

## Resin Designs Corrosion-Resistant Gaskets for EMI Shielding and/or Electrical Grounding (GND)

### 1.0 INTRODUCTION

- 1.1 Scope. This specification covers the design, performance and qualification requirements for Resin Designs gel-impregnated metallic gasket materials for use in areas where EMI shielding and/or electrical grounding must be maintained across the gasket.
- 1.2 Description. Resin Designs gaskets for EMI shielding and/or electrical grounding consist of a flexible metallic matrix impregnated with a crosslinked gel of silicone or fluorosilicone. The metallic matrix provides EMI shielding and/or electrical grounding between the gasketed surfaces, and the gel provides corrosion protection of the metallic matrix and of the immediate contact area on the gasketed surfaces. Gel-impregnated gaskets are suitable for one-time installation and use. EMI gaskets provide a weather seal, preventing the passage of dust, dirt, and splashes of water and certain other fluids, depending on the gel material. These gaskets are covered with a peel off release liner for protection during shipping and storage.
- 1.3 Classification. Gel-impregnated metallic gaskets covered by this specification are classified in accordance with 1.3.1, 1.3.2 and 1.3.3.
  - 1.3.1 Gel Material.
    - a. High Performance Silicone (TGSI), (CSI)
    - b. Fluorosilicone. (FS)
  - 1.3.2 Metallic Matrix Configuration.
    - a. Sheet.
    - b. Profiled (Rope).
  - 1.3.3 Use.
    - a. EMI Shielding.
    - b. Electrical Grounding (GND).
- 1.4 Temperature Rating. The gaskets are suitable for use in the temperature range of minus 55°C to plus 125°C for Silicone and High Performance Silicone and minus 55°C to plus 150°C for Fluorosilicone.
- 1.5 Intended Use. These gaskets are intended for use in electrical grounding or electromagnetic interference/radio frequency interference suppression applications.

### 2.0 APPLICABLE DOCUMENTS

- 2.1 Issues of Documents. The following documents, of the issue in effect on date of order or request for proposal, form a part of this specification to the extent specified herein. However, this specification takes precedence over the referenced documents.

## RT/RW Specification

2.2 American Society for Testing and Materials (ASTM).

- B 117-02      Standard Test Method of Salt Spray (Fog) Testing
- D 1004-03      Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, [www.astm.org](http://www.astm.org))

2.3 Society of Automotive Engineers, Inc. (SAE).

- ARP 1705      Coaxial Test Procedure to Measure the RF Shielding characteristics of EMI Gasket Materials

(Copies of SAE publications may be obtained from the Society of Automotive Engineers, [www.sae.org](http://www.sae.org))

2.4 Standard References.

Handbook on Corrosion Testing and Evaluation, W. H. Ailor, John Wiley and Sons, Inc., 1971

**3.0 REQUIREMENTS**

- 3.1 Specification Control Drawings (SCD's). The requirements for the gasket products furnished under this specification shall be as specified herein and on the applicable specification control drawing. In the event of conflict between the requirements of this specification and those of the applicable specification control drawing, the latter shall govern.

- 3.2 Classification of Requirements. The requirements for the gaskets are classified herein as follows:

Requirement	Paragraph
Qualification	3.3
Materials	3.4
Design and Construction	3.5
Performance	3.6
Product Identification	3.7
Workmanship	3.8

- 3.3 Qualification. Products furnished under this specification shall be products that meet all of the applicable requirements of this specification. Products may be qualified to this specification by successful completion of the applicable tests as defined herein, or by similarity of design, materials, and construction to qualified products.
- 3.4 Materials. All materials used in the manufacture of these products shall be of the quality and form best suited for the purpose intended. The gel and the metallic matrix materials shall be as specified on the applicable specification control drawing.

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- 3.4.1 Gel. The gel shall be a crosslinked silicone or fluorosilicone material capable of maintaining its cohesion before and after installation of the gasket. When gaskets are installed, the gel shall deform so as to provide mechanical barrier to the intrusion of contaminants between gasketed surfaces.
- 3.4.2 Metallic Matrix. The metallic matrix shall meet the requirements of QQ-N-281, Class A or RR-W-365 as applicable.
- 3.5 Design and Construction. A gasket shall consist of a metallic matrix impregnated with gel and protected by a release liner.
- 3.5.1 Dimensions. The dimensions shall be as specified in the applicable specification control drawing.
- 3.6 Performance. Gel gasket products shall conform to the requirements specified herein and on the applicable specification control drawings. Unless otherwise specified, room temperature shall be 25° + 5°C.
- 3.6.1 DC Resistance. When tested in accordance with 4.5.4, gel gaskets shall meet the DC resistance requirements listed in the applicable specification sheet.
- 3.6.2 Shielding Effectiveness. When gel gaskets are tested in accordance with 4.5.5, the shielding attenuation shall be in accordance with the applicable specification sheet.
- 3.6.3 Mechanical Strength. When gel gaskets are tested in accordance with 4.5.6, the load required to tear or break the gasket shall be in accordance with the applicable specification sheet.
- 3.6.4 Fluid Resistance. When gel gaskets are tested in accordance with 4.5.7, the change in weight shall be in accordance with the applicable specification sheet.
- 3.6.5 Heat Aging. When tested in accordance with 4.5.8 (168 hours at 150°C for SI, CSI, and TGSI, 175°C for FS), gel gaskets shall be tested as specified in 4.5.4.
- 3.6.6 Salt Spray. When tested in accordance with 4.5.9, the assembly shall meet the shielding effectiveness requirements of 3.6.2 for EMI gaskets and the visual inspection for corrosion requirements of 3.6.6.1. Sheet gaskets shall meet the D.C. Resistance requirements of the applicable specification sheet and the visual inspection for corrosion requirements of 3.6.6.1.
- 3.6.6.1 Visual Inspection for Corrosion. When areas of the fixture that were in contact with the gasket are inspected in accordance with 4.5.9.1, pitting due to corrosion shall be in accordance with the following reference: Handbook on Corrosion Testing and Evaluation, Page 690, Chart A, "Number 2 Few" and Chart B, "Size 1 Minute". Tarnishing of the fixture surface shall not be cause for failure.
- 3.6.7 Thermal Cycling. When tested in accordance with 4.5.10 (5 cycles, one hour each at -55°C to 125°C for Silicone and High Performance Silicone, -55°C to 150°C for Fluorosilicone), gel gaskets shall show no evidence of dripping, flowing or cracking followed by test as specified in 4.5.4.
- 3.6.8 High Temperature Endurance. When tested in accordance with 4.5.11 (48 hours at 156°C for Silicone and High Performance Silicone, 187°C for Fluorosilicone), gel gaskets shall be tested as specified in 4.5.4.
- 3.6.9 Environmental Sealing. When tested in accordance with 4.5.12 gasket shall meet sealing pressure requirements of the applicable specification sheet.

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- 3.7 Product Identification. Each unit package shall be identified with the material number, lot number and date of manufacture.
- 3.8 Workmanship. The gaskets shall be processed in such a manner as to be uniform in quality. They shall be free from defects that would adversely affect life or serviceability.

**4.0 QUALITY ASSURANCE PROVISIONS**

- 4.1 Responsibility for Inspection. The supplier is responsible for the performance of all inspection tests specified herein. The supplier may utilize his own or any other suitable testing facility. Inspection records of the tests shall be kept complete and available to the buyer as specified in the contract or order.
- 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 supplier.
- 4.1.2 Inspection Sampling Instruction. Qualification and acceptance test samples shall be cut from standard manufactured material selected at random. Unless otherwise specified gaskets shall be tested without release liner.
- 4.2 Classification of Inspections. The examination and testing of gel gaskets covered by this specification shall be classified as follows:
- a. Qualification inspection (See paragraph 4.3)
  - b. Acceptance inspection (See paragraph 4.4)
- 4.3 Qualification Tests. Qualification testing shall consist of the tests listed in Table I
- 4.3.1 Test Samples for Qualification Inspection. Test samples submitted for qualification inspection shall be produced and selected in accordance with paragraph 4.1.2.
- 4.3.2 Failures. One or more failures of the tests listed in Table I shall be cause for failure of qualification of the product under test.
- 4.3.3 Qualification Report. Qualification shall be documented in a report which shall be available to the buyer.
- 4.4 Acceptance Inspection. Each lot as defined in 4.4.1 shall be tested for conformance with this specification. Quality conformance inspection testing shall consist of the workmanship and dimensional examination of 4.5.3. In-process testing may be used for acceptance. Statistical process control (SPC) data may be used to demonstrate conformance in place of these inspections, provided the manufacturer controls production processes in accordance with ISO 9001, section 4.9.
- 4.4.1 Inspection Lot. An inspection lot shall consist of all gaskets of one part number, manufactured under essentially the same conditions, and offered for inspection at one time.
- 4.4.2 Inspection Levels and Acceptable Quality Levels (AQL). The inspection level and AQL shall be in accordance with MIL-STD-105. The inspection level shall be S-3; there shall be zero defects.
- 4.4.3 Rejected Lots. Failure to meet any requirement of this specification shall be cause for rejection of the entire lot.

**TABLE I. QUALIFICATION INSPECTION**

Test	Requirement Paragraph	Procedure Paragraph	Number of Samples
Visual & Dimensional Examination	3.1, 3.4, 3.4.1, 3.4.2, 3.5, 3.5.1	4.5.3	3
DC Resistance	3.6.1	4.5.4	3
Heat Aging followed by D.C. Resistance	3.6.5	4.5.8	3
Thermal Cycling followed by D.C. Resistance	3.6.7	4.5.10	3
High Temp. Endurance followed by D.C. Resistance	3.6.8	4.5.11	3
Shielding Effectiveness	3.6.2	4.5.5	3
Salt Spray followed by Shielding Effectiveness	3.6.6	4.5.9	3
D.C. Resistance	3.6.2	4.5.5	
Visual Inspection for Corrosion	3.6.1	4.5.4	
	3.6.6.1	4.5.9.1	
Mechanical Strength	3.6.3	4.5.6	3
Fluid Resistance followed by % Weight Change	3.6.4	4.5.7	3
Environmental Sealing	3.6.9	4.5.12	3

#### 4.5 Test Procedures.

4.5.1 Inspection and Test Conditions. Unless otherwise specified, all inspections and tests shall be conducted in a clean environment at room temperature conditions.

4.5.2 Specimen Preparation. The samples shall be conditioned at room temperature for at least 1 hour before testing. Unless otherwise specified, the release liners shall be removed from the specimens before testing.

4.5.3 Workmanship and Dimensional Examination (see 3.1, 3.4, 3.4.1, 3.4.2, 3.5, 3.5.1, 3.8).

Workmanship and dimensional examination shall be conducted with the unaided eye, except for normal vision correction. Measurements of the gasket shall be performed using suitable measuring equipment.

#### 4.5.4 DC Resistance

4.5.4.1 Test Apparatus. The DC resistance test shall be performed at room temperature. The test fixture shall consist of two clean, smooth, aluminum plates, each 4 inches square and a minimum of 0.25 inch thick. Each plate shall be equipped with a brass screw-terminal electrical contact point on the outer surface (See Figures 1a-1d). The testing apparatus shall be equipped with a four-terminal milliohmmeter joining each contact point to the fixture with current and voltage leads.

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4.5.4.2 Test Procedure. The aluminum test fixture shall be isolated electrically by insulating the fasteners such that the current path is through the specimen only. The clean empty fixture shall be assembled and the fasteners torqued to 15 in./lb. The resistance reading shall be recorded after 15 minutes. The dimensions of the specimens shall be as follows:

Sheet matrix gasket: 4 inch x 4 inch frame, 1 inch wide (see Figure 1c)  
Profiled matrix gasket: Approx. 6" length cut to fit groove per Figure 1d

Flat matrix specimens shall be installed between the plates. Profiled matrix specimens shall be placed in the recessed area of the plate surface. Insulating shim material shall be inserted between the plates such that the current path is through the specimen only.

The electrical resistance value shall be recorded after 15 minutes. The DC resistance of the specimen shall be the difference between the resistance with a specimen minus the resistance without a specimen.

4.5.5 Shielding Effectiveness the specimen shall be measured in accordance with SAE document ARP 1705 with the following details and exceptions:

Flat gasket:	Ring	
	mean diameter:	1.6 inch
	width	0.3 inch
	(surface area 1.5 sq. inch)	
Profiled gasket:	Ring in groove	
	Mean groove diameter	1.58 inch
	Groove parameters	See table and drawing Figure 2
	(gasket length 5 inch)	

The specimen shall be placed between two aluminum plates. The plates shall be cleaned before use with an abrasive cloth followed by an alcohol wash. The plates shall be held together by means of three non-conductive bolts torqued to a value of 8 inch-pounds. For flat gaskets, no spacers shall be used. For profiled gaskets, spacers consisting of 0.003-inch thick adhesive-backed polyimide or polyester tape shall be used to ensure that the aluminum plates are not in direct contact with each other.

During salt fog exposure the plates holding the specimen shall be removed from the test fixture and placed in a salt fog chamber without disturbing the specimen. The central hole in the upper plate shall be covered to prevent salt contamination of the lower plate contacting surface. Bolts shall not be retorqued during or following salt fog exposure.

Shielding effectiveness shall be measured over the range 10 MHz to 1000 MHz at sufficient intervals to fully characterize the shielding performance.

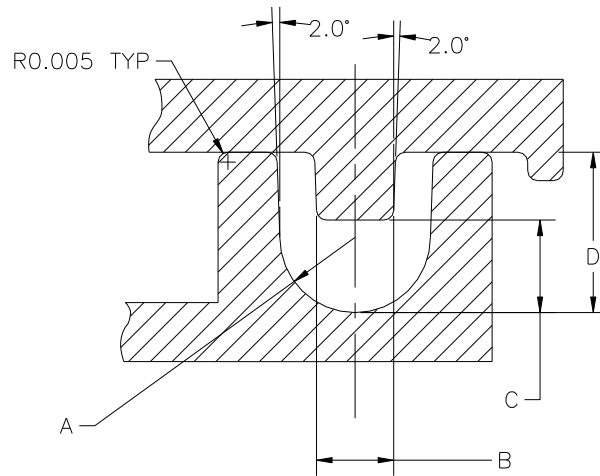


Figure 2 Optimized groove and tongue design (all tolerances are  $\pm 0.003''$ )

Figure 2 continued

Size (nominal)	A (inch)	B (inch)	C (inch)	D (inch)
<b>0.063</b>	0.039	0.040	0.048	0.083
<b>0.094</b>	0.061	0.063	0.075	0.130
<b>0.125</b>	0.078	0.080	0.096	0.166
<b>0.156</b>	0.093	0.096	0.115	0.199
<b>0.188</b>	0.109	0.112	0.135	0.233
<b>0.250</b>	0.140	0.144	0.172	0.298

4.5.6 Mechanical Strength. The release liners shall remain on the specimen while it is prepared (cut), and shall be removed before the test.

4.5.6.1 Flat Gaskets. The mechanical strength shall be tested in accordance with ASTM D 1004. The sample may, alternatively, be cut using the die for the Sheet Gasket Specimen shown in Figure 1b. The sample is cut on 45 degree bias to the mesh of the screen. Pounds to failure is recorded on Instron with 2 inch jaw separation and 2 inches /min crosshead speed.

4.5.6.2 Profiled Gaskets. A specimen 6 inches in length shall be clamped in the jaws of a tensile tester. The crosshead speed shall be 2 inches per minute until the specified load has been exceeded or the specimen fails, which ever occurs first.

4.5.7 Fluid Resistance Specimens shall be weighed to determine initial value. Specimens shall then be immersed in the fluids as specified in the applicable specification sheet. Three specimens shall be immersed in each fluid listed. After immersion the specimens shall be lightly blotted with a paper towel, hung vertically and allowed to dry at room temperature for 1 hour. The specimens shall then be weighed and the change in weight calculated. The average of the three specimens shall be recorded.

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Sheet matrix gasket: 1 inch x 1 inch  
Profiled matrix gasket: 3-inch length

- 4.5.8 Heat Aging Three specimens shall be prepared per 4.5.4 and then conditioned in an air circulating oven for 168 hours at 150°C for Silicone and High Performance Silicone, 175°C for Fluorosilicone. After conditioning, the specimen shall be removed from the oven and allowed to stabilize for 1 hour at room temperature. After heat aging the specimen shall be tested for D.C. Resistance per 4.5.4.
- 4.5.9 Salt Spray Salt spray testing shall be performed in accordance with ASTM B117. The specimen shall be secured in the specimen holder. A protective coating shall be applied to the specimen holder such that a band of the sample mounting disc approximately 0.25 inch wide around the female clamping fastener remains bare. The remainder of the specimen holder shall be completely covered. After conditioning for 500 hours (1000 hours for High Performance Silicone), the specimen holder shall be rinsed in clean water and dried. The protective coating and any exterior corrosion shall be removed to ensure good electrical contact in the subsequent testing. After salt spray conditioning, the shielding effectiveness for EMI gaskets shall be measured as described in 4.5.5 and then visual inspection shall be performed in accordance with 4.5.9.1. Electrical grounding gaskets shall meet the D.C. Resistance requirements of 4.5.4 and the visual inspection for corrosion requirements of 4.5.9.1.
- 4.5.9.1 Visual Inspection for Corrosion. The specimen shall be removed from the fixture and all gel particles shall be removed from the fixture with isopropyl alcohol. The fixture shall be visually examined for pitting in the area that was in contact with the specimen.
- 4.5.10 Thermal Cycling: Three specimens shall be prepared per 4.5.4 and then conditioned in an air circulating oven for 1 hour at high temperature (150°C for fluorosilicone and 125°C for silicone). Remove the specimens from the oven and within 2 minutes transfer the specimens to the low temperature chamber for 1 hour at -55°C. The specimens shall be alternated between high and low temperature for a total of 5 cycles. After thermal cycling the specimen shall be allowed to stabilize for 1 hour at room temperature. The specimens shall then be tested for D.C. Resistance per 4.5.4.
- 4.5.11 High Temperature Endurance Three specimens shall be prepared per 4.5.4 and then conditioned in an air circulating oven for 48 hours at 156°C for Silicone and High Performance Silicone. 187°C for Fluorosilicone. After conditioning, the specimen shall be removed from the oven and allowed to stabilize for 1 hour at room temperature. After heat aging the specimen shall be tested for D.C. Resistance.
- 4.5.12 Environmental Sealing. Sealing pressure test shall be performed under water. The test apparatus shall consist of: container filled with water, test fixture, and air supply system equipped with pressure gauge. The test fixture shall consist of two clean, smooth, aluminum plates. The top plate shall be supplied with the tongue and have dimensions as shown in Fig. 2. The bottom plate shall be supplied with the groove and have dimensions as shown in Fig. 2. The detailed design of the groove and tongue is shown in the installation guide TUS-14-3110. The air inlet should be installed in the top plate to allow for creating a positive pressure inside the test fixture.
- 4.5.13 Test Procedure  
The test fixture should be assembled and fasteners torqued to 15 inch-lb. The test fixture should be connected to the air supply. The entire assembly should be submerged in water. The internal pressure shall be increased gradually until air bubbles, escaping from the text fixture, are noticed. The pressure at which the first air bubbles are noticed should be higher than the sealing pressure requirement of the applicable specification sheet.



## **5.0 PREPARATION FOR DELIVERY**

- 5.1 Packaging and Packing. Unless otherwise specified in the procurement document, packaging and packing shall be in accordance with standard commercial practice.
- 5.2 Marking of Shipment. Unless otherwise specified in the procurement document, marking shall be in accordance with standard commercial practice.

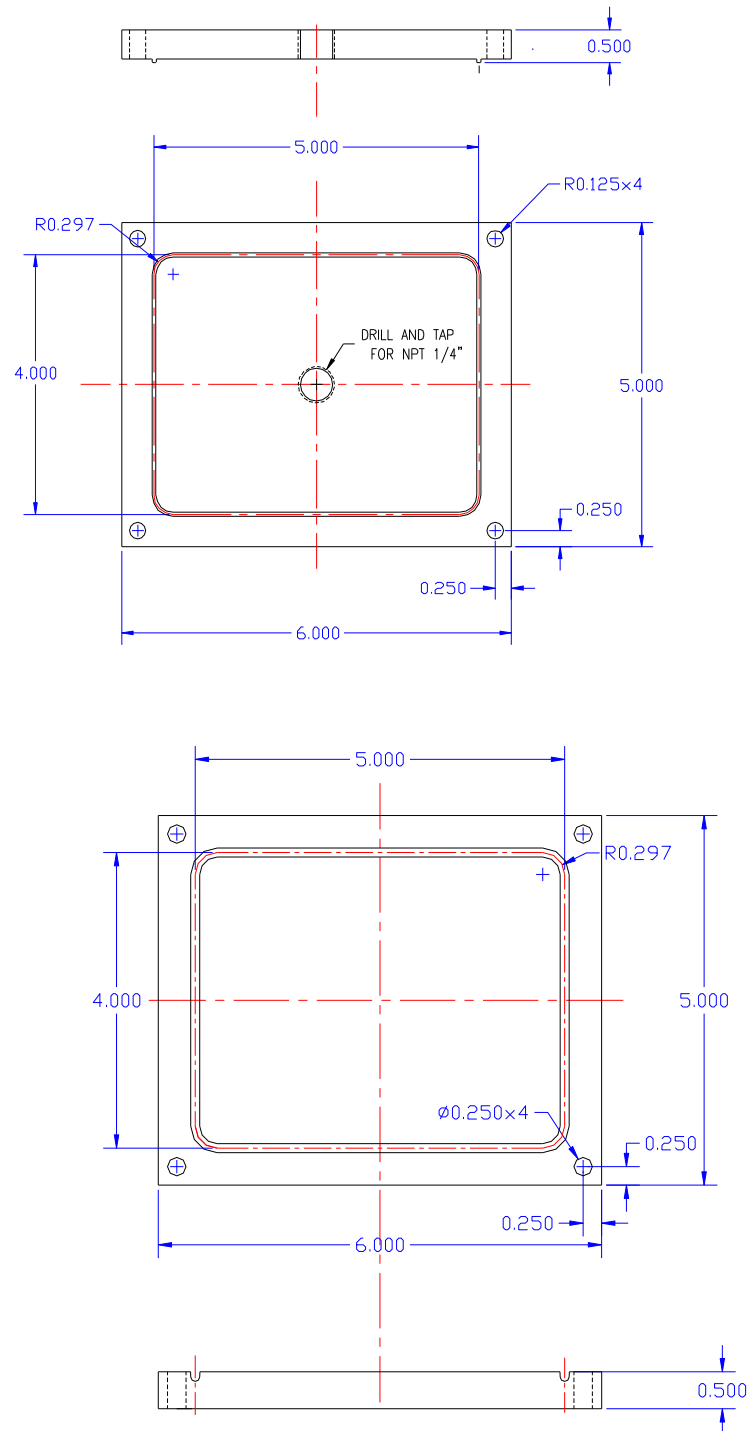
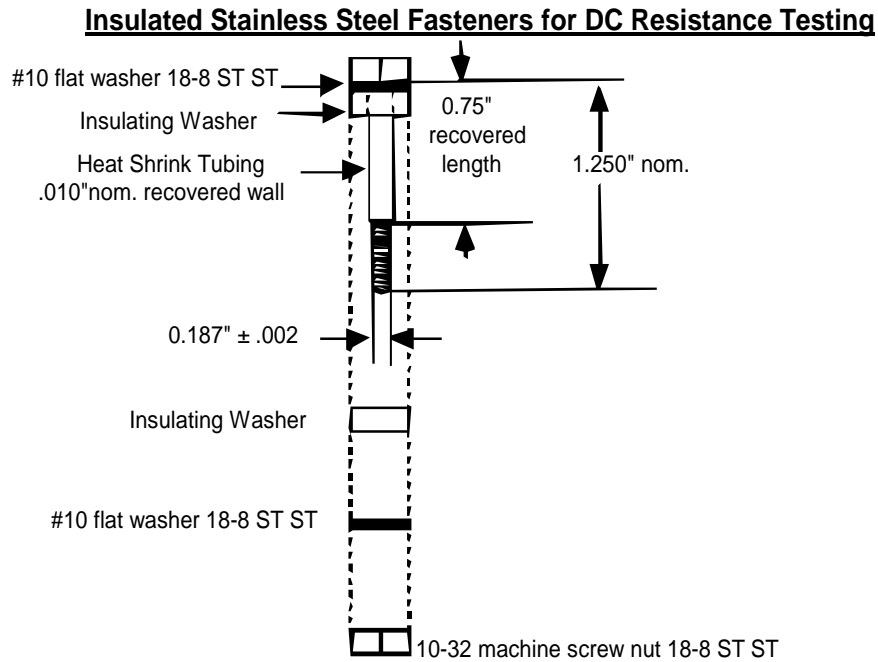
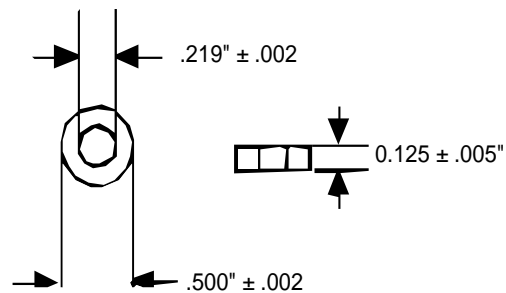


Fig. 1 Bottom and top fixture plates

Figure 1a. Test Fixture for DC Resistance



**Insulating Washer Dimensions**



The insulating washer must be dimensionally stable up to 175°C, for example glass-filled nylon.

Figure 1b. Test Fixture for DC Resistance

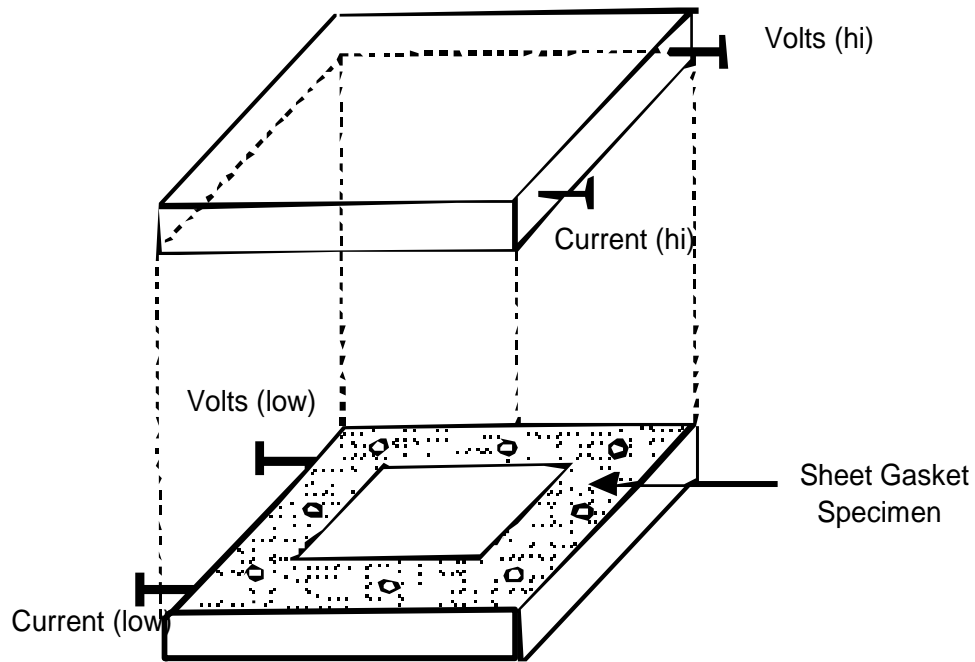
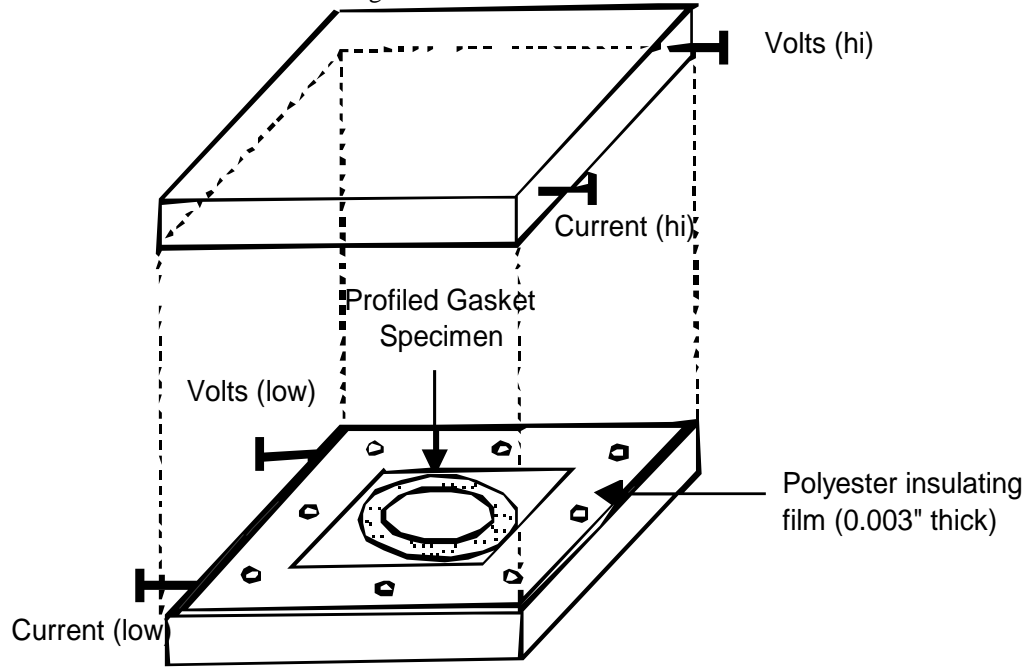
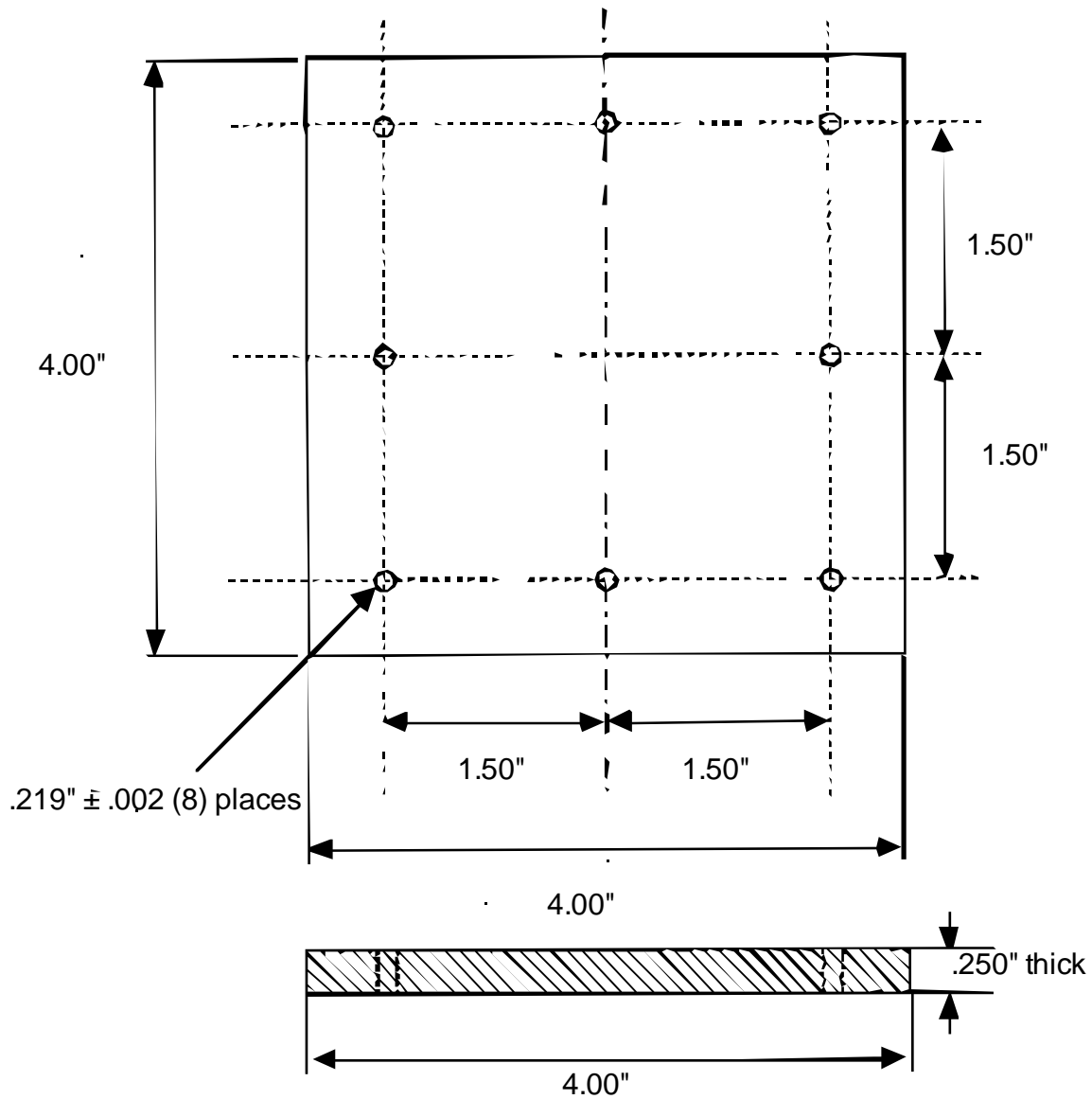


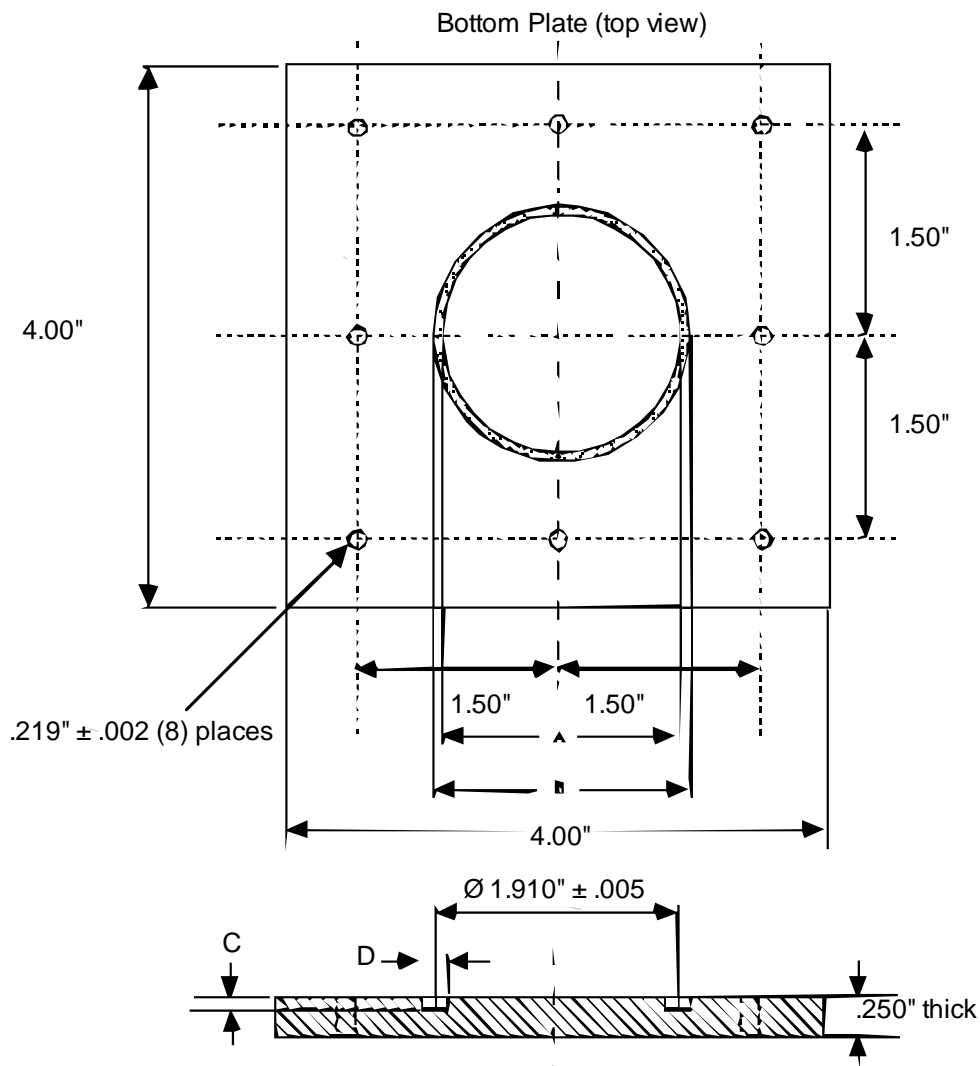
Figure 1c. Test Fixture for DC Resistance



**All  
Dimensions  $\pm$   
.005 except  
where  
noted**

Figure 1d. Test Fixture for DC Resistance

Nominal Gasket Diameter (inches)	Dimension A (inches)	Dimension B (inches)	Dimension C (inches)	Dimension D (inches)
0.063	1.830	1.990	0.048 ± .001	0.080 ± 0.001
0.094	1.786	2.034	0.072 ± .003	0.112 ± 0.003
0.125	1.756	2.064	0.098 ± .003	0.154 ± 0.003
0.156	1.723	2.097	0.112 ± .003	0.187 ± 0.003
0.188	1.694	2.126	0.147 ± .003	0.216 ± 0.003
0.250	1.624	2.196	0.172 ± .003	0.286 ± 0.003



Note:  
Testing to be performed using a Valhalla Scientific digital ohmmeter model 4165-1344 or equivalent at 20m V