AEROSPACE MATERIAL SPECIFICATION

AMS3376™	REV. D
Issued 1985-07 Revised 2021-06 Superseding AMS3376C	

Sealing Compound, Non-Curing, Fluorosilicone Groove Injection Temperature and Fuel Resistant

RATIONALE

This is a Five-Year Review of AMS3376. Update formatting and reference specification titles. Clarify “extrusion” nomenclature, exposure procedure, and figure notes.

1. SCOPE

1.1 Form

This specification covers a permanently mastic, non-curing fluorosilicone sealing compound in the form of a paste.

1.2 Application

This product has been used typically for sealing or resealing integral fuel tanks designed for groove-injection type sealing for use from -65 to +360 °F (-54 to +182 °C), but usage is not limited to such applications.

1.3 Classification

Sealing compounds covered by this specification are classified as follows:

Class 1 - High viscosity, permanently mastic, fuel resistant, fluorosilicone paste compound suitable for sealing applications with structural mismatch of 0.005 inch (0.13 mm) or less, normally contains glass bead filler material.

Class 2 - Medium viscosity, permanently mastic, fuel resistant, fluorosilicone paste compound suitable for sealing applications with structural mismatch of 0.005 inch (0.13 mm) or less, normally contains glass bead filler material.

Class 3 - High viscosity, permanently mastic, fuel resistant, fluorosilicone paste compound suitable for sealing applications with structural mismatch of 0.015 inch (0.38 mm) or less, normally contains cured fluorosilicone rubber particles.

1.4 Safety - Hazardous Materials

Shall be in accordance with AS5502 (1.1).

2. APPLICABLE DOCUMENTS

Shall be in accordance with AS5502 (Section 2).

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2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2629	Fluid, Jet Reference
AMS3167	Solvents, Wipe for Cleaning Prior to Application of Primer and Top Coat Materials, or Sealing Compounds
AMS3660	Polytetrafluoroethylene (PTFE) Moldings, General Purpose Grade, As Sintered
AMS3819	Cloths, Cleaning for Aircraft Primary and Secondary Structural Surfaces
AMS4035	Aluminum Alloy, Sheet and Plate, 4.4Cu - 1.5Mg - 0.60Mn (2024-O), Annealed; or when specified, “As Fabricated” (2024-F)
AMS4045	Aluminum Alloy, Sheet and Plate, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr, 7075: (-T6 Sheet, -T651 Plate), Solution and Precipitation Heat Treated
AMS5070	Steel, Bars and Forgings, 0.18 - 0.23C (SAE 1022)
AMS5640	Steel, Corrosion-Resistant, Bars, Wire, and Forgings, 18Cr - 9.0Ni, Free Machining
AMS6370	Steel, Bars, Forgings, and Rings, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)
AMS-C-27725	Coating, Corrosion Preventative, for Aircraft Integral Fuel Tanks for Use to 250 °F (121 °C)
AS5127	Aerospace Standard Test Methods for Aerospace Sealants, Methods for Preparing Aerospace Sealant Test Specimens
AS5127/1	Aerospace Standard Test Methods for Aerospace Sealants, Two-Component Synthetic Rubber Compounds
AS5502	Standard Requirements for Aerospace Sealants and Adhesion Promoters
AS8879	Screw Threads, UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter
AS71051	Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT - Design and Inspection Standard

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D471	Standard Test Method for Rubber Property - Effect of Liquids

2.3 PRI Publications

Available from Performance Review Institute, 161 Thorn Hill Road, Warrendale, PA 15086-7527, Tel: 724-772-1616, www.pri-network.org.

PRI-QPL-AMS3376	Products Qualified Under AMS3376

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3. TECHNICAL REQUIREMENTS

3.1 Material

Sealing compound shall be a permanently deformable, non-curing fluorosilicone product which does not contain solvents. Sealing compound shall exhibit no separation of components. Occluded gases shall not be permitted.

3.2 Date of Packaging

Shall be in accordance with AS5502 (3.1).

3.3 Toxicological Formulations

Shall be in accordance with AS5502 (3.2).

3.4 Shelf Life

Shelf life shall be a minimum of 18 months from the date of packaging when stored at 90 °F (32 °C) or lower. Material may be retested for shelf life extension per 4.3.3.

3.5 Quality

Shall be in accordance with AS5502 (3.3).

3.6 Properties

Sealing compound shall conform to the requirements shown in Table 1, determined in accordance with specified test methods.

Table 1 - Properties

Paragraph	Property	Requirements	Test Method
3.6.1	Nonvolatile Content, minimum	98%	AS5127/1 (5.1)
3.6.2	Extrusion Force		4.5.4
	Class 1	200 to 275 pounds force (890 to 1223 N)	
	Class 2	100 to 200 pounds force (445 to 890 N)	
	Class 3	250 to 350 pounds force (1112 to 1557 N)	
3.6.3	Corrosion Resistance	The surface of the panel which was in contact with sealing compound shall have no more corrosion or severe discoloration than the uncoated panel.	4.5.5
3.6.4	Pressure Rupture, minimum	10 inches Hg (254 mm Hg)	4.5.6
3.6.5	Fuel Resistance		4.5.7
3.6.5.1	Volume Change	+5 to +35%	4.5.7.1
3.6.5.2	Weight Loss, maximum	6%	4.5.7.2
3.6.6	Liquid and Vapor Sealability	No leaks or loss of pressurization	4.5.8
3.6.7	Reinjection Time, maximum	20 seconds	4.5.9

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Shall be in accordance with AS5502 (4.1).

4.1.1 Source Inspection

Shall be in accordance with AS5502 (4.1.1).

4.1.2 Sampling

Shall be in accordance with AS5502 (4.3).

4.2 Classification of Tests

Shall be in accordance with AS5502 (4.2).

4.2.1 Qualification Tests

All technical requirements listed in Table 1 are qualification tests and shall be performed on a production lot of the sealing compound prior to shipment to a purchaser, when a change in ingredients and/or processing requires reapproval, or when purchaser deems confirmatory testing to be required.

4.2.2 Acceptance Tests

Requirements shown in Table 2 are acceptance tests and shall be performed on each lot per AS5502 (4.2.2.2).

Table 2 - Acceptance tests

Test	Requirement Paragraph
Nonvolatile Content	3.6.1
Extrusion Force	3.6.2
Pressure Rupture	3.6.4
Fuel Resistance	3.6.5

4.3 Sampling and Testing

Shall be in accordance with AS5502 (4.3).

4.3.1 Acceptance Tests

Shall be in accordance with AS5502 (4.3.1).

4.3.1.1 Each lot shall be subjected to acceptance testing. Sufficient material for acceptance testing shall be packaged in the same type containers that are being procured. After packaging, test kits shall be selected at random for acceptance testing. Acceptance testing is to be conducted on the final packaged product and consist of those tests outlined in 4.2.2.

4.3.2 Qualification Test Samples

Sample lots shall be produced using production scaled equipment. Enough material shall be supplied to perform all required tests.

4.3.2.1 Samples shall be identified as specified herein and below:

Sealing Compound, Non-Curing, Fluorosilicone Groove Injection, Temperature and Fuel Resistant
AMS3376D Class
MANUFACTURER'S IDENTIFICATION _____
LOT NUMBER _____
DATE OF PACKAGING _____
SHELF LIFE EXPIRATION DATE _____
STORE BELOW 90 °F (32 °C)

4.3.3 Shelf Life Extensions

4.3.3.1 Sampling

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Shall be in accordance with AS5502 (4.3).

4.3.3.2 Shelf Life Testing

The testing to be conducted for shelf-life extensions are listed in Table 3.

Table 3 - Shelf life testing

Test	Requirement Paragraph
Nonvolatile Content	3.6.1
Extrusion Force	3.6.2
Pressure Rupture	3.6.4
Fuel Resistance	3.6.5

4.3.3.3 Time and Limits of Shelf Life Extensions

If tests are being performed at the end of the stated shelf life to extend the shelf-life of the sealing compound, and all tests are passed, the shelf-life will be extended 9 months. Up to four extensions are permissible.

4.4 Approval

Shall be in accordance with AS5502 (4.4).

4.5 Test Methods

4.5.1 Standard Conditions

Standard laboratory conditions shall be as specified in AS5127 (Section 4).

4.5.2 Standard Tolerances

Unless otherwise specified herein, standard tolerances of AS5127 (Section 3) shall apply.

4.5.3 Standard Cleaning

Unless otherwise specified herein, all test panels and jigs shall be cleaned using AMS3167 and AMS3819, Grade A, cleaning cloths.

4.5.4 Extrusion Force

The extrusion plastometer shown in Figures 1 and 2 shall be packed with a hand rolled, cylindrically shaped mass of sealing compound about 0.75 inch (19 mm) in diameter and 2.25 to 2.50 inches (57.2 to 63.5 mm) long. Special precaution should be taken to avoid forming air pockets in the slug of sealing compound. Sufficient fingertip pressure shall be used to force the sealing compound into intimate contact with the cylinder walls. The packed apparatus shall be stabilized for 24 hours at standard conditions (4.5.1). At the end of the stabilization period, insert the plastometer piston, center the assembly on the fixed base of a tensile machine, and load in compression at the constant rate of 0.100 inch ± 0.002 inch (2.54 mm ± 0.05 mm) per minute. When the top of the piston is approximately 1.25 inches (31.8 mm) from the top of the plastometer cylinder, the maximum scale load which occurs during the ensuing 0.25 inch (6.4 mm) of piston travel shall be recorded. Clean the plastometer completely per 4.5.3 after each trial. Repeat the test on the empty plastometer, measuring the scale load during the same piston travel location and the scale load obtained from the maximum scale loads obtained when the sealing compound was tested. The test shall be run in duplicate and the average of the results reported. Individual test results shall not deviate by more than 10% of the average value.

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4.5.5 Corrosion Resistance

Two AMS4045 panels approximately 0.040 x 2.75 x 6 inches (1.02 x 69.8 x 152 mm) in size shall be cleaned in accordance with AS5127 (6.2.1). Two parallel fillets of sealing compound 0.06 inch (1.5 mm) thick by 0.75 inch (19 mm) wide by 5 inches (127 mm) long shall be applied to one side of one of the panels. That panel shall be set aside under standard conditions, lying horizontally with the sealing compound face up, for a minimum of 24 hours. Both panels shall be immersed vertically for 20 days in a covered glass vessel containing a two-layer liquid consisting of a 3% by weight aqueous sodium chloride solution and AMS2629, Type I, jet reference fluid, so that 2 inches (51 mm) of the panels are exposed to salt water, 2 inches (51 mm) are exposed to jet reference fluid, and the remainder is exposed to air-vapor mixture. The temperature during the exposure shall be maintained at 140 °F (60 °C) for 20 days. Immediately upon removal from the liquid, the sealing compound shall be removed using a non-metallic scraper and the area underneath the sealant examined for evidence of corrosion.

4.5.6 Pressure Rupture

Specimens constructed in accordance with Figure 3 and finished as listed in Table 4 shall be used. Pack the sealing compound into the specimens taking care to eliminate air bubbles and stabilize the specimens at standard conditions (4.5.1) for not less than 24 hours. The specimens shall be cooled to below -20 °F (-29 °C) and any excess material beyond flush shall be trimmed from the surfaces with a razor blade. One of the specimens shall be mounted in the pressure rupture jig (Figure 3). One air hose bib of the apparatus shall be connected to a manometer, the other to a variable pressure source. The assembly shall be immersed in a water bath at 77 °F (25 °C) and stabilized for 5 minutes. Starting at atmospheric pressure, the pressure on the apparatus shall be uniformly increased at the rate of 1 inch (25.4 mm) of mercury per 15 seconds until failure occurs. A continuous stream of air bubbles observed to come from the specimen shall constitute a failure. The pressure applied at the time of failure shall be recorded. Test the other two specimens in the same manner. The average failure pressure of the three specimens shall be reported to the nearest 0.5 inch (12.7 mm) of mercury (Hg).

Table 4 - Pressure rupture specimens
(three each required)

1. Sulfuric acid anodized in accordance with AS5127 (6.3).
2. Sulfuric acid anodized in accordance with AS5127 (6.3) and coated with AMS-C-27725 corrosion preventive coating. Application, coating thickness, and curing shall be in accordance with manufacturer's recommendations. Care shall be taken to ensure a thin, even coat in the slot.

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4.5.7 Fuel Resistance

4.5.7.1 Volume Change

Six AMS4045 aluminum panels, approximately 0.040 x 1 x 2.50 inches (1.02 x 25.4 x 63.5 mm), shall be weighed accurately to the nearest milligram in air (W_1), and in water (W_2). A pad of sealing compound 0.06 x 1 x 2 inches (1.5 x 25.4 x 51 mm) shall be applied to each panel. One-half inch (12.7 mm) at one end of each panel shall not be coated for handling purposes. The sealing compound coated panels shall then be weighed in air (W_3) and in water (W_4). The panels shall be conditioned at standard conditions (4.5.1) for 24 hours. The panels shall then be exposed for 14 days at 160 °F (71 °C) with three of the panels immersed in AMS2629, Type I, fluid and the other three in ASTM D471 Reference Fuel A. The panels shall be weighed immediately upon removal from the fluid in air (W_5) and in water (W_6). The procedures in ASTM D471 for weighing specimens after fluid exposure shall be used. The percent change in volume shall be determined by Equation 1. The reported value shall be determined by averaging the three values obtained for each exposure. The average value shall be determined to the nearest 0.1%.

$$\text{Percent Volume Change} = \frac{(W_5 - W_6) - (W_3 - W_4)}{(W_3 - W_4) - (W_1 - W_2)} \times 100 \qquad \text{(Eq. 1)}$$

4.5.7.2 Weight Loss

Each panel shall then be placed in an oven at 200 °F (93 °C) for 24 hours, cooled to standard conditions (4.5.1) for at least 2 hours, and weighed in air (W_7). The percentage weight loss shall be determined by Equation 2. The reported value shall be determined by averaging the three values obtained for each exposure. The average value shall be determined to the nearest 0.1%.

$$\text{Percent Weight Loss} = \frac{W_3 - W_7}{W_3 - W_1} \times 100 \qquad \text{(Eq. 2)}$$

4.5.8 Liquid and Vapor Sealability

4.5.8.1 Jig Assembly

Washer and shim thicknesses required for jig assembly are shown in Table 5.

Table 5 - Jig assembly

Sealant Class	Washer and Shim Thickness
Class 1	0.005 inch ± 0.0002 inch (0.13 mm ± 0.005 mm)
Class 2	0.005 inch ± 0.0002 inch (0.13 mm ± 0.005 mm)
Class 3	0.015 inch ± 0.0002 inch (0.38 mm ± 0.005 mm)

A groove injection pressure test jig conforming to Figure 4 shall be cleaned in accordance with 4.5.3. Install washers 0.26 inch (6.6 mm) ID by 0.50 inch (12.7 mm) OD by appropriate thickness specified in Table 5 on every other of the outer circle bolts between the two plates. Install four shims 0.25 x 1.00 inch (6.4 x 25.4 mm) by appropriate thickness specified in Table 5 in the faying surface between the fuel cavity and the groove so that the shims do not protrude into the groove but may protrude into the fuel cavity. The bolts shall be torqued to 60 in/lb ± 2 in/lb (6.8 Nm ± 0.2 Nm).

4.5.8.2 Sealant Injection

A suitable sealing compound injection gun with a 70-to-1 injection pressure to air line pressure ratio shall be used for sealant injection. The line air pressure shall be maintained so that the maximum pressure developed at the injection tip (see Figure 5) is 2800 psi ± 70 psi (19.3 MPa ± 0.5 MPa). The sealing compound shall be injected into the jig through the four injection ports calling the first port injected A and going clockwise calling the other ports B, C, and D as follows:

4.5.8.2.1 With all injection ports unplugged, inject into A until not less than 1 inch (25.4 mm) sealing compound emerges from ports B and D (i.e., the two ports adjacent to the port being injected).

4.5.8.2.2 Insert a plug screw into port A and inject B until not less than 1 inch (25.4 mm) of sealing compound emerges from C.

4.5.8.2.3 Insert a plug screw into B and inject into C until not less than 1 inch (25.4 mm) of sealing compound emerges from D.

4.5.8.2.4 Insert a plug screw into C and remove the plug screw from A. Inject into D until not less than 1 inch (25.4 mm) of sealing compound emerges from A.

4.5.8.2.5 Insert a plug screw into A and D.

4.5.8.3 Pre-Exposure Pressure Test

To ensure that the jig is initially sealed, pressurize the jig to 5 psi (34.5 kPa), close the needle valve, and watch for a pressure drop for 60 seconds. The pressurized system shall be leak-free from the needle valve through the pressure gauge to the test jig. If a pressure drop occurs, immerse the pressurized jig in water to determine the location of the leak. Re-inject sealing compound into the proper portion of the groove to stop the leak and pressure test again. Specimens are ready for conditioning when no pressure drop occurs after 60 seconds of pressurization.

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4.5.8.4 Exposure Conditioning

The conditioning shall be as follows:

Table 6 - Liquid and vapor sealability exposures

Test	Exposure Conditions
Initial Exposure - Jig assembly filled with AMS2629, Type 1 (JRF)	44 hours at 160 °F (71 °C) at 0 psi (0 kPa), followed by 4 hours at -65 °F (-54 °C) at 5 psi (34.5 kPa)
Exposure Cycle	With jig assembly filled with JRF fluid, condition for: 16 hours at 160 °F (71 °C)
	Drain jig assembly and add 5 mL of JRF fluid to drained jig and pressurize to 5 psi (34.5 kPa) to obtain JRF vapors.
	With jig assembly filled with JRF vapor, condition for: 4 hours at 260 °F (127 °C) at 5 psi (34.5 kPa), followed by
	30 minutes at 360 °F (182 °C) at 5 psi (34.5 kPa), followed by
	60 minutes at room temperature at 0 psi (0 kPa)
	Refill the jig with JRF and condition for 150 minutes at room temperature at 0 psi (0 kPa).

Repeat the Exposure Cycle in Table 6 five times for a total of six cycles. Do not repeat initial exposure conditioning in Table 6. During any extended time between cycles, such as a weekend, the jig shall remain filled with JRF (fluid) and conditioned at standard conditions with no pressure. Any JRF leakage or loss of pressurization shall be reported and is considered a failure.

4.5.9 Reinjection

After completing the liquid and vapor sealability testing per 4.5.8.4, the jig shall be reinjected as follows:

4.5.9.1 The calculated tip pressure of the gun shall be 2800 psi ± 70 psi (19.3 MPa ± 0.5 MPa).

4.5.9.1.1 The injection shall be performed as in 4.5.8.2, except that only two adjacent injection ports shall be unplugged at one time, the plug being injected and the next plug clockwise.

4.5.9.1.2 Four injections (i.e., plug A to B, plug B to C, plug C to D, and plug D to A) shall be timed to the nearest second from when the trigger is depressed until the piston reaches the end of its travel. The arithmetic average of the times shall be reported.

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4.6 Reports

Shall be in accordance with AS5502 (4.5).

4.7 Resampling and Retesting

Shall be in accordance with AS5502 (4.6).

4.8 Qualification

Shall be in accordance with AS5502 (4.7). All products sold to this specification shall be listed, or approved for listing, on the Qualified Products List, PRI-QPL-AMS3376.

5. PREPARATION FOR DELIVERY

Shall be in accordance with AS5502 (Section 5).

6. ACKNOWLEDGMENT

Shall be in accordance with AS5502 (Section 6).

7. REJECTIONS

Shall be in accordance with AS5502 (Section 7).

8. NOTES

8.1 Revision Indicator

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

8.2 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

8.3 Purchase documents should specify not less than the following:

AMS3376D
Class of sealing compound desired
Type and size of container desired
Quantity of containers desired
Special packaging, if required

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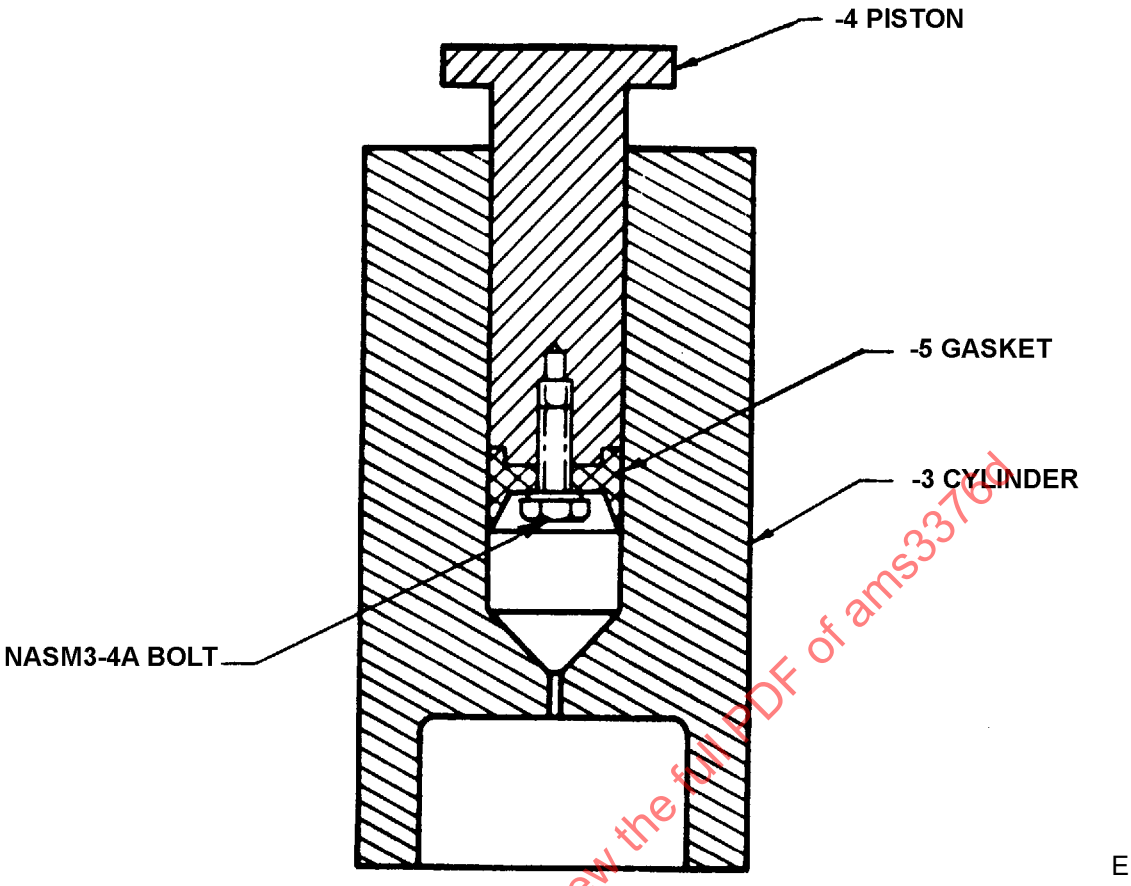

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Figure 1 - Extrusion plastometer

NOTES FOR EXTRUSION PLASTOMETER (FIGURE 1):

1. The plastometer shall be maintained at standard conditions (4.5.1) during testing.
2. The rate of plastometer piston travel is critical. The rate of head travel of the tensile machine should be checked with a dial micrometer while testing.
3. The plastic gasket should be frequently checked for wear and replaced if undersized or irregular.
4. The plastometer piston shall be removed immediately following a test to avoid permanent compression of the plastic gasket.
5. If the plastometer is not to be used for 5 days or longer, the inside surface shall be thoroughly covered with a protective oil.
6. The plastometer shall be cleaned in accordance with 4.5.3 before use.

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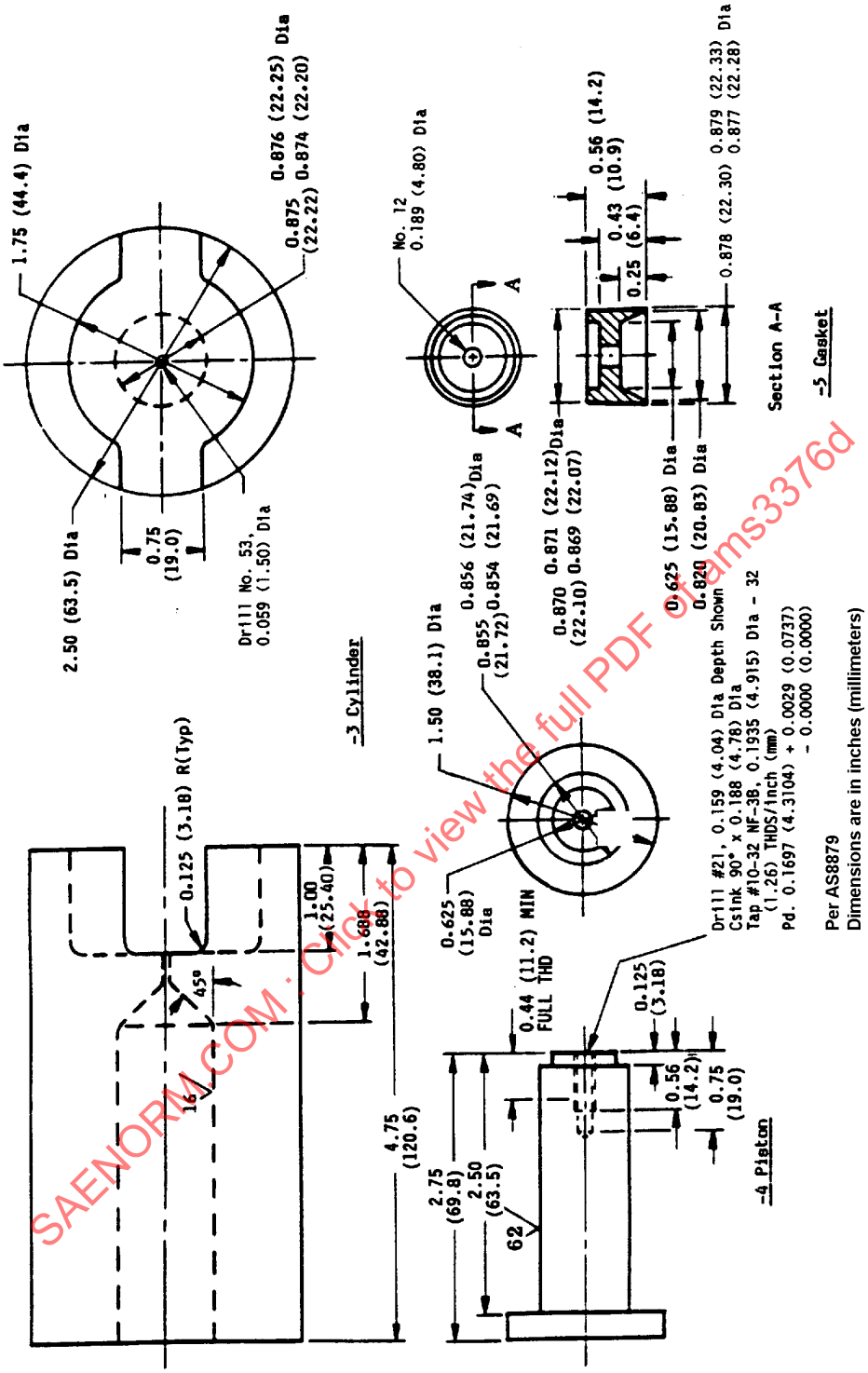

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Figure 2 - Extrusion plastometer – dimensions are in inches (millimeters)

NOTES FOR EXTRUSION PLASTOMETER (FIGURE 2):

1. Material of -3 Cylinder: AMS6370 Steel Bar, Heat Treated to 180 to 200 ksi (1241 to 1379 MPa).
2. Material of -4 Piston; AMS5070 Steel Bar which has been case hardened 0.032 inch (0.81 mm) deep to a hardness of 55 HRA, minimum. The core strength shall be a minimum of 55.0 ksi (379 MPa).
3. Material of -5 Gasket: AMS3660 Plastic Rod.
4. Machine finish all surfaces 250 microinches (0.00635 mm), except as noted.
5. Tolerances shall be ±0.005 inch (±0.13 mm), except as noted.