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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3276C

Issued OCT 1993
Revised JAN 1999

Superseding AMS 3276B

Submitted for recognition as an American National Standard

Sealing Compound, Integral Fuel Tanks and General Purpose, Intermittent Use To 360 °F (182 °C)

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1. SCOPE:

1.1 Form:

This specification covers five classes of a fuel-resistant polysulfide (T) sealing compound supplied as a two-component system.

1.2 Application:

This sealing compound has been used typically for fuel tank sealing, cabin pressure sealing, and aerodynamic smoothing, but usage is not limited to such applications. It can be used for faying surface sealing, wet-installation of fasteners, overcoating fasteners, sealing joints and seams, and nonstructural adhesive bonding. This room-temperature curing sealing compound can be used in fuel areas as well as nonfuel areas. Curing of this material can be accelerated at higher temperatures. Prior to applying this fuel tank sealant, the bond surfaces should be treated with AMS 3100 adhesion promoter to enhance sealant adhesion. This material is usable from -65 to 250 °F (-54 to 121 °C), with short-term exposure (approximately six hours) to 360 °F (182 °C).

1.3 Classification:

Sealing compounds covered by this specification are classified by method of application and application time (or worklife) as follows:

Class A - Suitable for brush application. Available with the following application times:

a. A-1/2
b. A-2
c. A-4

Class B - Suitable for application by extrusion gun, spatula, brush, or roller; and used, primarily, for fillet sealing, injection sealing, prepack sealing, and rework of damaged fillet seals. Class B sealants are available with the following application times:

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1.3 (Continued):

a. B-1/4
b. B-1/2
c. B-1
d. B-2
e. B-4
f. B-6
g. B-12

Class C - Suitable for application by extrusion gun, spatula, brush or roller; and mostly used for fay surface sealing and wet installation of fasteners. Class C materials are available with the following application times; unless otherwise indicated, squeeze-out (or assembly) times are shown in parentheses next to each application time:

a. C-1/2 [not applicable (N/A)]
b. C-2 (N/A)
c. C-8 (20)

Class D - Suitable for application by extrusion gun or spatula. Used for hole and void filling, or for other applications where a very thick sealant is required. Available with the following application times:

a. D-1/4
b. D-1/2

Class E - Suitable for application by automatic riveting equipment. Available as Class E-6.

1.3.1 The specific sealing compound supplied shall conform to the class and application time or squeeze-out time (assembly time) that is ordered.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may require the use of hazardous materials, this specification does not address hazards which may be involved in such use. It is the sole responsibility of the user to be familiar with safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2471	Anodic Treatment of Aluminum Alloys, Sulfuric Acid Process, Undyed Coating
AMS 2629	Jet Reference Fluid
AMS 3020	Oil, Reference, for "L" Stock Rubber Testing
AMS 3021	Fluid, Reference, for Testing Di-Ester (Polyol) Resistant Material
AMS 3100	Adhesion Promoter, for Polysulfide Sealing Compounds
AMS 3819	Cloths, Cleaning, for Aircraft Primary and Secondary Structural Surfaces
AMS 4037	Aluminum Alloy Sheet and Plate, 4.4Cu - 1.5Mg - 0.6OMn, (2024; -T3 Flat Sheet, -T351 Plate), Solution Heat Treated
AMS 4045	Aluminum Alloy Sheet and Plate, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr, (7075; T6 Sheet, -T651 Plate), Solution and Precipitation Heat Treated
AMS 4049	Aluminum Alloy Sheet and Plate, Alclad, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr, (Alclad 7075; -T6 Sheet, -T651 Plate), Solution and Precipitation Heat Treated
AMS 4901	Titanium Sheet, Strip, and Plate, Commercially Pure Annealed, 70.0 ksi (485 MPa) Yield Strength
AMS 5516	Steel Sheet, Strip, and Plate, Corrosion Resistant, 18Cr - 9.ONi (SAE 30302), Solution Heat Treated
AMS-QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 412	Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
ASTM D 792	Specific Gravity (Relative Density) and Density of Plastics by Displacement
ASTM D 2240	Rubber Property - Durometer Hardness
ASTM E 1742	Radiographic Examination

2.3 U.S. Government PublicationsU.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

L-P-390	Plastic, Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium and High Density)
TT-N-97	Naphtha, Aromatic
CCC-C-419	Cloth, Duck, Unbleached, Plied Yarns, Army and Numbered
PPP-B-636	Box, Shipping Fiberboard
PPP-C-96	Can, Metal, 28 Gauge and Lighter
PPP-D-729	Drum, Shipping and Storage, Steel, 55 Gallon (208 Liters)
PPP-P-704	Pails, Metal (Shipping, Steel, 1 through 12 Gallons)
FED-STD-141	Paint, Varnish, Lacquer and Related Materials Method of Inspection, Sampling and Testing
A-A-58054	Abrasive Mats, Non-woven, Non-metallic

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2.3 (Continued):

MIL-PRF-23377	Primer Coating, Epoxy, Chemical and Solvent Resistant
MIL-PRF-27725	Coating, Corrosion Preventive, for Aircraft Integral Fuel Tanks
MIL-C-38334	Corrosion Removing Compound, Prepaint, for Aircraft Aluminum Surfaces
MIL-S-38714	Sealant Cartridge for Two Component Materials - Inactive for new design
MIL-C-38736	Compound, Solvent, for Use in Integral Fuel Tanks
MIL-C-81706	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
MIL-PRF-85285	Coating, Urethane, Aliphatic lsocyanate, for Aerospace Applications
MIL-PRF-85582	Primer Coatings, Epoxy Waterborne
MIL-C-87937	Cleaning Compound, Aerospace Equipment
MS-21042	Nut, Self-Locking, 450 oF, Reduced Hexagon, Reduced Height, Ring Base, Non-Corrosion Resistant Steel (ASG)
AN 4	Bolt and Machine, Aircraft

2.4 AIA Publications:

Available from National Standards Association, Inc., 1321 14th Street, NW, Washington, DC 20005.

NAS 679	Nut, Self-Locking, Hexagon Head, Titanium, 190 to 500
NAS1154	Screw,Machine-Flat,10-Degree Head, Close Tolerance, Short Thread, Torque Set

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

The basic ingredient shall be a polysulfide-based synthetic rubber (Thiokol-type, or T-type). The sealing compound shall cure by addition of a curing agent to the base compound; the curing agent is also called a catalyst or accelerator. Curing of the sealing compound shall not depend on solvent evaporation for curing. The material shall contain no lead compounds. The curing agent shall possess sufficient color contrast to base compounds to permit easy identification of an unmixed or incompletely mixed sealing compound. Neither the base compound nor the cured sealant shall be red or pink in color.

3.2 Properties:

The sealing compound, when mixed in accordance with the manufacturers instructions and cured as specified in 4.5.2.8, shall conform to requirements shown in Table 1, determined in accordance with specified test methods.

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TABLE 1 - Properties

	Property	Requirement	Test Method
3.2.1	Specific Gravity, max	1.65	4.5.4
3.2.2	Hardness, Shore A Durometer Scale, Instantaneous, min	40	4.5.5
3.2.3	Nonvolatile Content, (% by weight), min		4.5.6
	Class A	85	
	Class B	96	
	Class C	92	
	Class D	97	
	Class E	85	
3.2.4	Viscosity of Base Compound		4.5.7
	Class A	100 to 600 poises (10 to 60 Pa·s)	
	Class B	9,000 to 16,000 poises (900 to 1,600 Pa·s)	
	Class C	1,000 to 4,000 poises (100 to 400 Pa·s)	
	Class D	20,000 to 30,000 poises (2,000 to 3,000 Pa·s)	
	Class E	300 to 800 poises (30 to 80 Pa·s)	
3.2.5	Viscosity of Curing Agent	700 to 2500 poises (70 to 250 Pa·s)	4.5.8
3.2.6	Flow		4.5.9
	Class B	0.10 to 0.75 inch 2.5 to 19.0 mm)	
	Class C	0.010 inch (0.25 mm), min	
	Class D	0.20 inch (5.1 mm), max	

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TABLE 1 - Properties (Continued)

	Property	Requirement	Test Method
3.2.7	Application Time, min		
3.2.7.1	Class A - From beginning of mixing, the viscosity shall not exceed 2,500 poises (250 Pa·s).		4.5.10.1
	A-1/2	1/2 hour	
	A-2	2 hours	
	A-4	4 hours	
3.2.7.2	Class B - From beginning of mixing, 15 grams per minute (minimum) shall be extruded.		4.5.10.2
	B-1/4	1/4 hour	
	B-1/2	1/2 hour	
	B-1	1 hour	
	B-2	2 hours	
	B-4	4 hours	
	B-6	6 hours	
3.2.7.3	Class C - From beginning of mixing, 30 grams per minute (minimum) shall be extruded.		4.5.10.2
	C-1/2	1/2 hour	
	C-2	2 hours	
	C-8(20)	8 hours	
3.2.7.4	Class D - From beginning of mixing, 15 grams per minute (minimum) shall be extruded.		4.5.10.2
	D-1/4	1/4 hour	
	D-1/2	1/2 hour	
3.2.7.5	Class E - From beginning of mixing, the viscosity shall be between 800 to 1,100 poises (80 to 110 Pa·s).		4.5.10.3
	E-6	6 hours	
3.2.8	Assembly Time (or Squeeze-out Time), min		4.5.11
	Class C-6	6 hours	
	Class C-20	20 hours	

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TABLE 1 - Properties (Continued)

	Property	Requirement	Test Method
3.2.9	Tack-Free Time (Measured from beginning of mixing, max		4.5.12
	Classes B-1/4, D-1/4	6 hours	
	Classes A-1/2, B-1/2, C-1/2, D-1/2	10 hours	
	Class B-1	12 hours	
	Classes A-2, B-2, C-2	24 hours	
	Classes A-4, B-4	36 hours	
	Classes B-6	48 hours	
	Class E-6	120 hours	
	Class B-12	120 hours	
	Class C-8(20)	96 hours	
3.2.10	Standard Cure Time, max (35 Shore A, minimum)		
	Classes B-1/4, D-1/4	16 hours	
	Classes A-1/2, B-1/2. C-1/2. D-1/2	30 hours	
	Classes B-1	36 hours	
	Classes A-2, B-2, C-2	72 hours	
	Classes A-4, B-4	90 hours	
	Classes B-6, C-6	120 hours	
	Class E-6	240 hours	
	Class B-12	240 hours	
	Class C-20	336 hours	
3.2.11	Fluid immersion Cure Time		4.5.14
	Classes B-1/4, A-1/2, B-1/2 only, min		
	After 48 hours	25 Shore A	
	After 120 hours	35 Shore A	
3.2.12	Peel Strength, min		4.5.15, and 4.5.15.1 to 4.5.15.4
3.2.12.1	All classes, except Class C-2	20 pounds force per inch (3503 N/m), 100% cohesive failure	
3.2.12.2	Repairability	10 pounds force per inch (1,751 N/m), 100% cohesive failure	4.5.15.5
3.2.13	Chalking	Slight chalk is permitted	4.5.16
3.2.14	Shear Strength, min	200 psi (1 379 kPa)	4.5.17
	Classes C and E only	average with 100% cohesive failure	

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TABLE 1 - Properties (Continued)

	Property	Requirement	Test Method
3.2.15	Air Content, max (Class B only)	4%	4.5.18
3.2.16	Weight Loss, Flexibility and Swell		4.5.19
3.2.16.1	Weight Loss, max	8%	
3.2.16.2	Flexibility	No cracking or surface checking	
3.2.16.3	Swell	5 to 15%	
3.2.17	Resistance to Thermal Rupture	No blistering or sponging, 5/32 inch (0.8 mm) deformation, max	4.5.20
3.2.18	Resistance to Thermal Expansion	Sealant flush with groove within +0.010 and -0.003 inch (+0.25 and -0.08 mm) at the wide end of the test block and within +0.005 and -0.003 inch (+0.13 and -0.08 mm) at the narrow end.	4.5.21
3.2.19	Heat Reversion Resistance (Classes B, C, and E only)	The sealant shall not revert to a liquid or paste-like consistency, nor shall it become brittle or lose adhesion.	
3.2.20	Tensile Strength and Elongation Classes B, C-1/2, C-2, C-6, D-1/4, and D-1/2		4.5.23
3.2.20.1	Standard Cure in accordance with 4.5.2.8	250 psi (1724 kPa) 250% elongation	
3.2.20.2	12 days at 140 °F (60 °C) plus 60 hours at 160 ° F (71 °C) plus 6 hours at 180 °F (82 °C), all with the specimens soaking in AMS 2629, Type 1 jet reference fluid (JRF).	125 psi (862 kPa) 100% elongation	
3.2.20.3	12 days at 140 °F (60 °C) plus 60 hours at 160 °F (71 °C) plus 6 hours at 180 °F (82 °C) All with soaking in JRF plus 24 hours at 120 °F (49 °C) plus Standard Heat Cycle in accordance with 4.5.1.3.	125 psi (862 kPa) 25 % elongation	

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TABLE 1 - Properties (Continued)

	Property	Requirement	Test Method
3.2.20.4	Standard Heat Cycle in accordance with 4.5.1.3	100 psi (689 kPa) 25% elongation	
3.2.20.5	72 hours in AMS 3020	125 psi (862 kPa) 100 % elongation	
3.2.20.6	72 hours in AMS 3021	125 psi (862 kPa) 100% elongation	
3.2.21	Low-Temperature Flexibility	No visual evidence of cracking, surface checking, or loss of adhesion.	4.5.24
3.2.22	Hydrolytic Stability, min	30 Shore A	4.5.25
3.2.23	Corrosion Resistance	No corrosion or signs of deterioration	4.5.26
3.2.24	Repairability, min	5 pounds force per inch (876 N/m), 100% cohesive failure	4.5.27
3.2.25	Paintability	No separation from sealant	4.5.28
3.2.26	Weather Resistance	No cracking, chalking, peeling, or loss of adhesion	4.5.29
3.2.27	Shaving and Sanding (Class B only)	No rolling or tearing of the sealant	4.5.30
3.2.28	Radiographic Density		4.5.31
3.2.28.1	Difference between bare plate and plate plus selant, max	1.00	
3.2.28.2	Through sealant in the slot, approximately	3.00	
3.2.29	Storage Stability		
3.2.29.1	Accelerated Storage		4.5.32
	Viscosity of Base Compound	Same as 3.2.4	4.5.7
	Viscosity of Curing Agent	Same as 3.2.5	4.5.8
	Flow	Same as 3.2.5	4.5.9
	Application Time	Same as 3.2.6	4.5.10
	Assembly Time	Same as 3.2.7	4.5.11
	Tack-Free Time	Same as 3.2.8	4.5.12
	Peel Strength	Same as 3.2.12	4.5.15

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TABLE 1 - Properties (Continued)

	Property	Requirement	Test Method
3.2.29.2	Long-Term Storage		4.5.32
3.2.29.2.1	Application Time; hours, max		
	Classes B-1/4, D-1/4	0.25	
	Classes A-1/2, B-1/2, C-1/2, D-1/2	0.5	
	Class B-1	1	
	Classes A-2, B-2, C-2	2	
	Classes A-4, B-4	4	
	Classes B-6, C-6	6	
	Class E-6	6	
	Class B-12	12	
	Class C-20	20	
3.2.29.2.2	Tack-Free Time, hours, max		
	Classes B-1/4, D-1/4	16	
	Classes A-1/2, B-1/2, C-1/2 D-1/2	20	
	Class B-1	24	
	Classes A-2, B-2, C-2	48	
	Classes A-4, B-4	72	
	Classes B-6, C-6	96	
	Classes E-6, B- 1 2	180	
	Class C-20	144	
3.2.29.2.3	Cure Time, hours, max		
	Classes B-1/4, D-1/4	24	
	Classes A-1/2, B-1/2, C-1/2, D-1/2	40	
	Class B-1	54	
	Classes A-2, B-2, C-2	72	
	Classes A-4, B-4	114	
	Classes B-6, C-6	144	
	Classes E-6, B-12	264	
	Class C-20	360	

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3.3 Performance and Application Requirements:

Properties are divided into two classes; performance requirements and application requirements. Performance requirements define those properties of the cured sealant and its performance in service. Application requirements define the properties of uncured sealant; and they affect the application parameters of the sealant but have little or no effect on the performance properties of cured sealant. Minor variations in application requirements during acceptance testing may not be cause for rejection if approved by the procuring agency. Application requirements are listed below; all other requirements are performance requirements.

a. Viscosity of Base Compound
b. Flow
c. Application Time
d. Tack-Free Time
e. Cure Time
f. Fluid Immersion Cure Time

3.4 Quality:

The base compound and curing agent, as received by the purchaser, shall each be of uniform blend and shall be free of excessive air, skins, lumps, and gelled or coarse particles. There shall be no separation of ingredients which cannot be easily redispersed.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The manufacturer of the sealing compound shall supply all samples and shall be responsible for all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the sealing compound conforms to all requirements of this specification.

4.1.1 Shelf-Life Surveillance and Updating:

4.1.1.1 Sampling: The minimum number of samples to be tested during shelf-life surveillance and updating is shown in Table 2.

TABLE 2 - Shelf-life Surveillance Samples

Items in Stock	Samples to be Tested
Up to 100, excl	3
100 to 500, incl	5
Over 500	7

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4.1.1.2 Testing The following inspections are to be conducted for shelf-life surveillance and updating:

a. Condition of Container
b. Application Time
c. Tack-free Time
d. Standard Cure Time
e. Viscosity of Base Compound (not possible with sectional-type containers)
f. Peel Strength - Two aluminum panels coated with MIL-PRF-27725, corrosion-preventive coating, soaked in JRF for seven days at 140 °F (60 °C).

4.1.1.2.1 Tests are to be conducted at the end of the stated shelf-life, in accordance with test methods outlined in this specification for acceptance tests. If tests are being performed to update the shelf-life of the sealing compound, and all tests are passed, the shelf-life will be extended an additional three months. Up to three updatings will be allowed.

4.1.2 Curing Compound Replacement: There are instances where sealant will become overaged and require excessive time to cure. Usually, the curing agent will be the component that has deteriorated; but curing agent can be replaced, so that the sealant can be used. Any time the curing agent is replaced, all the acceptance tests must be met by the final combination of curing agent plus base compound.

4.2 Classification of Tests:

4.2.1 Qualification Tests: All technical requirements are qualification tests (See 8.2) and shall be performed prior to or on the initial shipment of sealing compound to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1.1 Class B-2 shall be the first material that is qualified for each supplier of sealing compound (See 8.2). Class B-2 sealing compound shall meet all technical requirements of this specification with the exception of requirements applicable to other classes.

4.2.1.2 Once qualification for Class B-2 is obtained, other classes may be qualified. The formulation for other classes, and for other Class B materials, shall be the same as Class B-2, except for minor variations necessary for conformance to viscosity and application time requirements.

4.2.1.3 The manufacturer shall present written proof to the purchaser that all requirements are met prior to requesting qualification approval for any class. This includes assurance that the sealant will cure at standard conditions. Acceptance testing is conducted on sealant cured at 140 °F (60 °C). After the sealing compound has been accepted for qualification, approval will be granted and the sealant will be identified by reference to the manufacturer's code or formula number.

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4.2.2 Acceptance Tests: The following requirements are acceptance tests and shall be performed on each batch. A batch shall be the quantity of sealing compound run through a mill or mixer at one time.

a. Hardness (3.2.2)
b. Nonvolatile Content (3.2.3)
c. Viscosity of Base Compound (3.2.4) (See 4.2.2.1)
d. Flow (3.2.5)
e. Application Time (3.2.6)
f. Assembly Time (C-6 and C-20 only) (See 3.2.7)
g. Tack-Free Time (See 3.2.8)
h. Standard Cure Time (all classes except Class C-20) (See 3.2.9)
i. Fluid Immersion Cure Time (Classes B-1/4, A-1/2, B-1/2) (See 3.2.10)
j. Peel Strength (All classes except Class C-20) (See 3.2.11)
k. Chalking (See 3.2.12)
l. Shear Strength (Classes C and E only) (See 3.2.13)
m. Air Content (Class B only) (See 3.2.14)
n. Weight Loss, Flexibility and Swell (See 3.2.15)
o. Resistance to Thermal Rupture (See 3.2.16)

4.2.2.1 Testing need not be performed on sealant packaged in sectionalized containers or small size containers of under 8 ounces (237 ml).

4.2.2.2 Acceptance test requirements can be satisfied by use of the National Aerospace Defense Contractor's Accreditation Program (NADCAP) or by performing the tests required by 4.2.2. If the NADCAP system is used, the sealant manufacturer must be NADCAP accredited and product surveillance in accordance with NADCAP procedures must be performed on each batch of sealant. All tests specified in 4.2.2 must be performed by the manufacturer.

4.3 Sampling and Testing:

4.3.1 Sampling and testing for qualification tests shall be as follows:

Samples shall consist of one 5-gallon (19-L) and two 1-quart (0.95-L) containers of sealing compound. Samples shall be identified as follows and forwarded to the activity responsible for qualification testing as designated in the letter of authorization from the activity (See 8.2).

SEALING COMPOUND, INTEGRAL FUEL TANK AND GENERAL PURPOSE, INTERMITTENT USE TO 360 °F (182 °C)
SPECIFICATION AMS 3276C
MANUFACTURER'S IDENTIFICATION
NAME OF MANUFACTURER
LOT NUMBER
DATE OF MANUFACTURE
SUBMITTED BY (NAME) (DATE) FOR QUALIFICATION TESTS IN ACCORDANCE WITH AMS 3276C UNDER AUTHORIZATION (REFERENCE AUTHORIZING LETTER)

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4.3.2 For Acceptance Tests: Sufficient sealing compound shall be taken at random from each batch to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure; or, if not specified, at least three determinations shall be made for each requirement. Multiple testing is not required for viscosity, application time, flow, tack-free time, and hardness.

4.3.2.1 Sealing compound for testing shall be mixed, whenever possible, in the same containers in which materials were procured.:

4.3.2.2 If the sealing compound is being procured in sectional plastic injection kits, all tests shall be conducted on compound that has been packaged and mixed in the initial sample injection kits except for viscosity of the base compound. During filling of the initial sample injection kits, base compound and curing agent shall be placed in 1-quart (0.95-L) cans for the viscosity of base test (see 4.5.7). If more than one size of injection kit will be packaged from a particular batch, select one size for testing the sealing compound.

4.3.2.3 If sealing compound is being procured in cans, pails, or drums, the batch shall be tested on material placed in 1-quart (0.95-L) cans.

4.3.2.4 If sealing compound is being procured in all of the above types of containers, quality conformance tests shall be conducted on sealing compound packaged in plastic injection kits (See 4.3.2.2).

4.3.2.5 A statistical sampling plan, which is acceptable to the purchaser, may be used as an option to sampling in accordance with 4.3.2.

4.3.2.6 U.S. Government Procurement Each batch shall be subjected to both initial and final acceptance testing. Sufficient compound for initial acceptance testing shall be packaged in the same type containers that are being procured. Initial acceptance tests are listed in 4.2.2. Final acceptance testing is to be conducted on the final packaged product and consists of application time, tack-free time, standard cure time, and air content. After successful completion of initial quality conformance tests, the batch shall be released for final packaging. During packaging, test kits shall be picked at random to perform the following final acceptance tests

a. Application Time (3.2.6)
b. Tack-free Time (3.2.8)
c. Standard Cure Time (3.2.9)
d. Air Content (3.2.14).

4.3.2.6.1 If the batch is packaged in different types (or sizes) of containers, final acceptance tests shall be conducted on each type (or size) of container. If sealing compound is being procured under different purchase orders, but the purchase orders call for the same type and size of containers, final acceptance tests shall be performed only once.

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4.4 Approval:

4.4.1 Sealing compound shall be approved by the purchaser before being supplied for production use, unless such approval is waived by purchaser. For direct procurement, sealing compound shall be listed (or approved for listing) on the current qualified products list (QPL) for this specification. Results of tests on production sealing compound shall be essentially the same as those on the qualification sample.

4.4.2 The sealant manufacturer shall use ingredients, manufacturing procedures, processes, and methods of inspection on production sealing compound which are essentially the same as those used on the approved sample. If necessary to make any change in ingredients, in the type of equipment for processing, or in manufacturing procedures, the sealant manufacturer shall submit for reapproval a statement of proposed changes in ingredients and/or processing. If requested by the purchaser, the sealant manufacturer shall submit a sample of sealing compound. Production sealing compound made by a revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

Methods (or procedures) for testing of materials to the Engineering requirements of this specification shall be as follows:

4.5.1 Standard Conditions:

4.5.1.1 Test Conditions: Standard laboratory test conditions shall be 77 °F ± 2 °F (25 °C ± 1 °C) and 50% ± 5% relative humidity. Unless otherwise specified herein, all test specimens shall be prepared and cured, and all tests shall be performed, under these conditions.

4.5.1.2 Standard Tolerances: Unless otherwise specified herein, standard tolerances shown in Table 3 shall apply.

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TABLE 3 - Standard Tolerances

Measurement Units	Tolerances
Temperatures	±2 °F (1 °C)
Days	±2 hours
Hours	±5 minutes
Minutes	±10 seconds
Inches (mm)	±0.01 inch (0.25 mm)

4.5.1.3 Standard Heat Cycle: Standard heat cycle shall consist of the cure cycle of 4.5.2.8 followed by 24 hours ± 1 hour at 260 °F (127 °C), 4 hours ± 0.5 hour at 320 °F (160 °C), 6 hours ± 1 hour at 360 °F (182 °C) divided evenly into six portions, each consisting of 4 hours ± 0.5 hour at 260 °F (127 °C), 40 minutes ± 5 minutes at 32 °F (160 °C), and 1 hour ± 5 minutes at 360 °F (182 °C). At the completion of each 360 °F (182 °C) exposure, temperatures shall be reduced to below 100 °F (38 °C) before repeating exposure to the 260 °F (127 °C) cycle.

4.5.2 Preparation of Test Specimens:

4.5.2.1 Chemical Conversion Coating Application:

4.5.2.1.1 Coating Preparation: A chemical conversion coating, conforming to MIL-C-81706, Class 1A, Form II, Method C, shall be prepared according to the coating manufacturer's instructions. Nitric acid shall be used to adjust the coating solution's pH to 1.5.

4.5.2.1.2 Panel Preparation: Vapor or solvent degrease and alkaline detergent clean using MIL-C-87937, Type II or Type IV cleaning compound. Cleaning may be accomplished by brushing, swabbing, or soaking the panels in the detergent solution or by a combination of the above techniques. Rinse the cleaned panels in warm flowing tap water, 60 to 100 °F (16 to 38 °C), and check for cleanliness by observing for a waterbreak-free surface. If waterbreak occurs on the panel surfaces, return the panels to the detergent solution; and repeat the cleaning procedure until a waterbreak-free surface is obtained. Immediately transfer the cleaned panels to a deoxidizing solution consisting of the following:

a. Butyl alcohol 35% by weight
b. Distilled or deionized water 22% by weight
c. Isopropyl alcohol 25% by weight
d. Phosphoric acid (85% by weight) 18% by weight.

4.5.2.1.2.1 Acid deoxidizer conforming to MIL-C-38334 may also be used. Allow the panels to remain in solution of 4.5.2.1.2 for 3 to 5 minutes. Rinse the panels thoroughly under flowing tap water.

4.5.2.1.3 Coating Application (immersion): Transfer the deoxidized panels immediately to the MIL-C-81706 chemical conversion coating solution. Immerse the panels in the solution at standard temperature (See 4.5.1.1) for 3 to 5 minutes or until a light straw color develops. Color development time will vary with the aluminum alloy being conversion coated. After removal from the conversion coating solution, immediately rinse thoroughly in flowing distilled or deionized water. Arrange the panels in an upright position to drain dry; and protect panels against contamination. Apply the test materials to the conversion coated surfaces within 48 hours.

4.5.2.1.3.1 Mix the conversion coating solution either in 18-8 type stainless steel, polyethylene, or other compatible plastic containers. Do not mix the conversion coating solution in glass containers.

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4.5.2.2 Cure of Composite Panels: AS 4/3501-6 shall be fabricated using eight plies of unidirectional tape laid (0, 45, 90, 135) symmetrical. Size of the test panels shall be 0.040 x 2.75 x 6 inches (1.02 x 69.8 x 152 mm). Cure in accordance with 4.5.2.2.1.

4.5.2.2.1 Install peel ply to bag surface of laminate. Nylon peel ply is acceptable. Apply a vacuum of not less than 28 inches (711 mm) of mercury and 85 psi (586 kPa) pressure.

Heat to 225 °F (107 °C) at 1 to 4 F-degrees per minute (1 to 2 C-degrees per minute). Hold at 225 °F (107 °C) for one hour. Heat to 350 °F (177 °C) at 1 to 4 F-degrees per minute (1 to 2 C-degrees per minute). Hold at 350 °F ± 10 (177 °C ± 6) for two hours. Cool to 150 °F (66 °C) while maintaining vacuum and pressure. Remove the peel ply.

4.5.2.3 Preparation of Sealing Compound:

4.5.2.3.1 For Qualification Tests: The quantity of sealing compound required for the tests shall be mixed as thoroughly as practical. Classes B-2, B-4, B-6, and B-12 shall be machine mixed. Classes B-1/4, B-1/2, and all dash numbers for Classes A, C, D, and E shall be hand-mixed. The sealing compound shall have a minimum inclusion of air. Where applicable, the sealing compound, immediately after mixing, shall be placed in cartridges for extrusion from a pneumatic sealing gun. Sealing compound in sectional-type containers (such as Semkits) shall be machine mixed.

4.5.2.3.2 Acceptance Tests: The quantity of sealing compound required for tests shall be hand-mixed or machine mixed in accordance with instructions from the manufacturer of the sealing compound. MIL-S-38714 containers shall be used when applicable.

4.5.2.4 Quick Freezing: After machine mixing, two cartridges shall be held at room temperature. One cartridge shall be used for testing application time and the other for tack-free time, curing rate, and flow. The remainder of the cartridges shall be quick frozen. After the compound is loaded into the cartridges, both ends of the cartridges shall be closed after filling. The installed plunger constitutes a satisfactory plug at one end. The sealant shall be quick frozen immediately in TT-N-97, Type 1, Grade B, aromatic naphtha and dry ice bath at -80 °F (-62 °C) or lower for 30 minutes. The cartridge shall be placed in a plastic bag and immersed with its plugged nozzle end down and the upper end about 1 inch (25 mm) above the liquid level. Storage time of quick-frozen material shall not exceed 10 days at -67 °F (-55 °C). Thaw-out shall be accomplished by immersion of frozen cartridges in a 120 °F (49 °C) water bath for 18 minutes with the plugs installed and the upper end of the cartridge shall be 1 inch (25 mm) above the liquid level. Time zero is when the 18-minute period ends and the timed tests are started. Sealant may be thawed out by standing at room temperature, instead of by immersion in hot water.

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4.5.2.5 Cleaning of Test Panels: All test panels shall be cleaned by scrubbing and rinsing with MIL-C-38736, Type I or Type II solvent and clean AMS 3819, Grade A cloths which are free of sizing and any other contaminants. The panels shall be wiped dry immediately with clean AMS 3819, Grade A cloths. Titanium, stainless steel, and carbon-reinforced epoxy (composite) panels shall be scrubbed with abrasive mats and MIL-C-38736, Type I or Type II solvent. After scrubbing, the panels shall be rinsed using MIL-C-38736, Type I or Type II solvent and clean cloth, followed by wiping the panel surfaces until dry. Abrasive mats shall conform to A-A-58054, Type I, Class 1, Grade A, for stainless steel and composite panels and A-A-58054, Type III, Class 1, Grade A, for titanium panels.

4.5.2.5.1 When organic coatings are specified for test panels, the coatings shall be fully cured before cleaning; cure of organic finishes shall be in accordance with the applicable coating specification,. Applied coatings shall be at least 14 days old and not more than six months old when stored at ambient indoor temperatures.

4.5.2.6 Application of Adhesion Promoter: When specified, the panel surface shall be treated with AMS 3100 adhesion promoter, immediately after the panel is cleaned, by wetting a clean AMS 3819, Grade A cloth and wiping the surface. Allow adhesion promoter to air-dry for 30 minutes to two hours before applying sealant. If more than two hours has elapsed, reclean and reapply the adhesion promoter before applying sealant.

4.5.2.7 Application of Sealing Compound: Unless otherwise specified herein, test panels shall be given an application of sealing compound to produce a coating having a total thickness of 0.125 inch ± 0.016 inch (3.18 mm ± 0.41 mm) when cured. For Class A material, a time equal to the rated application life shall be used between applications to permit release of solvents.

4.5.2.8 Cure of Sealing Compound: For qualification testing, the sealing compound shall be cured for 14 days at 77 °F (25 °C) and 50% ± 5% relative humidity. For acceptance testing, the sealing compound shall be given an accelerated cure for 48 hours at 77 °F (25 °C) and 50% ± 5% relative humidity plus 24 hours at 140 °F (60 °C). Tests on cured sealing compound shall begin within two days of when the specified cure is completed.

4.5.3 Jet Reference: The jet reference fluid (JRF) required for fluid immersion tests shall conform to AMS 2629. Type 1 fluid shall be used for all tests that require exposure of specimens to JRF, except Type 2 JRF shall be used for the chalking test (4.5.15).

4.5.4 Specific Gravity: Three test specimens, approximately 0.125 x 1 x 1 inch (3.18 x 25 x 25 mm), shall be cut out with a sharp razor blade or scalpel from a sheet of sealing compound that has been cured as in 4.5.2.8. Determine the specific gravity of each sample in accordance with ASTM D 792, Method A, and report the average value.

4.5.5 Hardness: The instantaneous hardness shall be determined in accordance with ASTM D 2240, Method 3021, after the sealing compound is cured as in 4.5.2.8. The reading shall be taken on a double back-to-back, 0.125 inch (3.18 mm)-thick specimen making the total thickness 0.25 inch (6.4 mm).

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4.5.6 Nonvolatile Content: Within five minutes after mixing or warming to application temperature, 1 to 12 grams of mixed sealing compound shall be transferred, as rapidly as possible, to a previously weighed (W1) aluminum dish approximately 2 inches (51 mm) in diameter. The Class A and Class C sealants shall be poured into the dish. Class B sealant shall be extruded from a plastic cartridge, fitted with 0.125 inch (3.18 mm) orifice nozzle, to fill the bottom of the dish to a uniform depth. The initial weight (W2) shall be determined using an analytical balance accurate within ±1 milligram. Immediately after weighing, place the sample and dish in a circulating-air oven preheated to 160 °F (71 °C) for three days; then, remove the sample and dish from the oven and cool them at room temperature in a desiccator. Final weight (W3) of the sample and dish shall be determined on the same balance used for initial weights. All weights shall be recorded to the nearest milligram.

4.5.6.1 Percent nonvolatile content shall be determined from the average of three samples and calculated as shown in Equation 1:

$$\text{Percent Nonvolatile} = \frac{(W3 - W1)}{(W2 - W1)} \times 100 \qquad \text{(Eq. 1)}$$

4.5.7 Viscosity of Base Compound:

4.5.7.1 Shall be determined with the base compound placed in a 1-quart (0.95-L) can. The can shall be filled with the base compound to within 0.5 inch (13 mm) of the top, covered, and stored at 77 °F (25 °C) for not less than eight hours. The base compound shall be thoroughly mixed by stirring slowly for not less than three minutes after which the can shall be closed and the base compound shall be allowed to stand for one hour.

4.5.7.2 The Brookfield Model RVF viscometer, or equivalent, shall be used. Viscometer readings shall be converted to poises (Pa·s). For Class A sealant, the No. 6 spindle, at 10 rpm, shall be used. For Classes B and D sealants, the No. 7 spindle, at 2 rpm, shall be used. For Class C sealant, the No. 6 spindle, at 2 rpm, shall be used. For Class E sealant, the No. 7 spindle, at 10 rpm, shall be used. The highest reading shall be taken after the instrument has run in the base compound for at least one minute.

4.5.8 Viscosity of the Curing Agent: The viscosity of the curing agent shall be determined in accordance with 4.5.7, except a No. 7 spindle at 10 rpm shall be used.

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4.5.9 Flow (Classes B, C and D Only):

4.5.9.1 Classes B and D: A standard sealant gun cartridge, fitted with a suitable nozzle, shall be filled with freshly mixed sealing compound. The gun and sealing compound shall be maintained at standard conditions (4.5.1.1) throughout the test. The test shall be conducted with a flow test fixture as shown in Figure 1. Depth of the plunger tolerance is critical and shall be controlled within the specified tolerance during all tests. The flow fixture shall be placed on a table with the front face upward and the plunger depressed to the limit of its travel. Within 15 minutes after the beginning of mixing, enough mixed sealing compound shall be extruded from the application gun to fill the recessed cavity of the fixture. Then, the mixed sealing compound shall be leveled off with the block. The test at this interval shall be considered the initial flow of the sealing compound. Within ten seconds after the leveling operation, the fixture shall be placed on its end and the plunger immediately advanced to the limit of its forward travel.

The flow measurement shall be taken exactly 30 minutes after the sealing compound has been applied to the test fixture. The flow shall be measured from tangent to the lower edge of the plunger to the farther point to which the flow has advanced. The flow test shall be repeated at the time intervals specified below. All time intervals, other than for the initial test, shall be measured from the end of the mixing period.

a. B-1/4, D-1/4 Initial Reading Only
b. B-1/2, D-1/2 Initial Reading Only
c. B-1 Initial, 30 minutes
d. B-2 Initial, 50 minutes, 90 minutes
e. B-4 Initial, 2 hours, 3.5 hours
f. B-6 Initial, 3 hours, 5.5 hours
g. B-12 Initial, 6 hours, 11.5 hours.

4.5.9.2 Class C: A 0.015 to 0.020 inch (0.38 to 0.51 mm) layer of freshly mixed sealant shall be applied to an AMS 4049 aluminum alloy panel; dimensions of this panel shall be 0.040 x 2.75 x 6 inches (1.02 x 69.8 x 152 mm). Immediately place the panel in a vertical position; and keep it in that position for a period equivalent to the rated tack-free time. The sealant thickness at its thinnest spot shall conform to 3.2.6.

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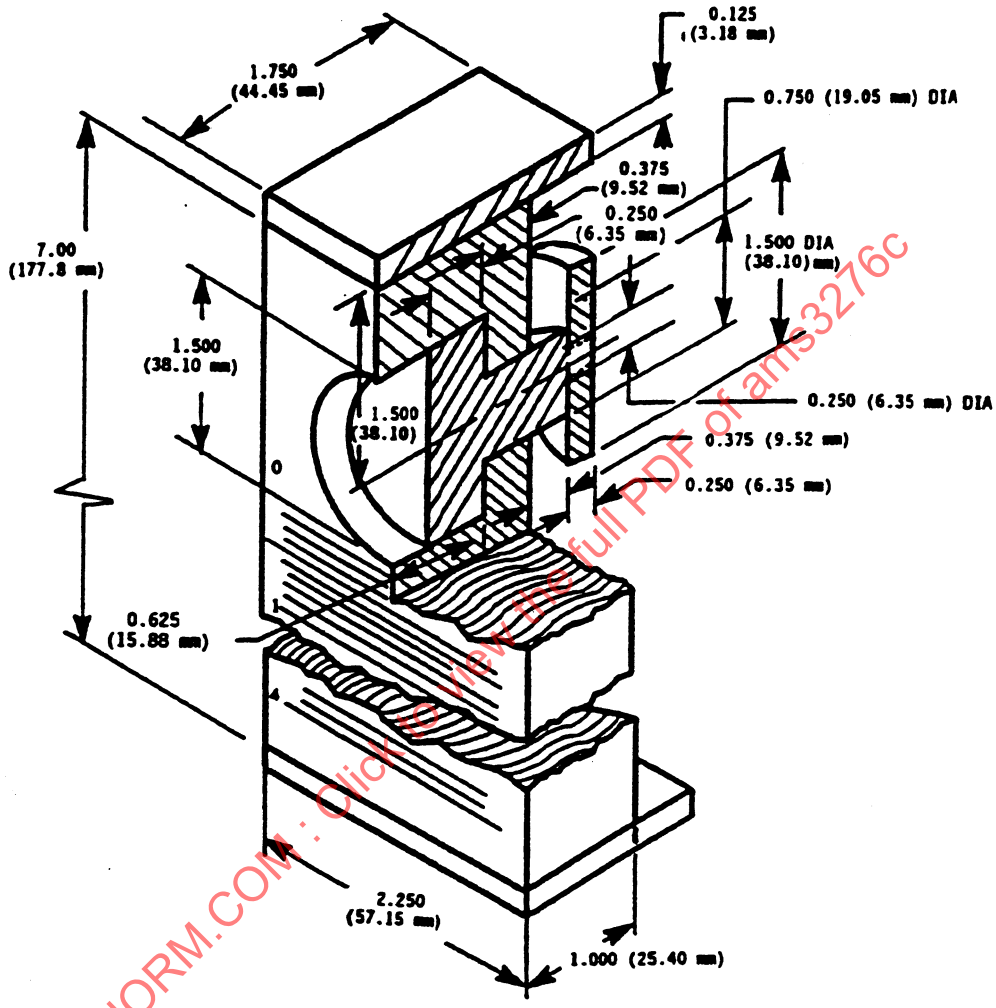

NOTES:

Material: Aluminum alloy

Dimensions in inches (millimeters)

Tolerances: Decimals +/- 0.016 inch (+/- 0.41 mm) **(NOT TO SCALE)**

FIGURE 1 - Flow-Test Fixture

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4.5.10 Application Time:

4.5.10.1 Class A and E Material:

4.5.10.1.1 The base compound and curing agent shall be stabilized at standard conditions (4.5.1.1) for not less than eight hours before a sample of base compound is mixed with the amount of curing agent sufficient to fill a standard 0.5-pint (0.24-L) can, 2.88 inches (73.2 mm) in diameter by 2.88 inches (73.2 mm) high to within 0.5 inch (13 mm) of the top. The can shall be tightly covered, except when testing for viscosity.

4.5.10.1.2 At the end of 0.5 hour for A-1/2, two hours for A-2, four hours for A-4, and six hours for E-6, measured from the beginning of the mixing period, the sealing compound shall be tested for viscosity using a Brookfield Model RVF viscometer, or equivalent. The No. 7 spindle at 10 rpm shall be used. The highest reading shall be recorded after the instrument has run in the sealing compound for one minute.

4.5.10.2 Class B, C, and D Material:

4.5.10.2.1 Stabilize the base compound, curing agent, and application gun at standard conditions (4.5.1.1) for at least eight hours; then mix at least 250 grams of base compound with the proper amount of curing agent.

4.5.10.2.2 The mixed sealing compound shall be used to fill a standard sealing gun cartridge, having a nozzle (Figure 2) with an orifice of 0.125 inch ± 0.004 (3.18 ± 0.10 mm). The gun cartridge and sealing compound shall be maintained at standard conditions throughout the test.

4.5.10.2.3 The gun shall be attached to a constant air supply of 90 psi ± 5 psi (621 kPa ± 34 kPa). Initially, extrude 2 to 3 inches (51 to 76 mm) of sealing compound to clear any entrapped air. Perform a one-minute extrusion of sealing compound onto a suitable previously-weighed receptacle; and determine the weight of extruded sealant at the end of the times, as measured from the beginning of the mixing period

4.5.10.2.3.1 0.25 hour for Classes B-1/4 and D-1/4

4.5.10.2.3.2 0.5 hour for Classes B-1/2, C-1/2, and D-1/2

4.5.10.2.3.3 1 hour for Class B-1

4.5.10.2.3.4 2 hours for Classes B-2 and C-2

4.5.10.2.3.5 4 hours for Class B-4

4.5.10.2.3.6 6 hours for Classes B-6 and C-6

4.5.10.2.3.7 12 hours for Classes B-12 and C-20.

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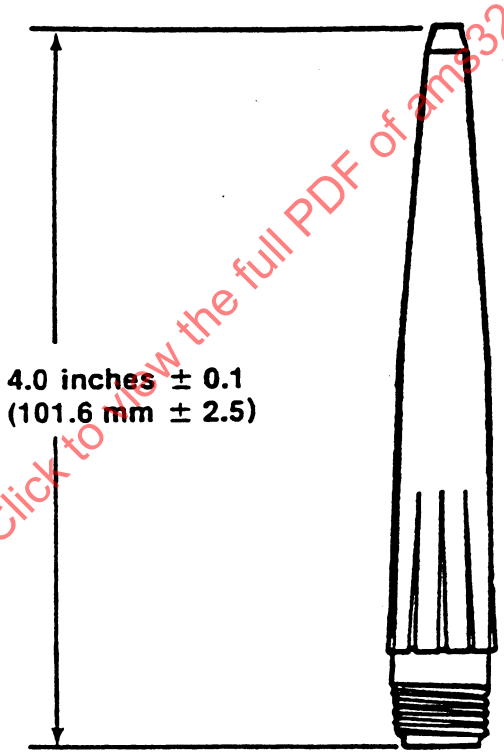

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NOTES:

1. Orifice diameter shall be 0.125 inch +/- 0.004 (3.18 mm +/- 0.10).

2. Material shall be polyethylene conforming to L-P-390.

FIGURE 2 - Standard Test Nozzle

4.5.11 Assembly Time (Class C Only): Six test panels, 0.040 x 1.5 x 4 inches (1.02 x 38 x 102 mm), shall be prepared from AMS 4049 aluminum alloy. Drill two holes with a No. 1 drill, 1.2 inches (30 mm) from one end with centers 0.75 inch (19 mm) apart and 0.38 inch (9.7 mm) from each side. Deburr; then clean as specified in 4.5.2.5. Accurately determine the thickness of the panels around the holes. Apply freshly mixed sealant to the drilled end of three specimens and allow to cure for 0.5 hour. The thickness of the sealant shall be 0.010 to 0.015 inch (0.25 to 0.38 mm). Place the other cleaned panels on those to which sealant has been applied, so that the holes line up and result in a one inch (25 mm) overlap. Sealant shall cover the entire 1 inch (25 mm) faying surface overlap area. Insert two 10-32 steel bolts, heat treated to at least 160 ksi (1,103 MPa), into the holes; and tighten the NAS 679-A3 nuts to a torque value of 40 inch pounds (4.5 N-m) until the sealant squeezes out. Measure the thickness of the assembly at the bolts with a micrometer. Expose the specimens to standard conditions (4.5.1.1) for four hours. Subtract the thickness of the panels from the thickness of the assembly. The mixed sealing compound shall have an assembly time in accordance with 3.2.7. The sealant must squeeze out to a thickness of 0.005 inch (0.13 mm) or less.

4.5.12 Tack-Free Time:

4.5.12.1 A 0.040 x 2.75 x 6 inch (1.02 x 69.8 x 152 mm) AMS 4049 aluminum alloy panel shall be cleaned in accordance with 4.5.2.5. Sealing compound shall be applied in accordance with 4.5.2.7. The sealant shall be cured in accordance with 4.5.2.8 until the end of its tack-free time (See 3.2.9).

4.5.12.2 At the end of the tack-free time two 1 x 7 inch (25 x 178 mm) strips of polyethylene 0.005 inch ± 0.002 inch (0.13 mm ± 0.05) thick shall be applied to the sealing compound and held in place at a pressure of approximately 0.5 ounce per square inch (0.0002 N/mm^2) for two minutes.

4.5.12.3 The polyethylene strips shall be slowly and evenly peeled back at right angles to the sealing compound surface. The polyethylene shall come away clean and free of sealing compound.

4.5.13 Standard Cure Time: Cure the sealant at standard conditions (4.5.1.1) for the time specified in 3.2.10; then, determine the sealant's hardness in accordance with ASTM D 2240 (instantaneous) using a Type A durometer. The hardness reading shall be taken on a double back-to-back, 0.125 inch (3.18 mm) thick specimen.

4.5.14 Fluid Immersion Cure Time (Classes A-1/2, B-1/4, B-1/2 and C-1/2 only): An AMS 4049 aluminum alloy test panel, 0.040 x 2.75 x 6 inches (1.02 x 69.8 x 152 mm), shall be cleaned in accordance with 4.5.2.5 and covered with sealing compound to a depth of 0.25 inch (6.4 mm). After curing at standard conditions for six hours. the test panel shall be immersed in AMS 2629, Type 1 JRF at 77 oF (25 °C). The hardness shall be determined, after 48 hours (42 hours in JRF) and after 120 hours (114 hours in JRF), in accordance with ASTM D 2240 (instantaneous) using a Type A Durometer.

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4.5.15 Peel Strength (All Classes except C-20):

4.5.15.1 The type, quantity, and thickness of panels shown in Table 4 shall be used for evaluation of peel strength. All panels shall be as described in Figure 3. The panels shall be prepared in accordance with Table 4. The manufacturer's recommended adhesion promoter shall be applied as in 4.5.2.6. The center 4 inches (102 mm) of the panels shall be coated on one face with a 0.125 inch (3.18 mm) thickness of sealing compound. An optional configuration consists of coating the bottom [approximately 5 inches (127 mm)] of the panel with sealant (Figure 3). A 2.75 x 12 inch (69.8 x 305 mm) strip of wire screen [20 to 40 (850 to 425 mm) mesh aluminum or monel wire fabric or CCC-C-419, Type 3, cotton duck cloth shall be impregnated with sealing compound, so that approximately 5 inches (127 mm) at one end is completely covered on both sides. The sealant-coated end of the fabric shall be placed on the sealant-coated panel; then, the sealant-coated end of the fabric shall be compressed onto the layer of sealing compound, taking care not to entrap air. An additional coating of sealing compound -- approximately 0.031 inch (0.79 mm) thick -- shall be applied over the fabric. The sealant shall be given a standard cure as in 4.5.2.8.

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TABLE 4 - Peel Strength Panels

Quantity	Panel Material	Panel Thickness
6	AMS 4049 aluminum alloy, chemical treated in accordance with 4.5.2.1	0.040 inch (1.02 mm)
6	AMS 4045 aluminum alloy, sulfuric acid anodized in accordance with AMS 2471	0.040 inch (1.02 mm)
6	AMS 5516 stainless steel (Use AMS 3100 adhesion promoter prior to sealing.)	0.025 to 0.040 inch (0.64 to 1.02 mm)
10[1]	AMS 4901 titanium (Use AMS 3100 adhesion promoter prior to sealing)	0.025 to 0.040 inch (0.64 to 1.02 mm)
10[1]	AMS 4045 aluminum alloy, sulfuric acid anodized in accordance with AMS 2471, and coated with MIL-PRF-27725	0.040 inch (1.02 mm)
6	AMS 4045 aluminum alloy, sulfuric acid anodized in accordance with AMS 2471, and coated with MIL-PRF-27725 (Use AMS 3100 adhesion promoter prior to sealing)	0.040 inch (1.02 mm)
2	AMS 4045 aluminum alloy, sulfuric acid anodized in accordance with AMS 2471, coated with MIL-PRF-23377, and cured seven days at standard conditions	0.040 inch (1.02 mm)

TABLE 4 - Peel Strength Panels (Continued)

Quantity	Panel Material	Panel Thickness
2	AMS 4045 aluminum alloy sulfuric acid anodized in accordance with AMS 2471, coated with MIL-PRF-23377, cured two hours at 200 °F (93 °C)	0.040 inch (1.02 mm)
2	AMS 4045 aluminum alloy, sulfuric acid anodized in accordance with AMS 2471, coated with MIL-PRF-23377 and MIL-PRF-85285 urethane topcoat	0.040 inch (1.02 mm)
2	AMS 4045 aluminum alloy, sulfuric acid anodized in accordance with AMS 2471, coated with MIL-PRF-23377 and coated with MIL-PRF-85285 urethane topcoat	0.040 inch (1.02 mm)
2	AMS 4045 aluminum alloy, sulfuric acid anodized in accordance with AMS 2471, coated with MIL-PRF-85582 waterbased primer. (Use AMS 3100 adhesion promoter prior to sealing.)	0.040 inch (1.02 mm)
2	Carbon-reinforced epoxy (composite) as specified in 4.5.2.2. (Test ply side and tool side; do not test both sides of same panel.)	0.040 inch (1.02 mm)

[1]See 4.5.15.2.1.

4.5.15.2 After the sealing compound has been cured, two panels of each substrate listed in Table 4 shall be subjected to each of the following test conditions.

EXCEPTION: Do not expose the specimens that were coated with MIL-PRF-23377 primer, MIL-PRF-85285 topcoat, or MIL-PRF-85582 primer:

a. Seven days at 140 °F (60 °C) in AMS 2629, Type 1 JRF;
b. Seven days at 140 °F (60 °C) in equal parts of JRF and 3% by weight aqueous sodium chloride solution;
c. 100 hours at 140 °F (60 °C), 10 hours at 160 °F (71 °C), 1 hour at 180 °F (82 °C) in equal parts JRF and 3% by weight aqueous sodium chloride solution.

Repeat the above cycle five times (for a total of six cycles), using new fluid each time.

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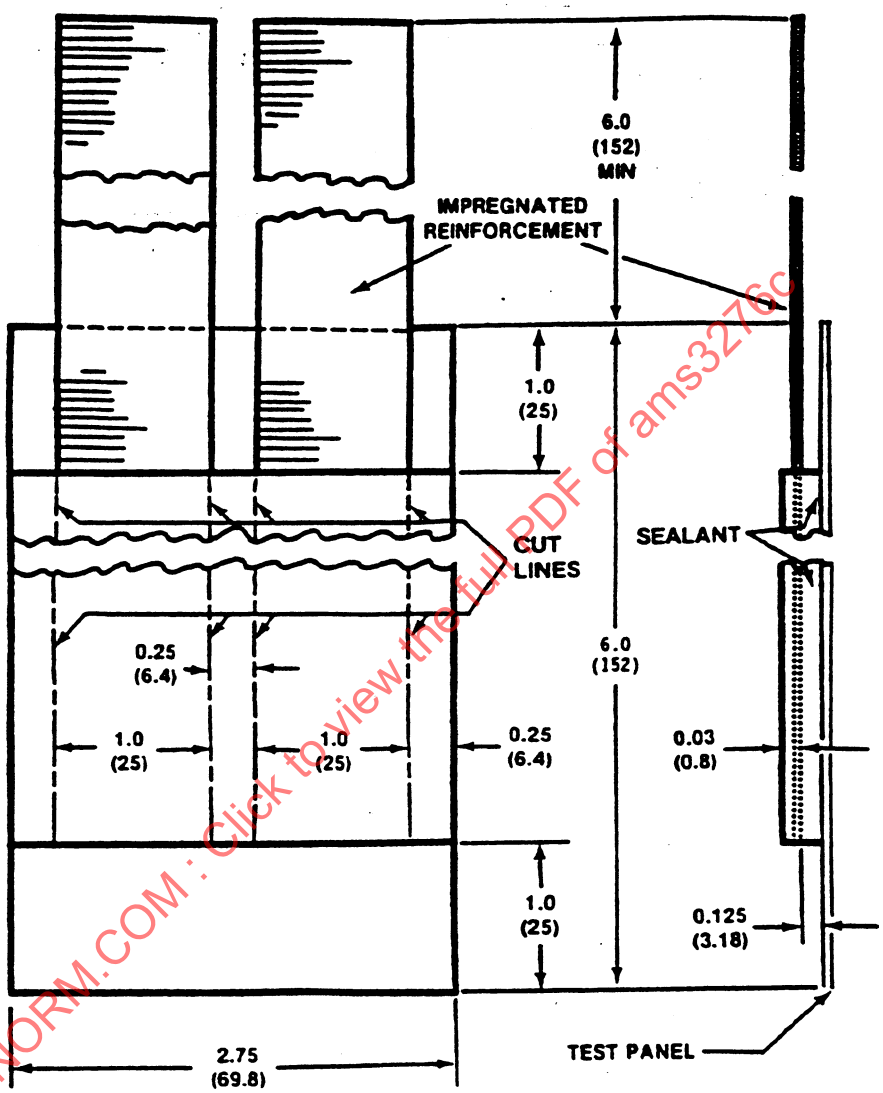

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NOTES:

1. Dimensions are in inches (millimeters).
2. Unless otherwise specified, dimensions shown shall be nominal.
3. Sealant and fabric covers lower 1 inch (25 mm) of panel in the optional specimen.

FIGURE 3 - Peel Specimen Configuration

4.5.15.2.1 Two panels of each substrate marked in Table 4 with an asterisk (*) shall be exposed to the following test conditions:

a. 70 days at 140 °F (60 °C) in JRF with fluid change every 14 days.
b. 70 days at 140 °F (60 °C) in equal parts JRF and 3% by weight aqueous sodium chloride solution with fluid change every 14 days.

4.5.15.2.2 Four of the panels coated with MIL-PRF-23377 primer [two cured at standard conditions and two cured at 200 °F (93 °C)], two of the panels coated with MIL-PRF-85285 urethane topcoat, and two of the panels coated with MIL-PRF-85582 waterbased primer shall be subjected to seven days at 140 °F (60 °C) in 3% by weight aqueous sodium chloride solution. After the specified exposure at 140 °F (60 °C), the panels shall be retained in the fluid for one day at standard conditions (4.5.1.1). Measure the peel strength within five minutes after removal of the specimens from the test fluid.

4.5.15.3 Two 1-inch (25-mm) wide strips shall be cut through the sealing compound and wire screen or fabric to the metal and extended the full length of the wire screen or fabric.

4.5.15.4 The specimens shall be stripped back at an angle of 180 degrees to the metal panel in a suitable tensile testing machine having a jaw separation rate of 2 inches per minute (0.8 mm/s). During peel strength testing, three cuts shall be made through the sealing compound to the panel in an attempt to promote adhesive failure; these cuts shall be at approximately 1-inch (25-mm) intervals. The results reported shall be the numerical average of the peak loads during cohesive failure. Bond failures between the sealing compound and fabric shall not be included in peel strength values.

4.5.15.5 Repairability: For Classes A-1/2, B-1/4, B-1/2, and C-1/2, two AMS 4045 aluminum alloy panels, 0.040 x 2.75 x 6 inch (1.02 x 69.8 x 152 mm), shall be sulfuric acid anodized in accordance with AMS 2471 and coated with MIL-PRF-27725. Apply sealing compound in accordance with 4.5.15.1. After curing at standard conditions for six hours (Class B-1/4) or for 10 hours (Classes A-1/2, B-1/2, C-1/2), immerse the panels in JRF at 77 °F (25 °C) for seven days. Test the panels in accordance with 4.5.15.3 and 4.5.14.4.

4.5.15.6 For Acceptance Tests: Four AMS 4045 aluminum alloy panels, 0.040 x 2.75 x 6 inch (1.02 x 69.8 x 152 mm), shall be sulfuric acid anodized in accordance with AMS 2471 and coated with MIL-PRF-27725. Prepare peel panels as specified in 4.5.15.1. Soak two panels in JRF and two panels in JRF/salt water for seven days at 140 °F (60 °C). Test the panels in accordance with 4.5.15.3 and 4.5.15.4.

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4.5.16 Chalking: Four, 0.125 x 0.125 x 5 inch (3.18 x 3.18 x 127 mm), specimens shall be cut from a sheet of the sealing compound cured in accordance with 4.5.2.8. The specimens shall be suspended on a nylon cord in a closed glass container with 900 ml of AMS 2629, Type 2 JRF, so that the specimens are totally immersed in the fluid. Aluminum foil shall be used to seal the containers. No metal items shall be in contact with fluid or specimens during the immersion period. Specimens shall not touch each other; all sides of specimens shall be exposed to the fluid. The immersion temperature shall be 77 °F (25 °C). Testing shall be started on a Wednesday; and the JRF shall be changed on the following Friday. Specimens shall be examined for chalking on the following Monday. Remove specimens from the JRF, and allow the fluid to evaporate. Do not blot or wipe the specimens. Inspect strips in a well lighted area. Use an original specimen for comparison with the specimens under test to detect chalking. The rating criteria for sealant chalking are:

a. Slight Chalk Initial observation of white or light gray formation, usually at edges of the sealant.
b. Moderate Chalk The white or light gray formation has spread to approximately one quarter to one half of the surface area.
c. Heavy Chalk The white or light gray formation has spread to approximately three-quarters or more of the surface.

4.5.17 Shear Strength (Classes C and E only): Six AMS 4049 aluminum alloy test panels, 0.040 x 1 x 3 inches (1.02 x 25 x 76 mm), shall be prepared. Apply a coat of sealant 0.010 to 0.020 inch (0.25 to 0.51 mm) thick to one end of three panels, covering approximately 1 inch (25 mm) on each panel. Overlap the sealant with another panel making a 1 square inch (645 mm^2) lap test specimen. Use the jig shown in Figure 4; or use test equipment that is similar to the jig shown in Figure 4. Reduce the sealant thickness to 0.005 to 0.010 inch (0.13 to 0.25 mm). Cure the sealant in accordance with 4.5.2.8. Determine the shear strength by pulling in shear at a speed of 2 inches per minute (0.8 mm/s).

4.5.18 Air Content (Class B only): The equipment used for the air content test shall be as follows:

a. Sealing Cartridge, 3-1/2 ounce (104 ml)
b. 2.5 inch (64 mm) nozzle with a 0.125 inch (3.18 mm) orifice
c. Dasher Rod with valve assembly
d. Separate plug and ramrod from a 6-inch (152-mm) sectional plastic sealant cartridge.

4.5.18.1 The test method shall conform to the following steps and shall refer to Figure 5 for the various steps:

4.5.18.1.1 Test shall be performed at standard conditions as in 4.5.1.1.

4.5.18.1.2 Test sealant conditions shall be stabilized at standard conditions (4.5.1.1) for at least eight hours prior to the test.

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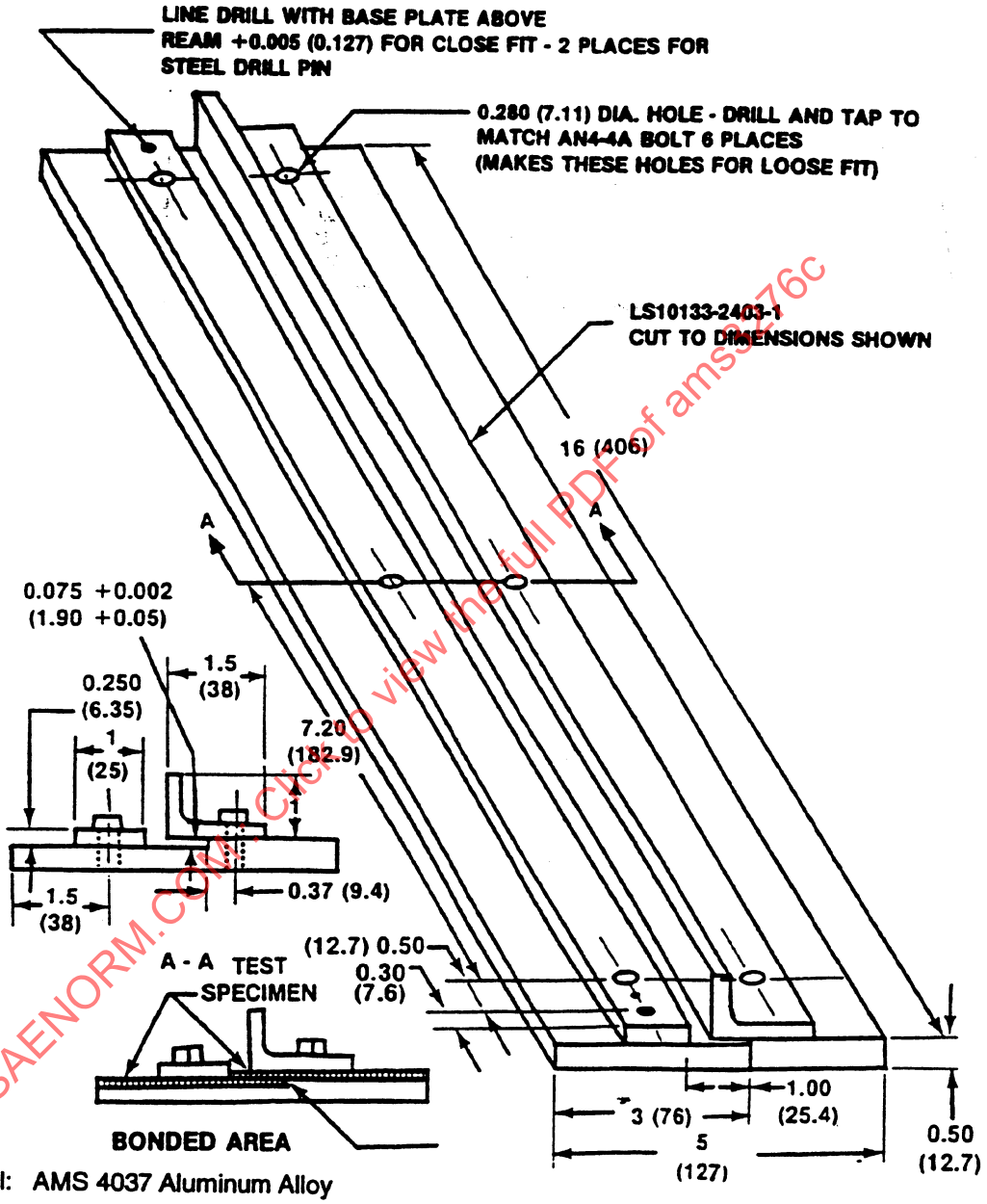

NOTES: Material: AMS 4037 Aluminum Alloy

Dimensions are in inches (millimeters).

Unless otherwise specified, tolerances are +/- 0.015 inch (+/- 0.38 mm).

FIGURE 4 - Shear Specimen Fixture

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4.5.18.1.3 Fill cartridge with sealant; and prevent air entrapment within the material as the cartridge is being filled. Attach a 2.5-inch (64-mm) nozzle with a 0.125-inch (3.18-mm) orifice to the cartridge. Cut 1.125 inches (28.58 mm) from the tip of the nozzle. Extrude approximately 2 inches (51 mm) of sealant to remove entrapped air.

4.5.18.1.4 Prior to starting the test, the dasher rod should have the seal ring just contacting the dasher end and the valve is open.

4.5.18.1.5 Insert the tip of the filled cartridge firmly into the handle of the dasher rod and deliver sealant slowly until dasher is about three-quarters full. The sealant, however, should completely fill the handle end of the dasher.

4.5.18.1.6 Fill the wider flange side of the plug with sealant and place the plug in the rod behind the sealant with the wide flange side toward the sealant, taking care not to entrap air. Clean off excess sealant.

4.5.18.1.7 Measure the length of the sealant in the dasher in millimeters. Measurements shall be between the interior bottom of the plug and the middle of the curved bead of sealant at the other end of the dasher rod (length OX', as shown in Figure 5).

4.5.18.1.8 Insert the ramrod into the dasher rod and push it until the valve is in the fully-open position, as shown in Figure 5.

4.5.18.1.9 Remove ramrod and clean off any remaining excess sealant at the handle end of the dasher ramrod.

4.5.18.1.10 Slowly push the valve body into the dasher, finally forcing a seal.

4.5.18.1.11 Insert the ramrod into the dasher until it merely touches the top of the plug. Make a mark “B” the ramrod at the handle end of the dasher.

4.5.18.1.12 Put firm hand pressure on the ramrod while the valve end of the dasher is held against a table edge. Make a second mark 'C'.

4.5.18.1.13 Measure the distance between the two marks on the ramrod.

4.5.18.2 The percent of air present in the sealant material can be calculated as shown in Equation 2:

$$\% \text{ Air Present} = \frac{\text{Distance between marks B and C on the ramrod}}{\text{Original length of the sealant in dasher rod}} \times 100 \qquad \text{(Eq. 2)}$$

4.5.18.3 Three test runs should be made; and the results shall be averaged. Use fresh equipment for each test run.

4.5.18.3.1 Sealant used for compression test shall not be obtained from the top of a drum or container.

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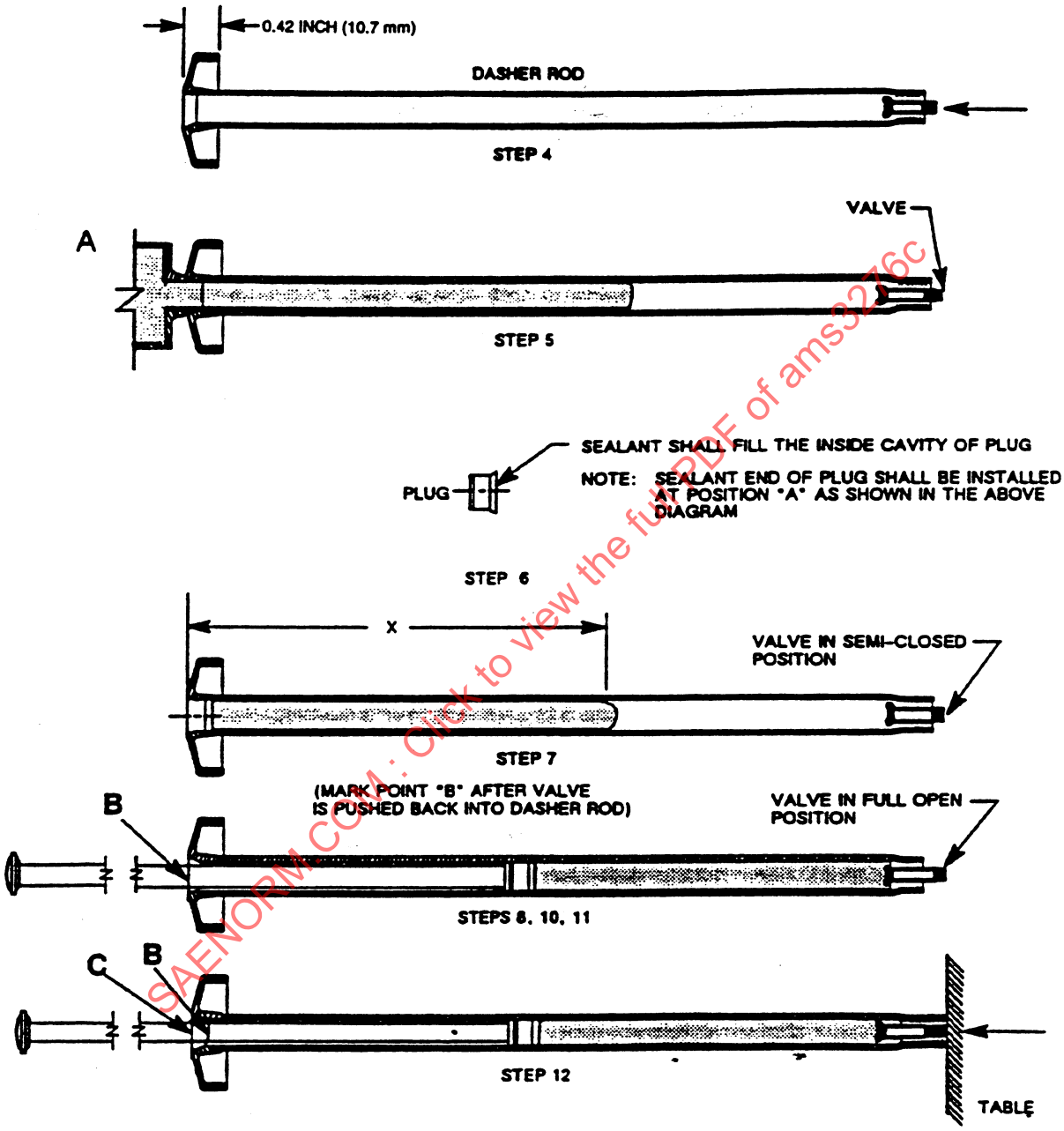

FIGURE 5 - Diagram of Stages in Filling Dasher Rod

4.5.19 Weight Loss, Flexibility, and Swell (Class B Only):

4.5.19.1 Four 0.125 x 1 x 5 inches (3.18 x 25 x 127 mm) specimens shall be cut from a sheet of the sealing compound that has been cured in accordance with 4.5.2.8.

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4.5.19.2 Specimens shall be weighed in air (W1) and in water (W2) and then dried. The specimens shall be immersed in 900 ml of JRF for seven days at 140 °F (60 °C) in a closed container. At the end of the exposure period, the specimens shall be removed from the fluid, dipped momentarily in methyl alcohol, and reweighed in air (W3) and in water (W4). Dry the specimens for 24 hours at 120 °F (49 °C); then cool the dried specimens to standard conditions (4.5.1.1) in a desiccator, and weigh them (W5). Percent swell shall be calculated as shown in Equation 3, and percent weight loss shall be calculated in accordance with Equation 4.

$$\text{Percent Swell} = \frac{(W2 + W3) - (W1 + W4)}{(W1 - W2)} \times 100 \quad \text{(Eq. 3)}$$

$$\text{Percent Weight Loss} = \frac{(W1 - W5)}{W1} \times 100 \quad \text{(Eq. 4)}$$

4.5.19.3 After weighing, the specimens shall be bent 180 degrees over a 0.125-inch (3.18-mm) mandrel. Visual evidence of cracking or surface checking is not acceptable.

4.5.20 Resistance to Thermal Rupture:

4.5.20.1 Two specimens shall be prepared, each having a fillet of sealing compound, approximately 0.125 inch (3.18 mm) thick by 2 inches (51 mm) in diameter, applied to a test panel of AMS 4045 aluminum alloy. The test panels shall be 0.040 x 3.5 x 3.5 inches (1 x 89 x 89 mm) with a hole in the center of the panel. Diameter of the hole shall be 0.25 inch (6.4 mm); and the hole shall be filled with sealant.

4.5.20.2 The sealing compound fillets shall be cured as in 4.5.2.8 and tests shall begin not more than two days after cure cycle.

4.5.20.3 One of the panels shall be immersed in JRF for 120 hours ± 4 at 140 °F (60 °C), plus 60 hours ± 4 hours at 160 °F (71 °C), and plus 6 hours ± 1 hour at 180 °F (82 °C).

4.5.20.4 The panel shall be removed from the fluid and immediately applied to the fixture, shown in Figure 6, using a suitable gasket. The panel shall be positioned on the fixture such that the sealant is within the fixture chamber.

4.5.20.5 The fixture shall be placed in an oven at 300 °F (149 °C). 10 psi (69 kPa) air pressure shall be applied using an air regulator. The clamp fixture shall be maintained in the oven for a minimum of 30 minutes after pressure is applied.

4.5.20.6 Deformation shall be measured from the surface of the test panel not exposed to pressure, to the point of maximum deformation of the sealing compound.

4.5.20.7 The test shall be repeated on test panels not immersed in JRF.

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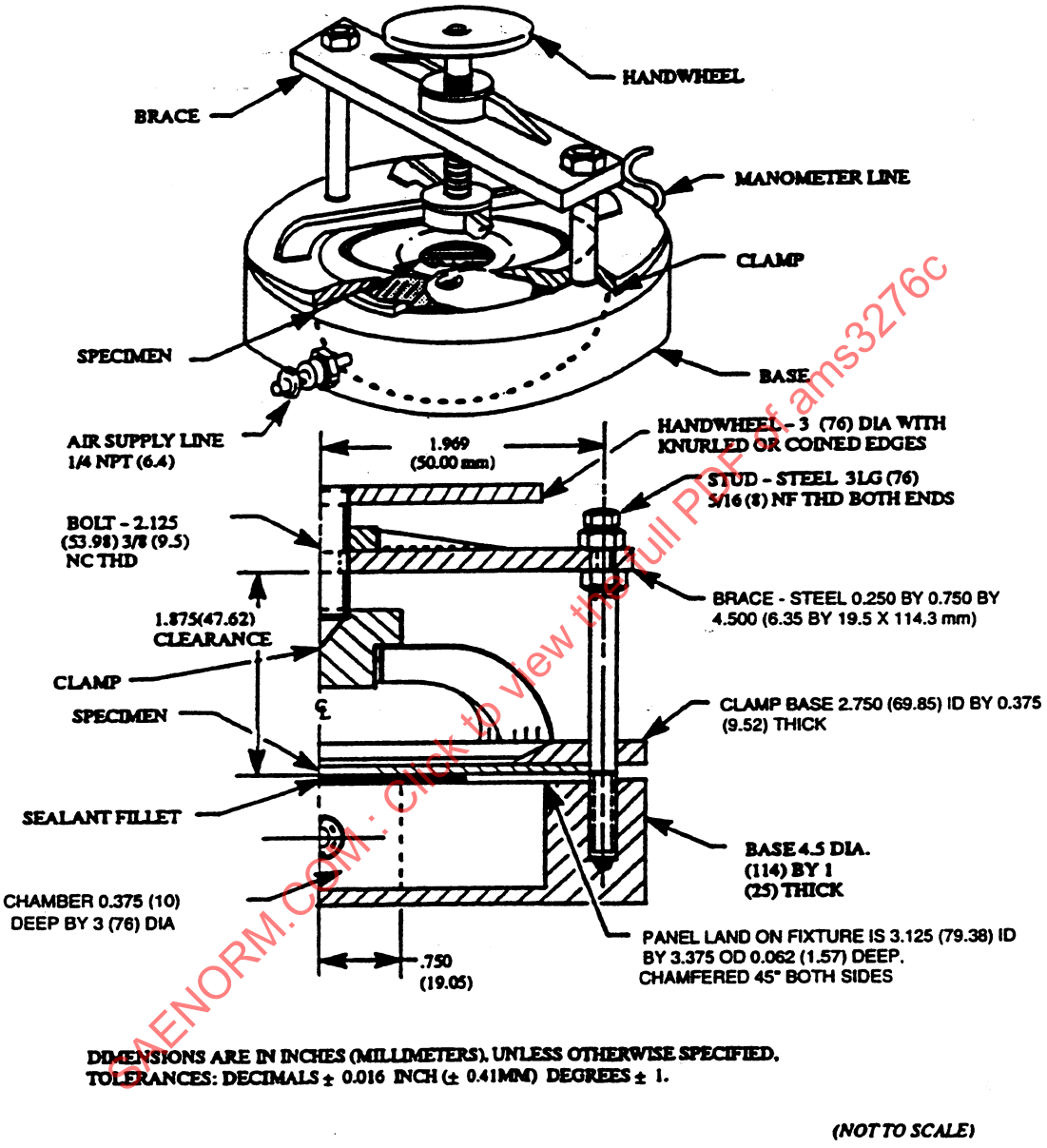

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FIGURE 6 - Thermal Rupture Fixture

4.5.21 Resistance to Thermal Expansion: The thermal expansion block shown in Figure 7 shall be anodized in accordance with AMS 2471 and overcoated with MIL-PRF-23377 primer. Fill the groove in the block with sealant. Care shall be taken to prevent air entrapment during filling. The sealant shall be given a standard cure as in 4.5.2.8, and the surface trimmed flush with the block, if necessary. Expose the specimen to a standard heat cycle as in 4.5.1.3, remove from the oven, and measure the amount of sealant expansion at a point located approximately 2 inches (51 mm) from each end of the block. Allow the block to cool to 77 °F (25 °C) and repeat the measurements. The expansion or contraction shall be reported.

4.5.22 Heat Reversion Resistance (Classes B, C, and E only): Use two AMS 4045 aluminum panels, 0.040 x 3 x 12 inches (1.02 x 76 x 305 mm) that are anodized in accordance with AMS 2471 and coated with 0.001 inch (0.025 mm) of MIL-PRF-27725. Select one of these panels; then coat one surface of the selected panel with a continuous layer of freshly-mixed sealing compound -- approximately 0.010 inch (0.25 mm) thick. Place the other panel over the sealant-covered surface to form a sandwich. The panels shall be given a standard cure as is 4.5.2.8; then the panels shall be exposed to a standard heat cycle as in 4.5.1.3. The panels shall be cooled to room temperature and peeled apart in a tensile testing machine at a jaw separation rate of 2 inches per minute (0.8 mm/s) Report the peak load value.

4.5.23 Tensile Strength and Elongation (Classes B (all dash numbers), C-1/2, C-2, C-6, D-1/4 and D-1/2):

4.5.23.1 Mixed sealing compound, 0.125 inch + 0.015 (3.18 mm + 0.4) thick, shall be prepared by pressing between two polyethylene sheets, removing the top sheet at the end of the tack-free time, and allowing the sealing compound to cure as in 4.5.2.8. Twenty-four tensile specimens shall be cut from the sheet using Die C, as specified in ASTM D 412. Three specimens shall be exposed to each of the environmental conditions.

4.5.23.1.1 Standard Cure as in 4.5.2.8:

4.5.23.1.2 JRF soak for 12 days at 140 °F (60 °C), plus 60 hours of soaking in JRF at 160 °F (71 °C), plus six hours of immersion in JRF at 180 °F (82 °C):

4.5.23.1.3 Condition for 24 hours at 120 °F (49 °C):

4.5.23.1.4 Standard heat cycle as in 4.5.1.3:

4.5.23.1.5 72 hours in AMS 3021 at room temperature:

4.5.23.1.6 72 hours in AMS 3020 at room temperature:

4.5.23.1.7 72 hours in AMS 3021 plus standard heat cycle as in 4.5.1.3:

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