Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 7273A
Superseding AMS 7273
Issued 11-1-68
Revised 11-15-72

RINGS, SEALING, FLUOROSILICONE RUBBER
High Temperature Fuel and Oil Resistant
70 - 80

1. SCOPE:

1.1 Form: This specification covers a fluorosilicone rubber in the form of molded rings.

1.2 Application: Sealing rings for use at temperatures from -55 to +175 C (-67 to +347 F) in fuels and from -55 to +150 C (-67 to +302 F) in lubricating oils. The cross-section of such rings is usually not over 0.275 in. (6.98 mm) in diameter or thickness.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS), Aerospace Standards (AS), and Aerospace Information Reports (AIR) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2817 - Packaging and Identification, Preformed Packings

2.1.2 Aerospace Standards:

AS 568 - Aerospace Size Standard for O-Rings
AS 871 - Manufacturing and Inspection Standards for Preformed Packings (O-Rings)

2.1.3 Aerospace Information Report:

AIR 851 - O-Ring Tension Testing Calculations

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM D471 - Changes in Properties of Elastomeric Vulcanizates Resulting from Immersion in Liquids
ASTM D1414 - Testing Rubber O-Rings

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be a compound based on a fluorosilicone elastomer, suitably cured to produce a product meeting all requirements of this specification.

3.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with ASTM D1414, insofar as practicable, except that the simulated component test of 3.2.7 shall be run on rings of the sizes specified therein produced from the same batch of compound as the parts supplied. Testing for tensile strength and tensile stress is not required on rings which are too small to permit assembly on rollers and are, after cutting, too short to permit testing as a single strand. Eliminating testing for tensile strength and tensile stress does not eliminate testing for elongation; elongation test can be made by stretching a ring over a mandrel of a size which will stretch the ring sufficiently to produce the required elongation when figured on the ID of the ring. Calculations of tensile strength, elongation, and tensile stress may be made in accordance with AIR 851.

3.2.1 As Received:

3.2.1.1	Hardness, Durometer "A" or equiv.	75 ± 5		
3.2.1.2	Tensile Strength, min	800 psi (5520 kPa)		
3.2.1.3	Elongation, min	100%		
3.2.1.4	Tensile Stress at 100% Elongation	700 - 1000 psi (4830 - 6900 kPa)		
3.2.1.5	Corrosion	Nil		
3.2.1.6	Specific Gravity, variation from approved sample	±0.03 max		
3.2.2	Aromatic Fuel Resistance: (Immediate Deteriorated Properties)		Medium: Temperature:	ASTM Ref. Fuel B 20 - 30 C (68 - 86 F)
3.2.2.1	Hardness Change, Durometer "A" or equiv.	-10 to 0	Time:	70 hr
3.2.2.2	Tensile Strength Change, max	-30%		
3.2.2.3	Elongation Change, max	-15%		
3.2.2.4	Volume Change	0 to +20%		
3.2.3	Lubricating Oil Resistance: (Immediate Deteriorated Properties)		Medium: Temperature:	SAE Ester Test Fluid No. 2 (See 8.1) 150 C ± 3 (302 F ± 5.4)
3.2.3.1	Hardness Change, Durometer "A" or equiv.	-10 to 0	Time:	70 hr
3.2.3.2	Tensile Strength Change, max	-25%		
3.2.3.3	Elongation Change, max	-20%		
3.2.3.4	Volume Change	0 to +12%		

3.2.4 Dry Heat Resistance: Temperature: 200 C ± 3 (392 F ± 5.4)
Time: 70 hr

3.2.4.1 Hardness Change, Durometer "A" or equiv.	-5 to +5
3.2.4.2 Tensile Strength Change, max	-10%
3.2.4.3 Elongation Change, max	-15%
3.2.4.4 Bend (Flat)	No cracking or checking

3.2.5 Compression Set: Temperature: 175 C ± 3 (347 F ± 5.4)
Time: 22 hr

Percent of Original Deflection Ring Cross Section Diameter	
0.066 to 0.110 in., incl (1.68 to 2.75 mm, incl)	50
Over 0.110 in. (2.75 mm)	30

3.2.6 Low Temperature Resistance:

Temperature Retraction, TR_{10} point, max	-55 C (-67 F)

3.2.7 Simulated Component Test: Sample rings shall pass the following test; any loss of test fluid in excess of "weeping" at any time or pressure on any fixture will be considered failure. Weeping is defined as the formation of small bubbles at a rate not greater than 10 per min. and which do not break the surface of the oil when tested under oil, and as slight wetting of the area around the fitting, with no visible flow of fuel, when tested in air.

3.2.7.1 Test Specimens: Shall be O-rings conforming in dimensions to AS 568-018, -120, and -214.

3.2.7.2 Apparatus: Shall consist of special blocks and plugs, as shown in Figs. 1 and 2, to be assembled as shown in Fig. 3, plus associated valves, piping, fittings and means of applying nitrogen at pressures up to 1500 psig (10,300 kPa) gage pressure as shown in Fig. 4.

3.2.7.3 Procedure: The following tests shall be run in sequence, holding for 10 min., unless otherwise specified, at each pressure. In raising pressure, any momentary leaking while O-rings are seating themselves shall be disregarded. If escape of test fluid in excess of weeping occurs, the test shall be discontinued at that step; if no escape of test fluid in excess of weeping occurs, the test shall be carried to the next step.

3.2.7.3.1 Fill recesses in blocks with ASTM Reference Fuel B (ASTM D471). Wipe specimens with ASTM No. 1 Oil (ASTM D471) to provide a lubricating oil film. Assemble specimens in their respective grooves in the plugs and assemble plugs to blocks. Tighten bolts to 90 - 110 lb-in. (10.2 - 12.4 N.m) torque. Fill text fixtures to top of each fitting, using a hypodermic syringe, with ASTM Reference Fuel B. Test for leakage at room temperature, using 100 psi (690 kPa) nitrogen pressure. If escape of test fluid in excess of weeping occurs, disassemble and reassemble test fixture, refill as necessary with ASTM Reference Fuel B, and again pressure test.

3.2.7.3.2 Place fixture in a suitable oil bath in an oven at 175 C ± 3 (347 F ± 5.4), attach pressure lines (See Fig. 4), and close all valves. (A suitable oil is one which is clear, light in color, and stable at the test temperature (See 8.2)). Heat fixture at 175 C ± 3 (347 F ± 5.4) for 6 hours. Pressure test, using nitrogen as the pressurizing medium, at 250, 500, 1000, and 1500 psig (1720, 3450, 6900 and 10,300 kPa gage pressure, respectively), noting any leakage by bubble formation in the oil. The valve system shall be used to isolate leakage of any particular ring.

3.2.7.3.3 Shut off heat input to the oven, allow apparatus to cool to room temperature, and release pressure. Remove fixture from the oil bath (See 8.3) and pressure test at room temperature in air at pressure of 250, 500, 1000, and 1500 psig (1720, 3450, 6900, and 10,300 kPa gage pressure, respectively) for 5 min. at each pressure, using nitrogen as the pressurizing medium.

3.2.7.3.4 Place the fixture, still filled with ASTM Reference Fuel B at atmospheric pressure, in refrigerator at -55 C ± 1 (-67 F ± 1.8) for 5 hours. While still in the refrigerator, pressure test at 250, 500, 1000, and 1500 psig (1720, 3450, 6900, and 10,300 kPa gage pressure, respectively) for 5 min. at each pressure, using nitrogen as the pressurizing medium.

3.2.7.3.5 Remove the fixture from the refrigerator, warm to room temperature, and pressure test as in 3.2.7.3.3.

3.2.7.3.6 Repeat the tests of 3.2.7.3.2 through 3.2.7.3.5 twice, making a total of 3 complete cycles. At the conclusions of the final cycle, disassemble the fixture and examine the rings. There shall be no evidence of extrusion, cracking, splitting, and other defects.

3.3 Quality: The product shall be uniform in quality and condition, clean, smooth, as free from foreign material as commercially practicable, and free from internal imperfections detrimental to performance of parts. Surface imperfections shall, unless otherwise specified, be no greater than permitted by AS 871 for minor defects.

3.4 Sizes and Tolerances: Shall be as specified on the drawing. Inspection for conformance to dimensional requirements shall be made in accordance with AS 871, unless otherwise agreed upon by purchaser and vendor.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of rings shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that rings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as acceptance or routine control tests and shall be performed on each lot of rings. A lot of rings is defined as all rings of the same size from the same batch of compound processed in one continuous run and submitted for the vendor's inspection at one time plus rings as required for the simulated component test when the sizes used for that test are not part of the lot. A batch shall be the quantity of compound run through a mill or mixer at one time.

Test	Paragraph Reference
Hardness, as received	3.2.1.1
Tensile Strength, as received	3.2.1.2
Elongation, as received	3.2.1.3
Tensile Stress, as received	3.2.1.4
Specific Gravity, as received	3.2.1.6
Volume Change in fuel	3.2.2.4
Compression Set	3.2.5
Simulated Component Test	3.2.7

4.2.2 Periodic Control Tests: Tests to determine conformance to the acceptance tests of 4.2.1 plus the following tests are classified as periodic control tests and shall be performed on rings produced from a production batch of compound at intervals not greater than 6 months.

Test	Reference Paragraph
Corrosion, as received	3.2.1.5
Tensile Strength Change in oil	3.2.3.2
Elongation Change in oil	3.2.3.3
Volume Change in oil	3.2.3.4
Hardness Change after dry heat exposure	3.2.4.1
Bend after dry heat exposure	3.2.4.4
Temperature Retraction, TR_{10} point	3.2.6

4.2.3 Qualification Tests: Tests to determine conformance to all requirements of this specification are classified as qualification tests and shall be the basis for approval (See 4.4) of the compound.

4.3 Sampling: A sufficient number of rings shall be taken from each lot or batch to perform each required tests, except the simulated component test, on three specimens; the simulated component test shall be run on one specimen of each required size from each lot or batch.

4.4 Approval:

4.4.1 Sample rings shall be approved by purchaser before rings for production use are supplied. Results of tests on production rings shall be essentially equivalent to those on the approved samples.

4.4.2 Vendor shall establish for each size of ring the control factors of processing which will produce rings meeting all requirements of this specification. These shall constitute the approved procedures and shall be used for manufacturing production rings. If necessary to make any change in control factors of processing which could affect quality or properties of the rings, vendor shall submit for reapproval a statement of the revised procedures and, when requested, sample rings. No production rings incorporating the revised procedures shall be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing rings include, but are not limited to, the following:

Compound ingredients or proportions thereof within established limits
Sequence of mixing compound ingredients
Type of mixing equipment
Method and equipment for preparing preforms
Basic molding procedure (compression, transfer, injection)
Curing time, temperature, and pressure (variations of ± 10% are permissible)
Finishing methods
Methods of routine inspection

4.4.2.1.1 Any of the above control factors of processing considered proprietary by the vendor may be assigned a code designation. Each variation in such factors shall be assigned a modified code designation.

4.5 Reports:

4.5.1 The vendor of rings shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's compound number, batch number, part number, and quantity.

4.5.2 In addition to the reports of 4.5.1, the vendor shall furnish at six-months intervals, the results of tests to determine conformance to the periodic control test requirements. This report shall be included with, or shall form a part of, the report of results of acceptance tests on the first lot of parts shipped following determination of conformance to the periodic control test requirements.

4.6 Resampling and Retesting: If an specimen used in the above tests fails to meet the specified requirements, disposition of the rings may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the rings represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Marking: Rings shall be packaged and identified as follows:

5.1.1 Individual rings shall be packaged and identified in accordance with AMS 2817 except cure date is not required.

5.1.2 Ring packages shall be packed in cartons in such a manner that the rings, during shipment and storage will not be permanently distorted and will be protected against damage from exposure to weather or any normal hazard. Each carton shall be marked to give the following information:

AMS 7273A
PART NUMBER _____
PURCHASE ORDER NUMBER _____
QUANTITY _____
COMPOUND NUMBER _____
BATCH NUMBER _____
MANUFACTURER'S IDENTIFICATION _____
DATE OF SHIPMENT _____

5.1.3 Cartons shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Parts not conforming to this specification or to authorized modifications will be subject to rejection.

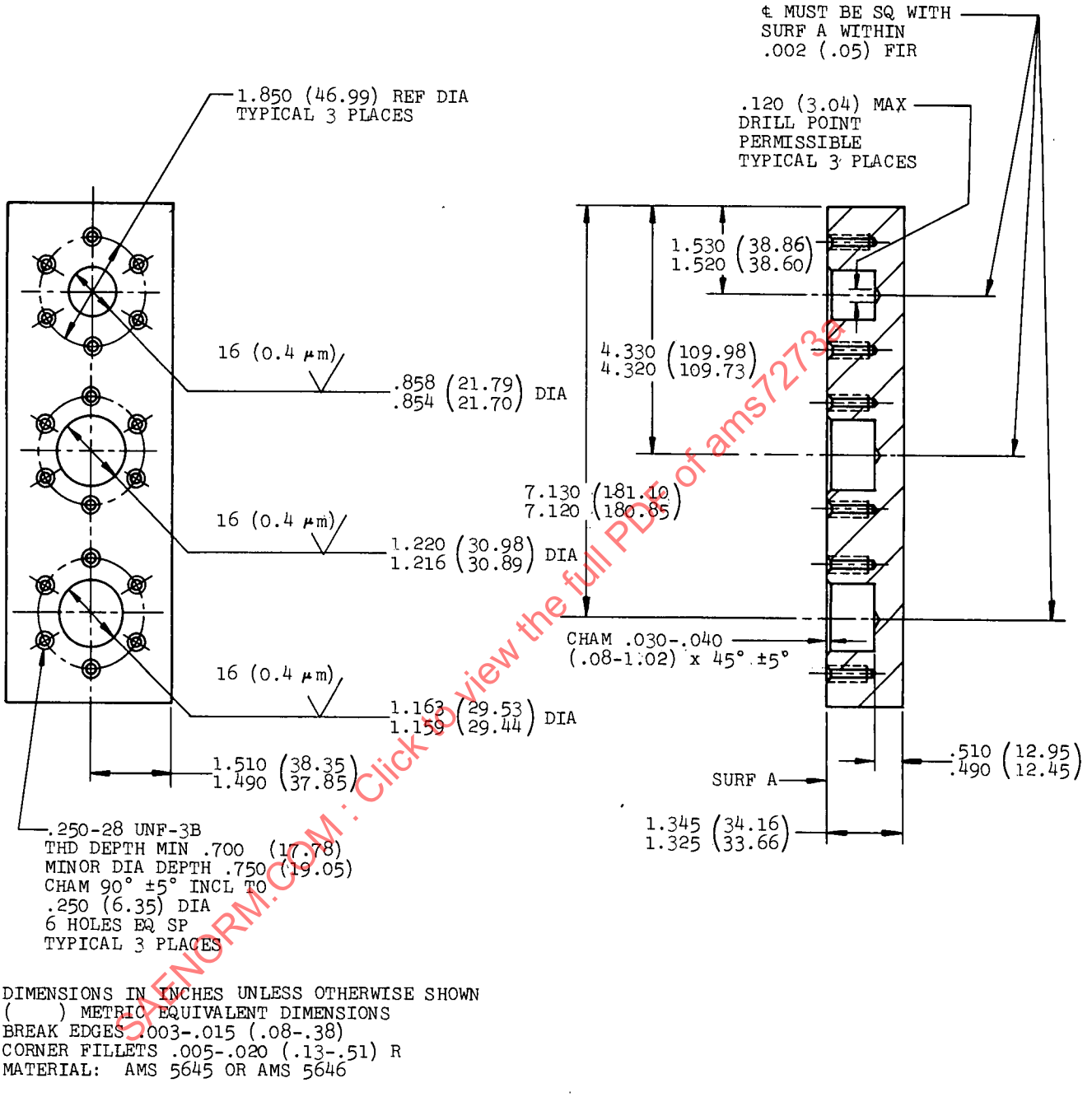
8. NOTES:

8.1 Test Fluid: SAE Ester Test Fluid No. 2 may be ordered as Stauffer Blend No. 7700 from:

Stauffer Chemical Company
Special Chemical Division
289 Park Avenue
New York, New York 10017

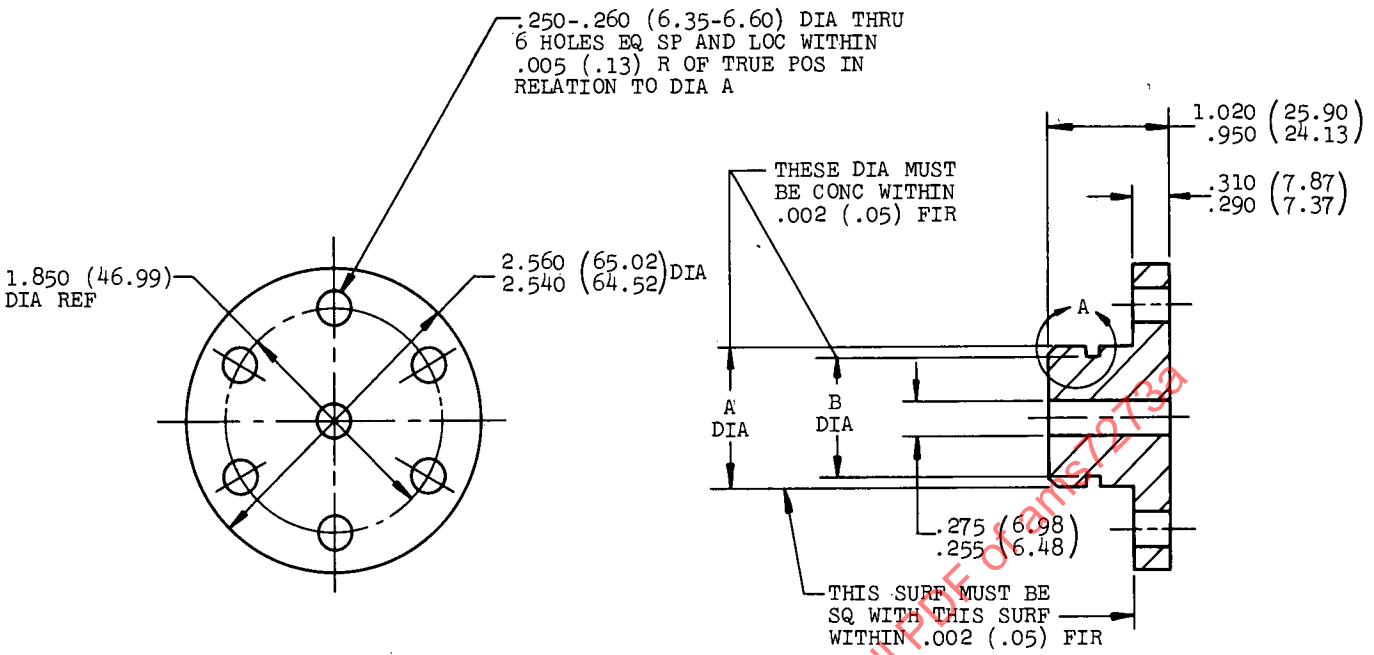
8.2 Immersion Fluid: Silicone oils having nominal viscosities between 20 and 50 centistokes at 25 C (77 F) are recommended for use in the high temperature exposure portion (3.2.7.3.2) of the simulated component test; the fluid used should have flash point higher than the exposure temperature.

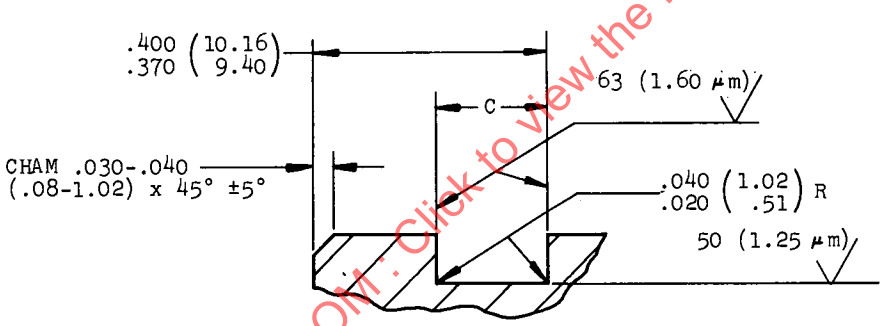
8.3 Marginal Indicia: No phi (Ø) symbol is used to indicate where technical changes have been made in this specification because of the extensive nature of all changes.



DIMENSIONS IN INCHES UNLESS OTHERWISE SHOWN
( ) METRIC EQUIVALENT DIMENSIONS
BREAK EDGES .003-.015 (.08-.38)
CORNER FILLETS .005-.020 (.13-.51) R
MATERIAL: AMS 5645 OR AMS 5646

FIGURE 1 - SEALING RING TEST FIXTURE BLOCK





O-ring size	Inches			Millimeters		
	A	B	C	A	B	C
-018	.850- .852	.744-.748	.100-.110	21.59-21.64	18.89-18.99	2.54-2.79
-120	1.155-1.157	.993-.997	.140-.150	29.34-29.38	25.23-25.32	3.56-3.81
-214	1.212-1.214	.990-.994	.180-.190	30.79-30.73	25.15-25.24	4.58-4.82

DIMENSIONS IN INCHES UNLESS OTHERWISE SHOWN
( ) METRIC EQUIVALENT DIMENSIONS
BREAK EDGES .003-.015 (.08-.38)
CORNER FILLETS .005-.020 (.13-.51) R
DIAMETERS MUST BE CONCENTRIC WITHIN .010 (.25) FIR UNLESS OTHERWISE SPECIFIED
MATERIAL: AMS 5645 OR AMS 5646

FIGURE 2 - SEALING RING TEST FIXTURE PLUGS