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Raychem

Specification	**RT-1371**
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RAYATEN ELASTOMERIC MOLDED COMPONENTS
Electrically Shielded, Flame Retarded, Semi-Rigid, Heat-Shrinkable

1. SCOPE

This specification covers the requirements for one type of semi-rigid, electrical insulating and shielded molded component which, when used with S-1184 or S-1185 adhesives, is designed to control electromagnetic interference (EMI). The dimensions of these molded components will reduce to a predetermined size upon the application of heat in excess of 175°C *(347°F)*.

2. APPLICABLE DOCUMENTS

This specification takes precedence over documents referenced herein. Unless otherwise specified, the latest issue of referenced documents applies. The following documents form a part of this specification to the extent specified herein.

2.1 GOVERNMENT-FURNISHED DOCUMENTS

Military

VV-F-800	Fuel Oil, Diesel
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base

2.2 OTHER PUBLICATIONS

American Society for Testing and Materials (ASTM)

D 412	Standard Method of Test for Rubber Properties in Tension

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

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RT-1325	Specification for Thermofit* Elastomeric Molded Components, Flame Retarded, Semi-Rigid, Heat-Shrinkable
RT-1011	Specification for Thermofit Adhesive S-1125, Epoxy, Flexible
RT-1084	Specification for Thermofit S-1184 Conductive Epoxy Adhesive
RT-1085	Specification for Thermofit S-1185 Conductive Hot Melt Adhesive
202S152-25S	Specification Control Drawing for Boot, Straight, Heat-Shrinkable, with Lip, Shielded

3. REQUIREMENTS

3.1 MATERIAL

The molded components shall be fabricated from a crosslinked, thermally stabilized, flame-retarded, elastomeric composition. They shall be internally metal plated to form a composite structure which shall provide an electrical shield.

3.2 APPEARANCE

The molded components shall be homogeneous and essentially free from pinholes, bubbles, and inclusions.

3.3 COLOR

The molded components shall be black.

3.4 PROPERTIES

The elastomeric components shall have met the requirements of RT-1325 before plating. The composite components shall meet the requirements of Table I.

4. QUALITY ASSURANCE PROVISIONS

4.1 CLASSIFICATION OF TESTS

4.1.1 Qualification Tests

Qualification tests are those performed on plated molded slabs and plated components submitted for qualification as satisfactory products and shall consist of all tests listed in this specification.

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4.1.2 Acceptance Tests

Acceptance tests are those performed on plated molded slabs and plated components submitted for acceptance under contract. Acceptance tests shall consist of the following:
Visual Examination, Dimensions, Dimensional Recovery, Tensile Strength, Ultimate Elongation and Heat Shock.

4.2 SAMPLING INSTRUCTIONS

4.2.1 Preparation of Test Samples

Molded slabs and molded components shall be prepared as follows: unless otherwise specified, tests shall be carried out on a molded test slab of material 6 x 6 x .075 ± .010 inches
(152 x 152 x 1.9 ± .25 mm). The test slab shall be electroplated with metal on one face. The thickness of metal shall be representative of the thickness deposited on the molded component. The standard molded component for qualification testing shall be 202S152-25S, unless otherwise specified.

4.2.2 Qualification Test Samples

Qualification test samples shall consist of six plated molded slabs as described in Section 4.2.1, and the number of plated molded components specified by the test program. The molded slabs shall be fabricated from the same lot of material and shall be subject to the same degree of crosslinking as the molded components.

4.2.3 Acceptance Test Samples

Acceptance test samples shall consist of specimens cut from a plated molded slab as described in Section 4.2.1, and plated molded components selected at random. The plated molded slab shall be fabricated from the same lot of material and shall be subjected to the same degree of crosslinking as the molded components. A lot of components shall consist of all plated molded components of the same part number from the same lot of material, from the same production run, and offered for inspection at the same time.

4.3 TEST PROCEDURES

4.3.1 Dimensional Recovery

Three samples of plated molded components, as supplied, shall be measured for dimensions. The samples then shall be conditioned for 15 minutes in a 200 ± 2°C *(392 ± 4°F)* oven, or equivalent, cooled to room temperature, and remeasured.

4.3.2 Tensile Strength and Ultimate Elongation

Three specimens cut from a plated molded slab using Die D of ASTM D 412 shall be tested for tensile strength and ultimate elongation in accordance with ASTM D 412, Method A. Jaw separation rate shall be 4 ± 0.4 inches *(100 ± 10 mm)* per minute. Test shall be conducted at room temperature.

4.3.3 Metal Adhesion

The metal surface of a plated test slab shall be wiped clean with 1,1,1 trichloroethane. Five 6 x 3/8-inch *(150 x 10 mm)* strips shall be cut from the clean test slab. A strip of aluminum foil, approximately .006 inches *(.15 mm)* thick, shall be bonded to the plated side of each strip of the test slab with S-1110* adhesive, or equivalent, to form a T-peel assembly. 3 inches *(75 mm)* of the assembly shall be left unbonded. The assembly shall be bonded using a roller and applying four firm rolling strokes.

The five specimens shall be subjected to 180° peel by clamping the unbonded end of the test specimen into one jaw of a tensile machine and the unbonded end of the aluminum strip into the other jaw. The rate of jaw separation shall be 2 ± .2 inches *(50 ± 5 mm)* per minute. The mean peel force (calculated by averaging the loads read from several equispaced points along the length, omitting the first and last 10% of the peel) for each specimen shall be recorded and the mean of the five recorded measurements reported as the peel strength.

4.3.4 Shielding Efficiency(1)

All shielding tests are performed on Rayaten components recovered onto triaxial aerial test fixtures similar to those shown in Figure 1A or 1B, as appropriate. The test method uses the current injection principle on a Rayaten specimen fixtured on a triaxial test circuit. Instruments are used to detect electrical variations in the circuit caused by the penetration of given potential through the shield causing an induced voltage on the center conductor of the fixture. This induced voltage is to be measured at various frequencies up to and including 100 MHz. A minimum level of shielding efficiency is specified for each type of Rayaten part (boot or transition) as defined in Table 1.

4.3.4.1 Preparation of Test Specimens

a) Select the appropriate test aerial fixture for the component under test.

b) Clean all bond interfaces with 1,1,1 trichloroethane or other suitable cleaning solvent and allow to dry.

c) Apply Raychem type S-1185 conductive adhesive to the aerial for acceptance test. For qualification tests, apply Raychem type S-1184 and S-1125. (See Figure 1A.)

d) Position the component on the aerial fixture and begin shrinking at the "H" end, using Raychem CV 5000 Hot Air Gun or equivalent, and continuing to the "J" end. Allow the component to conform freely to the aerial without manual manipulation. Allow the assembly to cool to room temperature.

*Mastic Tape, Tackified Rubber, obtainable from Raychem Corporation.

(1)Related Standards

BS 2316	Radio Frequency Cables
IEC 96	Radio Frequency Cables
VG95373	Screening Test Methods

e) Install the aerial test assembly (with component) in the properly sized metal test box. Installation is accomplished by means of soldering the resistor wire of the aerial fixture to one connector and fixing the other end by means of the special fitting and brass clamping nut as shown in Figure 1A or 1B as appropriate.

f) Connect the metal box containing the test aerial to the test circuit as shown in Figure 2. Allow the component to cool to room temperature prior to testing.

4.3.4.2 Test Procedure

The suggested test circuit is shown in Figure 2. Approved equivalent circuits may be used.

Sequence 1
Terminate the measurement circuit at the variable attenuator using a 50 ohm, 12 watt load. Connect the triaxial test fixture to the circuit and inject a signal from the function generator onto the triaxial leakage test box over the range of frequencies specified in Sequence 2. The resultant induced voltage on the center conductor is received and stored in the spectrum analyzer.

Sequence 2
Terminate the triaxial test fixture using a 50 ohm, 12 watt load. Connect the variable attenuator in circuit with the function generator.

Pass a signal from the function generator through the variable attenuator and adjust it until it matches the stored voltage signal from the test specimen.

Take measurements at frequencies from 3 kHz through 100 MHz. Record the readings from the variable attenuator at the selected frequencies as the shielding efficiency.

4.3.5 Heat Shock

Six specimens, five prepared in accordance with 4.3.3 for metal adhesion, and one prepared in accordance with 4.3.4.1 a through d for shielding efficiency shall be conditioned for 30 ± 5 minutes in a 200 ± 5°C *(392 ± 9°F)* mechanical convection oven with an air velocity of from 100 to 200 feet (*30.5 to 61.0 m)* per minute past the specimens. They shall be tested for metal adhesion for acceptance tests plus shielding efficiency for qualification testing.

4.3.6 Heat Aging

Eleven specimens, three prepared in accordance with 4.3.2 for ultimate elongation, five prepared in accordance with 4.3.3 for metal adhesion, and three plated molded components prepared in accordance with 4.3.4.1 a through d, shall be conditioned for 168 + 2 hours in a 160 + 3°C
(320 ± 5°F) mechanical convection oven with an air velocity of from 100 to 200 feet *(30 to 60 m)* per minute past the specimens. After conditioning, the specimens shall be removed from the oven and cooled to 23 ± 3°C *(73 ± 5°F)*. The specimens shall then be tested for ultimate elongation, metal adhesion, and shielding efficiency.

4.3.7 Thermal Cycling

Three molded components prepared in accordance with 4.3.4.1 a through d for shielding efficiency and three strip specimens prepared in accordance with 4.3.3 for metal adhesion shall be subjected to thermal cycling as follows: 4 ± 1/4 hours. at 150 ± 3°C *(302 ± 5°F)*, 1 ± 1/4 hr at 23 ± 3°C *(73 ± 5°F)*, 4 ± 1/4 hours. at -75 ± 3°C *(-103 ± 5°F)* and 1 ± 1/4 hr at 23 ± 3°C *(73 ± 5°F)*. After completion of three cycles the metal adhesion and shielding efficiency of the molded components shall be measured.

4.3.8 Fluid Resistance

Three specimens prepared in accordance with 4.3.2 and three plated molded components prepared in accordance with 4.3.4.1 a through d shall be completely immersed in each of the fluids listed in Table 1 for the times and temperatures listed. The volume of the fluids shall be not less than 20 times that of the specimens. After immersion the plated molded components shall be allowed to air dry for 18 to 24 hours at room temperature and shall then be tested for shielding efficiency in accordance with 4.3.4. The tensile test specimens cut from molded slabs shall be lightly wiped and then air dried for 30 to 60 minutes at room temperature, visually examined for delamination of the metal from the polymer and then tested for tensile strength and ultimate elongation in accordance with 4.3.2.

4.4 REJECTION AND RETEST

Failure of any sample to comply with any one of the requirements of this specification shall be cause for rejection of the lot represented. Material which has been rejected may be replaced or reworked to correct the defect and then resubmitted for acceptance. Before resubmitting, full particulars concerning the rejection and the action taken to correct the defect shall be furnished to the inspector.

5. PREPARATION FOR DELIVERY

5.1 PACKAGING

The molded components shall be packaged in accordance with good commercial practice. The exterior shipping container shall be not less than 125 pound test fiberboard.

5.2 MARKING

Each molded component shall be distinctly identified on the part and/or the bag with the manufacturer's name or symbol and the manufacturer's part number, lot number and date of manufacture.

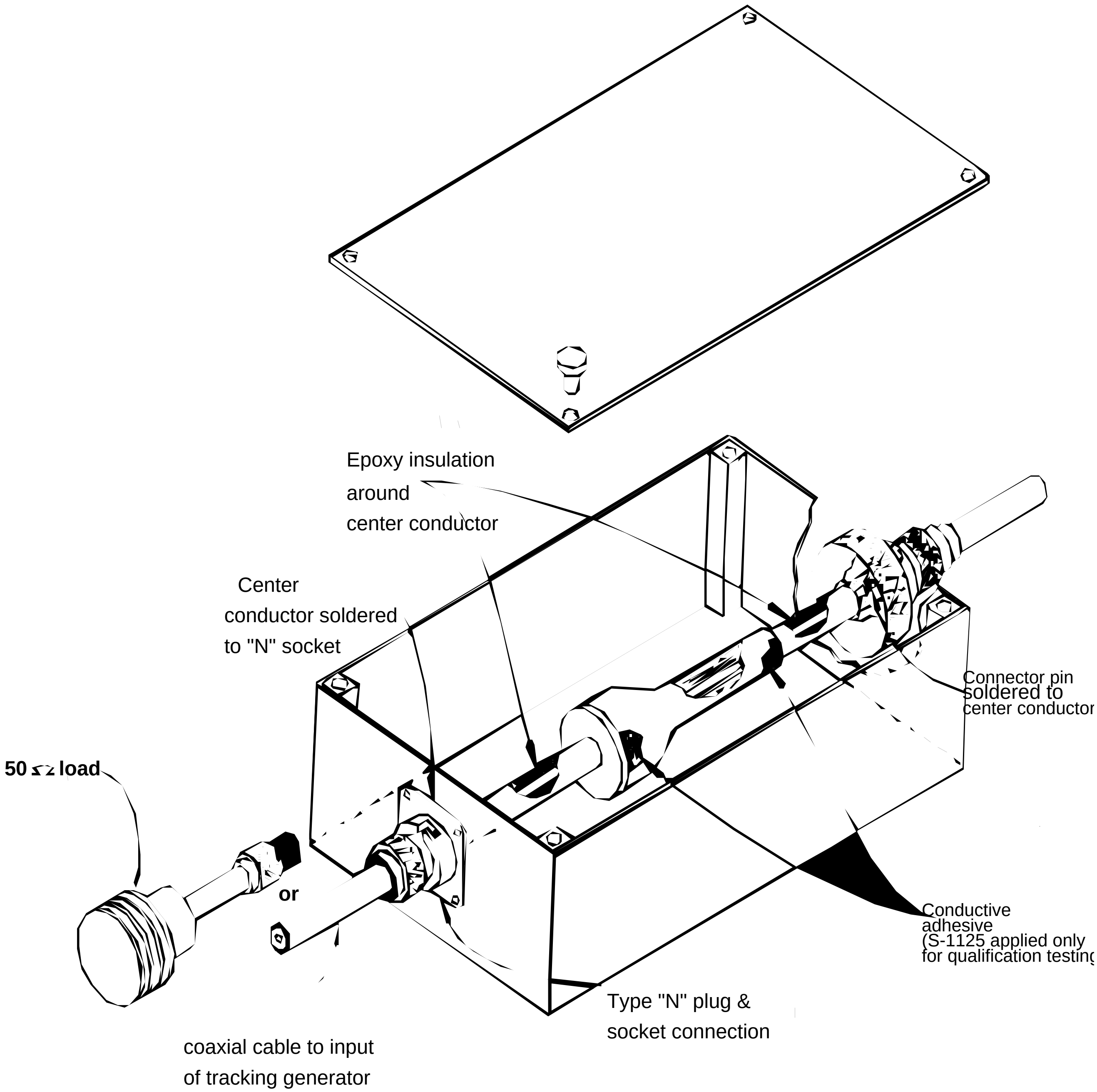

Figure 1A

Rayaten Boot in Aerial Test Fixture

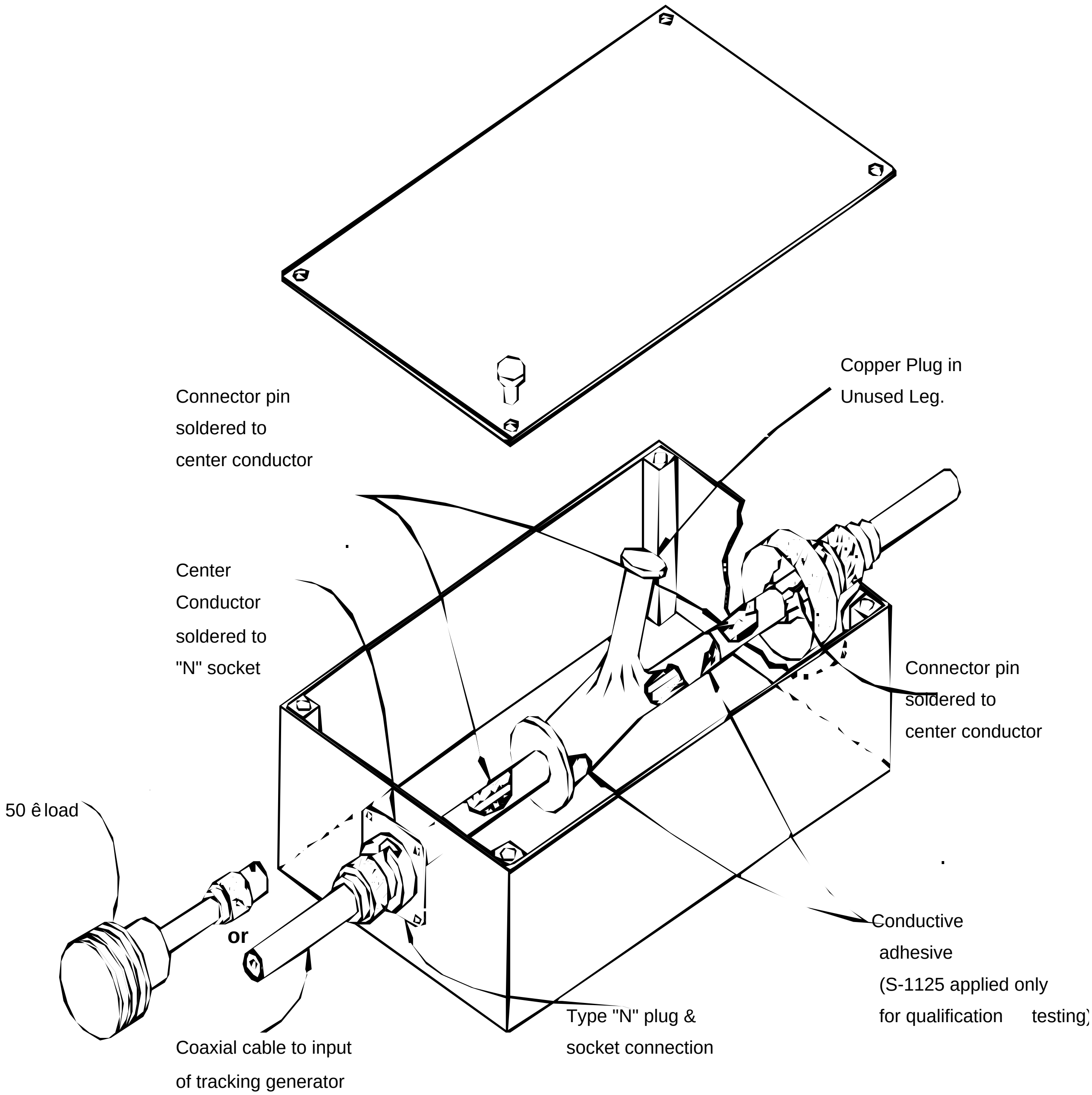

Figure 1B

Rayaten Transition in Aerial Test Fixture

Figure 2

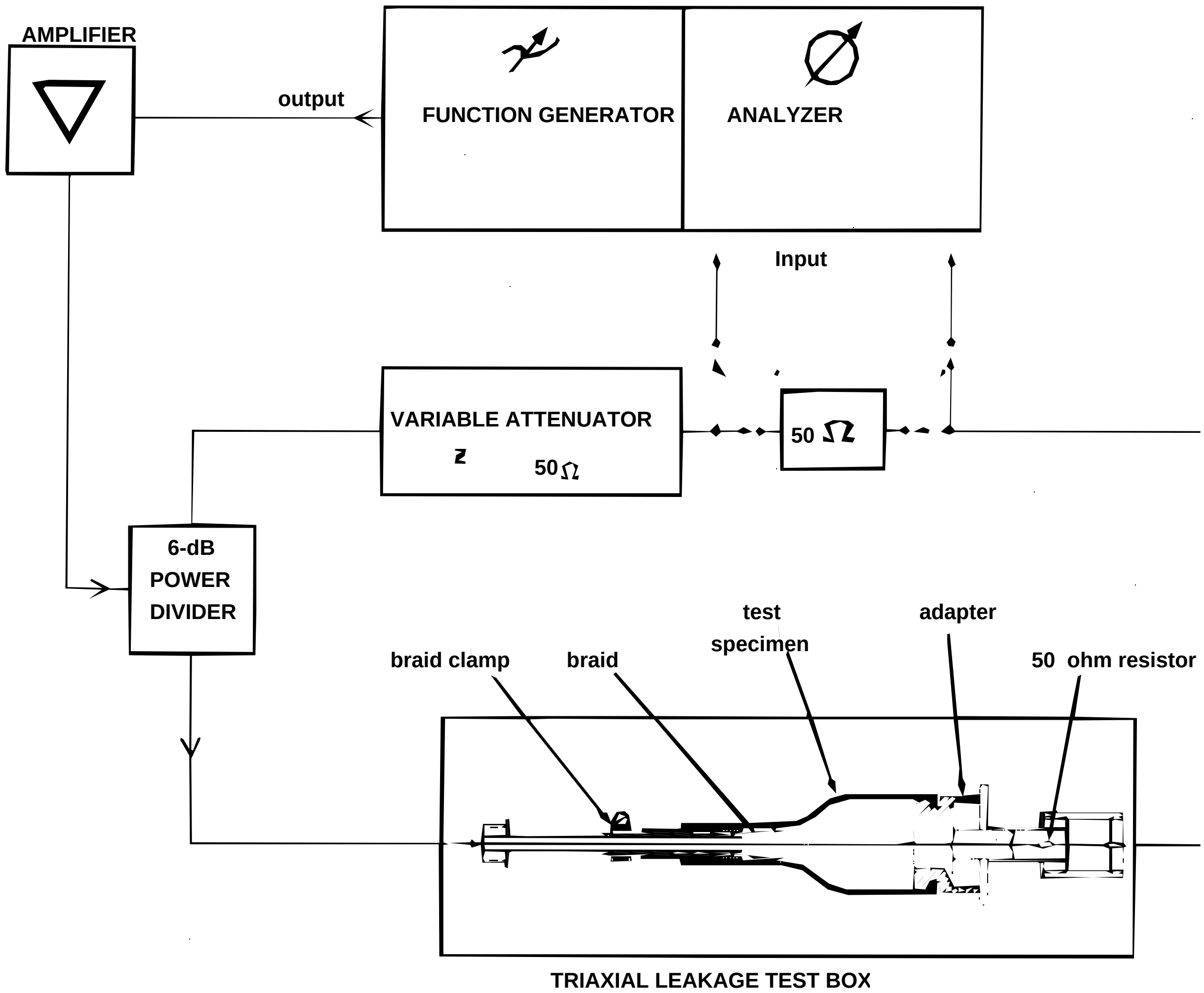
AMPLIFIER
output
FUNCTION GENERATOR
ANALYZER
Input
VARIABLE ATTENUATOR
Z
50Ω
50 Ω
6-dB
POWER
DIVIDER
test
specimen
adapter
braid clamp
braid
50 ohm resistor
TRIAXIAL LEAKAGE TEST BOX

TABLE 1
REQUIREMENTS

PROPERTY	UNIT	REQUIREMENTS	TEST METHOD
ELECTRICAL Shielding Efficiency 3 kHz through 100 MHz	dB	Boots, 70 minimum Transitions, 65 minimum	Section 4.3.4
PHYSICAL Visual Examination	---	Pass	
Dimensions	Inches *(mm)*	In accordance with specification control drawing	Section 4.3.1
Dimensional Recovery	Inches *(mm)*	In accordance with specification control drawing	
Tensile Strength	psi *(MPa)*	1750 minimum *(12.1)*	Section 4.3.2 ASTM D 412 Method A
Ultimate Elongation	Percent	400 minimum	
Metal Adhesion	lbs/inch *(N/cm)*	8.5 minimum *(15)*	Section 4.3.3
Heat Shock 30 minutes at 200°C (392°F) Followed by tests for:	---	No dripping, flowing or cracking	Section 4.3.5
Metal Adhesion	lbs/inch *(N/cm)*	8.5 minimum *(15)*	Section 4.3.3
Shielding Efficiency(1) 3 kHz through 100 MHz	dB	Boots, 70 minimum Transitions, 65 minimum	Section 4.3.4
Heat Aging 168 hours at 160°C (320°F) Followed by tests for:	---	---	Section 4.3.6
Ultimate Elongation	Percent	400 minimum	Section 4.3.2
Metal Adhesion	lbs/inch *(N/cm)*	8.5 minimum *(15)*	Section 4.3.3
Shielding Efficiency 3 kHz through 100 MHz	dB	Boots, 70 minimum Transitions, 65 minimum	Section 4.3.4
Thermal Cycling Range -75 to 150°C (-103 to 302°F) Followed by tests for:	---	---	Section 4.3.7
Metal Adhesion	lb/inch *(N/cm)*	8.5 minimum *(15)*	Section 4.3.3
Shielding Efficiency 3 kHz through 100 MHz	dB	Boots, 70 minimum Transitions, 65 minimum	Section 4.3.4

TABLE 1
REQUIREMENTS
(continued)

CHEMICAL Fluid Resistance 24 ± 2 hours at 23 ± 2°C *(73 ± 4°F)* JP-4 Fuel (MIL-T-5624) Fuel Oil, Diesel (VV-F-800, DF-2) Fluid Resistance 24 ± 2 hours at 50 ± 2°C (122 ± 4°F) Lubricating Oil (MIL-H-5606) Fluid Resistance 24 ± 2 hours at 100 ± 2°C (212 ± 4°F) Lubricating Oil (MIL-L-23699) Fluid Resistance 60 ± 5 minutes at 23 ± 2°C (73 ± 4°F) 1,1,1 Trichloroethane Followed by tests for:	---	No delamination	Section 4.3.8
Tensile Strength	psi *(MPa)*	1450 minimum *(10)*	Section 4.3.2
Ultimate Elongation	Percent	300 minimum	Section 4.3.2
Shielding Efficiency 3 kHz through 100 MHz	dB	Boots, 70 minimum Transitions, 65 minimum	Section 4.3.4

(1)Qualification only