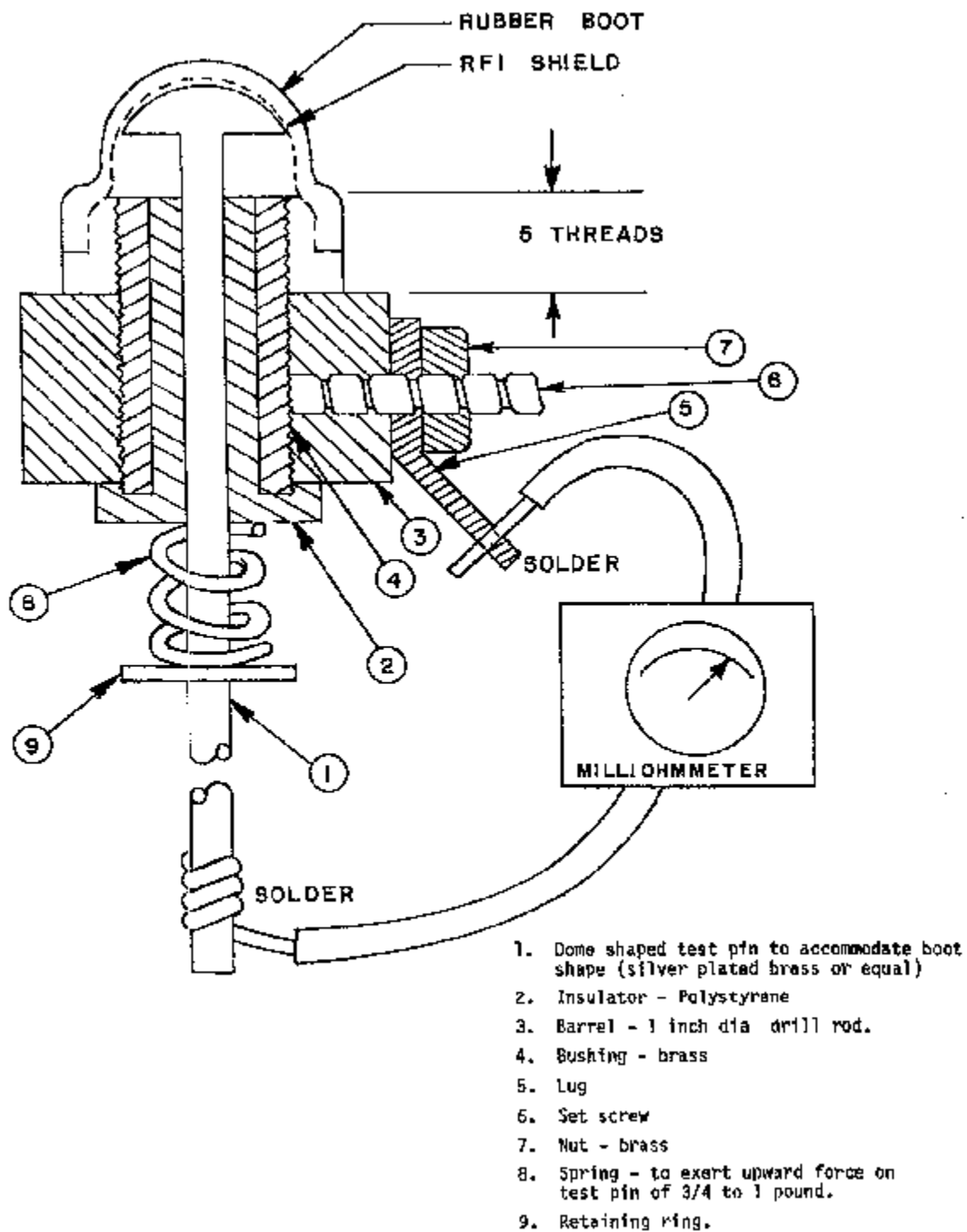


FIGURE 3. RFI test fixture (typical) for enclosed, nonintegral conductive rubber boots.



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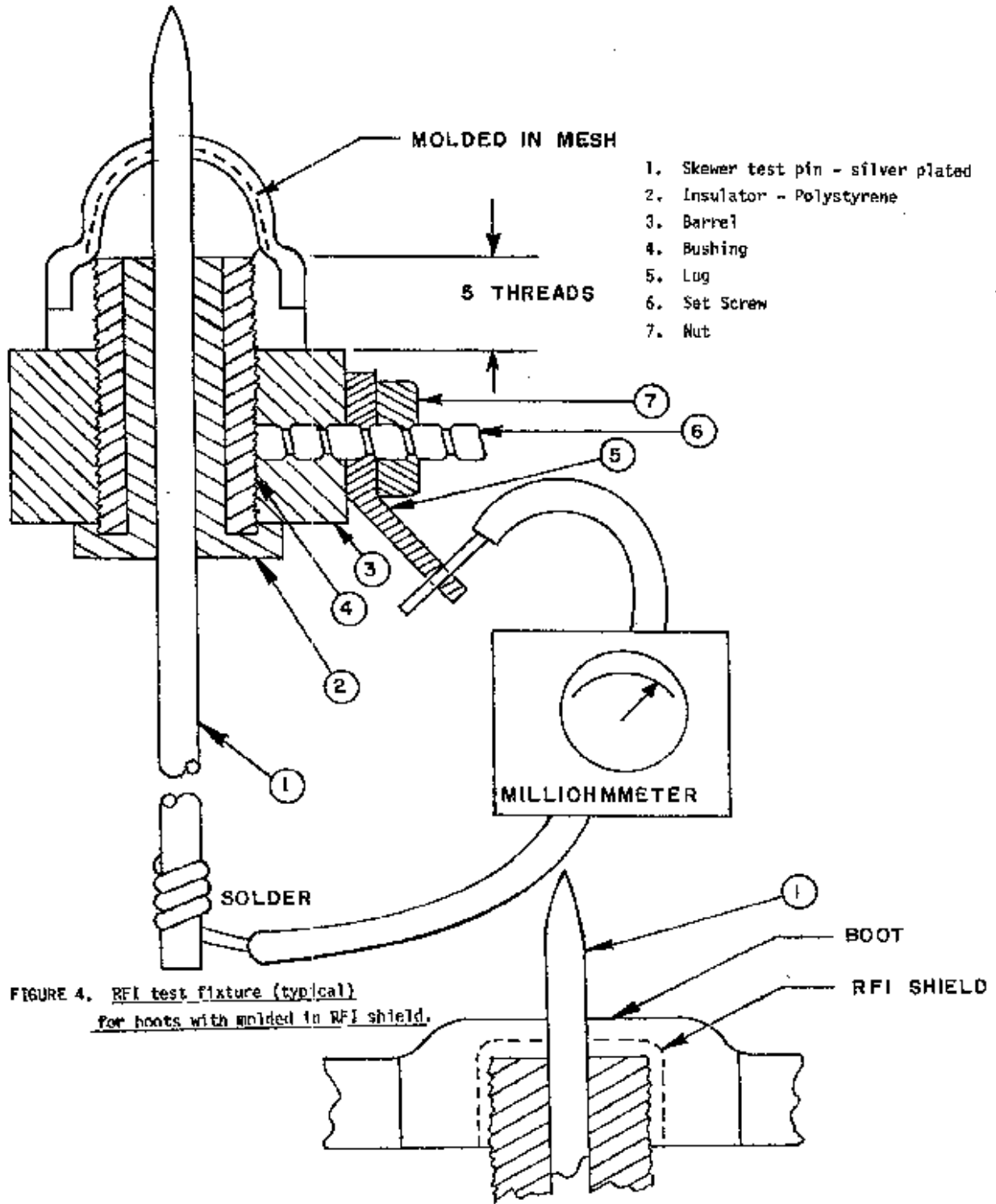


FIGURE 4. RFI test fixture (typical)  
for boots with molded in RFI shield.

FIGURE 4. RFI test fixture (typical) for boots with open construction.

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4.6.10.2 For boots with molded RFI mesh (see 3.1). The procedures and equipment shall be similar to that described in [4.6.10.1](#) except that a skewer pin (see [figure 4](#)) is used in place of the domed test pin. The spring is not required. The skewer is forced upward into the boot until significant penetration is accomplished. The balance of the test procedure is the same as [4.6.10.1](#). The values of resistance measured shall not exceed that specified by [3.13](#).

4.6.10.3 For type A, style 3, 4, 8, and 9 and type C boots (see 3.1). The test procedure of [4.6.10.2](#) shall be used except that for type C boots the test pin diameter shall be identical to that of the shaft of the switch the boot will accommodate. For type A through style boots, the pin diameter shall be as specified (see [3.1](#)). The balance of the procedure shall be identical to that for [4.6.10.2](#). The values of resistance measured shall not exceed that specified by [3.13](#).

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see [6.2](#)). When packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

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

6.1 Intended use. Boots covered by this specification are intended to provide protection for panel mounted components against such environments as sand, dust, water and other contaminants. The boots seal the shaft or other external parts as well as seal the panel on which the component parts, such as rotary switches, toggle switches, pushbuttons, circuit breakers, etc., are mounted.

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 the complete military PIN (see [1.2.1](#) and [3.1](#)).
- c. Color, if other than gray (see [3.3.1](#)).
- d. First Article Testing Requirements (see [3.2](#)).
- e. Packaging requirements. (see [5.1](#)).

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**6.3 Finishes and plating (see 3.3.2.).**

6.3.1 Nickel plating. It is recommended that [SAE-AMS-QQ-N-290](#) be considered for meeting the nickel plating requirements of this specification.

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

6.4 PIN. This specification requires a PIN that describes codification and/or classification and appropriate references to associated documents (see [1.2.1](#) and [3.1](#)).

6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website at <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see Section [3](#)).

**6.7 Subject term (key word) listing.**

- One-hole mounting
- Two-hole mounting
- Three-hole mounting
- Five-hole mounting
- Molded silicone rubber

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6.8 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where modifications 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.

Custodians:

Army -CR  
Navy - AS  
Air Force - 85  
DLA - CC

Preparing activity:

DLA - CC

(Project 5930-2008-056)

Review activities:

Army - EA

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil/> .