INCH-POUND

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SUPERSEDING
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MILITARY SPECIFICATION

SEALING COMPOUND, TEMPERATURE-RESISTANT, INTEGRAL FUEL TANKS AND FUEL CELL CAVITIES, HIGH-ADHESION

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers temperature-resistant -65°F to +250°F (-54°C to +121°C), two component synthetic rubber compounds of the polysulfide type for sealing and repairing integral fuel tanks and fuel cell cavities.

1.2 Classification. The sealing compound shall be of the following types and classes, as specified (see 6.3).

a. Types:

(1) Type I - Dichromate cured sealing materials.
(2) Type II - Manganese cured sealing materials.

b. Classes:

(1) Class A - Sealing material, suitable for brush application.
(2) Class B - Sealing material, suitable for application by extrusion-gun and spatula
(3) Class C - Sealing material, suitable for faying surface sealing.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENES, Wright-Patterson AFB, Ohio 45433-6503 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 8030

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1.2.1 Dash numbers. The following dash numbers shall be used to designate the minimum application time in hours for Classes A and B and assembly time in hours for Class C:

Class A dash numbers shall be -1/2, -1, -2.

Class B dash numbers shall be -1/2, -1, -2, and -4.

Class C dash numbers shall be -20 and -80.

1.2.2 Type designation examples. Type I, Class A-2 shall designate a dichromate cured, brushable material having an application time of 2 hours. Type II, Class B-1/2 shall designate a manganese cured, extrusion-gun material having an application time of 1/2 hour.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

O-O-670	Ortho Phosphoric Acid, Technical
QQ-A-250/12	Aluminum Alloy 7075, Plate and Sheet
QQ-A-250/13	Aluminum Alloy Alclad 7075, Plate and Sheet
TT-I-735	Isopropyl Alcohol
TT-B-846	Normal Butyl Alcohol
CCC-C-419	Cloth, Duck, Cotton, Unbleached, Plied Yarns, Army and Numbered
PPP-B-636	Box, Shipping Fiberboard
PPP-C-96	Can, Metal, 28 Gage 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)

MILITARY

MIL-A-9962	Abrasive Mats, Non-Woven, Non-metallic
MIL-S-4383	Sealing Compound, Topcoat, Fuel Tank, Buna-N Type

MIL-S-5059	Sheet, Corrosion-Resistant (18-8), Plate, Sheet and Strip
MIL-C-5541	Chemical Conversion Coating on Aluminum and Aluminum Alloys
MIL-A-8625	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-T-9046	Titanium and Titanium Alloy, Sheet, Strip and Plate
MIL-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-C-27725	Coating, Corrosion Preventive, For Aircraft Integral Fuel Tanks
MIL-C-38334	Corrosion Removing Compound, Prepaint, For Aircraft Aluminum Surfaces
MIL-P-38714	Packaging and Packing of Two component Materials in Semkits
MIL-C-38736	Compound, Solvent; For Use in Integral Fuel Tanks
MIL-C-81706	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
MIL-C-87936	Cleaning Compounds, Aircraft Exterior Surfaces, Water Dilutable

STANDARDS

FEDERAL

FED-STD-601	Rubber: Sampling and Testing

MILITARY

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-147	Pallatized Loads for 40" x 48" Pallets
MIL-STD-453	Inspection, Radiographic

(Unless otherwise indicated, copies of federal and military specifications, and standards are available from Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AMS 2629	Jet Reference Fluid for Sealants
AMS 3100	Adhesion Promoter for Polysulfide Sealing Compounds
AMS 3819	Cloths, Cleaning for Aircraft Interior and Exterior Surfaces

(Applications for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D412	Test Method for Rubber Properties in Tension
ASTM D1125	Electrical Conductivity of Water

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

UNIFORM CLASSIFICATION COMMITTEE, AGENT

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The sealing compounds furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.4).

3.2 Materials. The basic ingredient used in the manufacture of the sealing compound shall be synthetic rubber of the polysulfide type. The sealing compound shall cure by the addition of a separate curing compound to the base compound and shall not depend on solvent evaporation for curing. The curing compound shall possess sufficient color contrast to the base compound to permit easy identification of an unmixed or incompletely mixed sealing compound. Neither the base compound nor the cured sealing compound shall be red or pink in color.

3.2.1 Appearance. The base compound and the curing compound (accelerator) 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 readily dispersed.

3.3 Health and Safety. The material shall have no adverse effect on the health of personnel when used in conformance with the supplier's Material Safety Data Sheet and for its intended purpose. Questions pertinent to material effects on personnel health shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.4 Physical properties. THIS PARAGRAPH DOES NOT APPLY TO PURCHASES MADE BY THE U.S. GOVERNMENT. The physical properties are divided into two categories: performance requirements and application requirements. Performance requirements define those properties of the cured sealant and how the material will perform in service. Application requirements define those properties of the uncured sealant and affect the application parameters of the sealant, but have little or no effect on the performance properties of the cured sealant. Minor variations in application requirements during quality conformance inspection (see paragraph 4.4.3) may not be cause for rejection if approved by the procuring agency. Reference paragraphs for the two categories are as follows:

a. Performance requirements:

3.4.1 Specific gravity
3.4.2 Non-volatile content
3.4.11 Resistance to thermal rupture
3.4.12 Low-temperature flexibility
3.4.13 Hydrolytic stability
3.4.14 Shear strength (Class C only)
3.4.15 Corrosion
3.4.16 Radiographic density
3.4.17 Peel strength
3.4.18 Resistance to hydrocarbons
3.4.18.1 Weight loss and flexibility
3.4.18.2 Tensile strength and elongation (Class B only)
3.4.18.3 Chalking
3.4.19 Repairability (Classes A and B only)
3.4.20 Accelerated storage stability
3.4.21 Long term storage
3.4.22 Air Content (Class B only)

b. Application requirements:

3.4.3	Viscosity of base compound
3.4.4	Viscosity of curing compound (catalyst)
3.4.5	Flow (Classes B and C only)
3.4.6	Application time
3.4.7	Assembly time (Class C only)
3.4.8	Tack-free time
3.4.9	Standard cure rate (Classes A and B only)
3.4.10	Fluid immersed curing rate (Classes A-1/2, and B-1/2 only).

3.4.1 Specific gravity. When tested in accordance with 4.8.1, the specific gravity of the cured sealing compound shall be not more than 1.50 for Type I and 1.65 for Type II at standard conditions (see 4.5).

3.4.2 Nonvolatile content. When tested in accordance with 4.8.2, the nonvolatile content of the freshly mixed compound shall be not less than the amount specified below:

Class A - 84 percent by weight

Class B - Type I - 90 percent by weight
- Type II - 92 percent by weight

Class C - 92 percent by weight

3.4.3 Viscosity of base compound. Class A sealing compound shall be suitable for application by brush, and viscosity of the base compound shall be within the range of 100 to 500 poises (10 to 50 Pascal seconds [Pa.s]) when tested in accordance with 4.8.3. Class B sealing compound shall be suitable for application by extrusion gun or spatula, and the viscosity of the base compound shall be within the range of 9000 to 14000 poises (900 to 1400 Pa.s) when tested as specified in 4.8.3. Class C sealing compound shall be suitable for application by brush or spatula and viscosity of the base compound shall be within the range of 1000 to 4000 poises (100 to 400 Pa.s) when tested as specified in 4.8.3.

3.4.4 Viscosity of curing compound (catalyst). The viscosity of the curing compound shall be 700 to 1600 poises (70 to 160 Pa.s) when tested in accordance with 4.8.4.

3.4.5 Flow (Classes B and C only)

3.4.5.1 Class B. When tested in accordance with 4.8.5.1, freshly mixed Class B sealing compound shall exhibit an initial flow within the limits of 0.1 inch (2.5 millimeters [mm]) and 0.75 inch (19.0 mm) when a cylindrical section formed in the flow-test

fixture is allowed to flow under its own weight on a vertical surface. In addition, the sealing compound shall retain a flow with the limits 0.1 inch (2.5 mm) and 0.75 inch (19.0 mm) throughout the entire application time.

3.4.5.2 Class C. When tested in accordance with 4.8.5.2, a 0.015 inch (0.40 mm) to 0.02 inch (0.50 mm) layer of fresh sealant shall resist flowing to the extent that at the rated tack-free time the sealant layer shall measure no less than 0.010 inch (0.25 mm).

3.4.6 Application time. When tested in accordance with 4.8.6, the mixed sealing compound shall have an application time of not less than the time in hours specified in table I after addition of the curing compound, and it shall remain suitable for application during the period. The end of the application time shall be considered as 2500 poises (250 Pa.s) for Class A, 15 grams per minute for Class B, and 30 grams per minute for Class C.

3.4.7 Assembly time (Class C only). When tested in accordance with 4.8.7 the mixed sealing compound shall have an assembly time of not less than the time in hours specified in table I. The sealant must squeeze out to a thickness of 0.005 inch (0.12 mm) or less at the bolts.

3.4.8 Tack-free time. When tested in accordance with 4.8.8, the mixed sealing compound shall cure to a tack-free condition in not more than the time in hours specified in table II.

3.4.9 Standard curing rate (Classes A and B only). When tested in accordance with 4.8.9. the sealing compound shall have a type A hardness of not less than 30 after curing under standard conditions (see 4.5) for not more than the time specified in table II.

3.4.10 Fluid immersed curing rate (Classes A-1/2 and B-1/2 only). When tested in accordance with 4.8.10 the sealing compound shall have a hardness of not less than 25 after curing for 48 hours and not less than 35 after curing for 120 hours.

3.4.11 Resistance to thermal rupture. When tested in accordance with 4.8.11, the sealing compound shall not blister nor sponge, and it shall retain a pressure of 10 pounds per square inch (psi) (69 kilopascal [kPa] with no more than 1/8 inch (3mm) deformation.

3.4.12 Low-temperature flexibility. When tested in accordance with 4.8.12, the sealing compound shall withstand the low-temperature flexibility test at -67°F ±2°F (-55°C ±1°C) without cracking, checking, or loss of adhesion.

TABLE I. Application time or assembly time.

Class A	Application Time Hours	Class B	Application Time Hours	Class C	Application Time Hours	Assembly Time Hours
A-1/2	1/2	B-1/2	1/2	C-20	8	20
A-1	1	B-1	1	C-80	8	80
A-2	2	B-2	2			
		B-4	4			

TABLE II. Tack-free time and curing rate.

Class	Tack-free time (hours)	Curing rate (hours)	Class	Tack-free time (hours)	Curing rate (hours)	Class	Tack-free time (hours)
A-1/2	10	40	B-1/2	10	30	C-20	96
A-1	20	55	B-1	20	55		
A-2	40	72	B-2	40	72	C-80	120
			B-4	48	90		

3.4.13 Hydrolytic stability. When tested in accordance with 4.8.13, the sealing compound shall have a type A hardness of not less than 30.

3.4.14 Shear strength (Class C only). The shear strength of the cured sealing compound shall be not less than 200 psi (1380 kPa) when tested as specified in 4.8.14. At least 75 percent of the area of separation produced in the shear test specimens shall be within the sealing compound.

3.4.15 Corrosion. When tested in accordance with 4.8.15, there shall be no corrosion under the sealing compound and sealing compound shall show no sign of deterioration.

3.4.16 Radiographic density. When tested in accordance with 4.8.16, the H&D density difference between the plate and the plate plus sealant shall not exceed 1.00 as measured by an Ansco-Sweet densitometer, or equal. The density readings through the sealant in the slot shall be approximately 3.00.

3.4.17 Peel strength. When tested in accordance with 4.8.17, the Class A and Class B sealing compound shall have a minimum peel strength of 20 pounds force (lbf) (89 newton [N]) for the 7 day exposure and 7 lbf (31N) for the 70 day exposure. The Class C sealing compound shall have a minimum peel strength of 15 lbf (67N) and 7 lbf (31N), respectively. The material shall exhibit 100 percent cohesive failure, except for bubbles, knife cuts, and other causes that are obviously not the fault of the sealing compound.

3.4.17.1 Peel strength (Classes A-1/2 and B-1/2 only). When tested in accordance to 4.8.17.1, the sealing compound shall have a minimum peel strength of 10 lbf (45N) and exhibit 100 percent cohesive failure, except for bubbles, knife cuts, and other causes that are obviously not the fault of the sealing compound.

3.4.18 Resistance to hydrocarbons

3.4.18.1 Weight loss and flexibility. When tested in accordance with 4.8.18.1, the sealing compound shall lose not more than 8 percent be weight. The specimens shall not crack when bent 180 degrees over an 1/8-inch mandrel.

3.4.18.2 Tensile strength and elongation (Class B only). When Class B sealing compound is tested in accordance with 4.8.18.2, the ultimate tensile strength and elongation of the cured compound shall be not less than the values shown in table III.

TABLE III. Tensile strength and elongation (Class B material only).

Condition	Tensile Strength (psi)	Elongation Percent
Standard Cure	200 (1380 kPa)	200
14 day immersion in jet reference fluid (see 4.7) at 140°F ±2°F (60°C ±1°C)	50 (345 kPa)	200
7 days at 250°F ±5°F (121°C ±3°C)	125 (862 kPa)	100
72 hours immersion in jet reference fluid at 140°F ±2°F (60°C ±1°C), followed by 72 hours air-drying at 120°F (55°C), followed by 7 days air-aging at 250°F ±5°F (121°C ±3°C)	200 (1380 kPa)	75
24 hours at 250°F ± 5°F (121°C± 3°C), followed by 7 days immersion in jet reference fluid at 140°F ±2°F (60°C ±1°C)	100 (690 kPa)	150

3.4.18.3 Chalking. The rating criteria for sealant chalking are:

Slight Chalk - Initial observation of white or light gray formation, usually starting at edges of the sealant.

Moderate Chalk - The white or light gray formation has spread to 1/4 to 1/2 of the surface area.

Heavy Chalk - The white or light gray formation has spread to 3/4 or more of the surface.

The sealant shall not chalk to a moderate or heavier level when tested in accordance with 4.8.18.3

3.4.19 Repairability (Classes A and B only). Sealing compounds shall be suitable for repairing minor breaks in themselves or each other and in all other fuel-aged sealing compound previously qualified under this specification. Specimens of the sealing compound prepared in accordance with 4.8.19, shall have a peel strength of 10 lbf (45N) minimum.

3.4.20 Accelerated storage stability. After storing in accordance with 4.8.20, the base compound shall show no skinning, hardening, separation, nor settling of the material. It shall also conform to the original viscosity specified in 3.4.3. The aged curing compound shall not be adversely affected and shall be capable of being restored by normal agitation to a condition suitable for use. The aged base compound and the aged curing compound, when mixed, shall be in accordance with conditions for flow, application time, assembly time, and tack-free time specified in 3.4.5, 3.4.6, 3.4.7, and 3.4.8. respectively. The peel strength shall be 20 lbf (89N) minimum for Classes A and B and 15 lbf (67N) minimum for Class C.

3.4.21 Long term storage. After storing for 9 months in accordance with 4.8.21, the base compound and curing compound shall show no skinning or hardening and shall be capable of being restored by normal agitation to a condition suitable for use. The aged base compound and aged curing compound, when mixed, shall meet the minimum application time, maximum tack-free time, and maximum cure time requirements of tables IV and V.

TABLE IV. Application time or assembly time for materials stored for 9 months.

	Class A	Hours	Class B	Hours	Class C	Application Time Hours	Assembly Time Hours
Type I (Dichromate cures)	A-1/2 A-1 A-2	1/4 1/2 1	B-1/2 B-1 B-2 B-4	1/4 1/2 1 2			
Type II (Manganese cured)	A-1/2 A-1 A-2	1/2 1 2	B-1/2 B-1 B-2 B-4	1/2 1 2 4	C-20 C-80	8 8	20 80

TABLE V. Tack-free time and curing rate for materials stored for 9 months.

	Class	Tack-free Time (Hours)	Curing Rate (Hours)	Class	Tack-free Time (Hours)	Curing Rate (Hours)	Class	Tack-free Time (Hours)
Type I (Dichromate cured)	A-1/2 A-1 A-2	10 20 40	40 55 72	B-1/2 B-1 B-2 B-4	10 20 40 48	30 55 72 90		
Type II (Manganese cured)	A-1/2 A-1 A-2	16 30 64	64 78 112	B-1/2 B-1 B-2 B-4	16 30 64 72	45 78 112 136	C-20 C-80	144 184

3.4.22 Air Content (Class B only). When tested in accordance with 4.8.22 the sealing compound shall have an air content of not more than 4 percent(%).

3.4.23 Source inspection. All materials procured by the Government under this specification must be source inspected. (See 4.1.2).

3.5 Workmanship. The workmanship shall be in accordance with high-grade manufacturing practice covering this type of material. It shall be suitable for its intended use and free of defects which may affect its functionability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Source inspection. Materials procured by the Government under this specification must be source inspected, so there is assurance that the material meets the quality conformance tests (4.4.3) when it leaves the manufacturer's plant. Note that 4.4.2 requires that the sample for quality conformance tests be packaged and mixed as much as practical in the same containers that are being procured.

4.1.3 Shelf-life surveillance and updating

4.1.3.1 Sampling. An inspection lot shall consist of items produced by a single manufacturer and bearing the same lot or batch identification number. The minimum number of samples to be tested from each inspection lot during shelf-life surveillance and updating shall be as follows:

Items in stock	Samples to be tested
up to 100	3
100 to 500	5
more than 500	7

4.1.3.2 Shelf-life surveillance and updating tests. 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 curing rate

e. Viscosity of base compound (not possible with sectional type kits or kit sizes below one quart).

f. Viscosity of curing compound (not possible with sectional type kits or kit sizes below 5 gallons).

g. Peel strength, (two aluminum panels coated with material conforming to MIL-C-27725, aged in jet reference fluid seven days at 140°F (60°C).

Tests are to be conducted in accordance with test methods outlined in this specification for quality conformance tests (see 4.4.3). If the tests are being performed at the end of the stated shelf-life to update the shelf-life of the sealing material and all test are passed, the shelf-life will be extended and additional three months. Up to three updating shall be allowed.

4.1.4 Curing compound (catalyst) replacement. There are instances where sealant will become overaged and require excessive periods of time to cure. This is especially true of the type II materials. Usually, the curing compound will be the component that has deteriorated. It is possible to replace the curing compound so that the sealant can be used. Anytime the curing compound is replaced, all the quality conformance tests (see 4.4.3) must be met by the final curing compound/base combination.

4.2 Classification of tests. The inspection and testing of the sealing compound shall be classified as follows:

a. Qualification tests (4.3).

b. Quality conformance inspection (4.4).

4.3 Qualification tests. The first material that a manufacturer must qualify is Class B-2. That material must meet all the requirements of this specification with exception of those requirements that are for other classes. Once qualification for Class B-2 is obtained, other classes may be qualified. The formulation for Class A and C materials and other Class B materials shall be the same as that for the Class B-2, except for minor variations necessary for viscosity and application life. It will not always be necessary for the qualifying agency to conduct all the tests on the other classes. In general, the quality conformance tests will be sufficient, although additional tests can be required. The manufacturer will have to show proof that all requirements are met prior to requesting qualification approval for any class. This includes assurance that the material will cure at standard conditions. (Quality conformance testing is conducted on material which has been cured at 140°F (60°C). After the compound has been accepted for qualification, approval will be granted and the material will be identified by reference to the manufacturer's code or formula number.

4.3.1 Qualification test samples. The qualification test samples shall consist of five 1-quart (1 liter) kits and tree 1-pint (1/2 liter) kits of the compound upon which qualification is desired. The qualification samples shall be identified as specified herein and forwarded to the activity responsible for qualification as designated in the letter of authorization from that activity (see 6.3).

Samples for qualification tests:

SEALING COMPOUND, TEMPERATURE-RESISTANT, INTEGRAL FUEL TANKS AND FUEL CELL CAVITIES, HIGH ADHESION

Type, Class, and Dash No.
Specification MIL-S-8802F
Manufacturer's Code No.
Name of Manufacturer
Submitted by (name) (date) for qualification tests in accordance with MIL-S-8802F under authorization (reference authorizing letter)
Mixing instructions.

4.4 Quality conformance inspection

4.4.1 Batch. A batch shall be the quantity of material run through a mill or mixer at one time.

4.4.2 Contractor initial and final quality conformance tests. Each batch shall be subjected to both initial and final quality conformance testing. Sufficient material for initial quality conformance testing shall be packaged in the same type containers that are being procured. Initial quality conformance tests are those listed in para 4.4.3. Final quality conformance testing is to be conducted on the final packaged product and consists of application time, tack-free time, and standard curing rate.

4.4.2.1 Sampling for initial quality conformance tests. The sample material shall be packaged for the initial quality conformance testing in the same type containers that are being procured.

4.4.2.1.1 Plastic injection kits. If the material is being procured in plastic injection kits, such as those conforming to MIL-P-38714, all the tests shall be conducted on material that has been packaged and mixed in the initial sample injection kits except for viscosity of base compound and viscosity of curing compound. During filling of the initial sample injection kits, base compound and curing compound shall be placed in 1-quart (1-liter) cans for the viscosity tests. If more than one size of injection kits are to be packaged from a particular batch, it is necessary to test material from only one size kit.

4.4.2.1.2 Cans, pails, and drums. If the material is being procured in cans, pails, or drums, the batch shall be tested on material placed in 1-quart (1-liter) cans.

4.4.2.1.3 Both type containers. If the material is being procured in both type containers, the initial quality conformance tests shall be conducted on the material packaged in plastic injection kits. (See 4.4.2.1.1)

4.4.2.2 Sampling for final quality conformance tests. After successful completion of the 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 quality conformance tests:

a. Application time	4.8.6
b. Tack-free time	4.8.8
c. Standard curing rate	4.8.9
d. Air Content (Class B only)	4.8.22

If the batch is being packaged in different type and/or different size containers, the final quality conformance tests shall be conducted on each type and/or each size containers. If the material is being procured under different purchase orders, but the purchase orders call for the same type and size containers, it is only necessary to conduct the final quality conformance tests once.

4.4.2.3 Sampling for final quality conformance tests conducted by procuring agency. Final packaged material shall be subjected to quality conformance tests listed in 4.4.3. These samples shall be packaged in accordance with 4.4.2.1.1 through 4.4.2.1.3.

4.4.3 Quality conformance tests. Quality conformance tests for acceptance of individual batches shall consist of the following tests:

a. Nonvolatile content	4.8.2
b. Viscosity of base compound 1/	4.8.3
c. Viscosity of curing compound 1/	4.8.4
d. Flow (Class B only)	4.8.5
e. Application time	4.8.6

f. Assembly time (Class C only)	4.8.7
g. Tack-free time	4.8.8
h. Standard curing rate (Classes A and B only)	4.8.9
i. Fluid immersed curing rate (Classes A-1/2 and B-1/2 only)	4.8.10
j. Resistance to thermal rupture (fluid immersed only) 2/	4.8.11
k. Shear strength (Class C only) 2/	4.8.14
l. (1) Peel strength (4 aluminum panels, QQ-A-250/12, T6 sulfuric acid anodized in accordance with MIL-A-8625, type II, class 1 (dichromate sealed), coated with material conforming to MIL-C-27725, 7-day immersion test only). Do not use AMS 3100 adhesion promoter. 2/	4.8.17
(2) Peel strength (4 aluminum panels, QQ-A-250/12, chemically treated in accordance with 4.6.5). Do not use AMS 3100 adhesion promoter. 2/	4.8.17
(3) Peel strength (Classes A-1/2 and B-1/2 only). Do not use AMS 3100 adhesion promoter. 2/	4.8.17.1
m. Chalking 2/	4.8.18.3
n. Air Content (Class B only)	4.8.22

1/ Quality conformance testing of viscosity of base compound and curing compound need not be performed on sectional type kits and small size containers of less than 8 fluid ounces.

2/ In lieu of the 14-day cure specified, specimens shall be subjected to an accelerated cure of 48 hours at 77°F (25°C) at a relative humidity of 50 percent followed by 24 hours at 140°F (60°C). Class C-80 specimens shall be cured 48 hours at 77°F (25°C) at a relative humidity of 50 percent followed by 48 hours at 140°F (60°C).

4.4.3.1 THIS PARAGRAPH DOES NOT APPLY TO PURCHASES MADE BY THE U.S. GOVERNMENT. Minor variations in application requirements (viscosity of base compound and curing compound, flow, application time, assembly time, tack-free time, standard curing rate, and fluid immersed curing rate) may not be cause for rejection of a particular batch if the minor variation is acceptable to and approved by the procuring agency.

Compliance with Section 3.

4.5 Test conditions. Standard laboratory conditions are 77°F ±2°F (25°C ±1°C) and 50 ±5 percent relative humidity. Unless otherwise specified, all test specimens shall be prepared and cured under these conditions. In addition, viscosity of base compound, viscosity of curing compound, flow, application time, assembly time, tack-free time, and standard curing rate shall be tested under those conditions. Other tests shall be conducted at a temperature of 77°F ±5°F (25°C ±3°C) with no control on humidity necessary.

4.6 Preparation of test specimens

4.6.1 Cure of composite panels. AS 4/3501-6 shall be fabricated using 8 plies of unidirectional tape laid (0,45,90,135) symmetrical. Size of the test panels shall be 0.040 inch by 2 3/4 inches by 6 inches (1.00 by 70 by 150 mm). Cure shall be as follows:

Install peel ply to tool side of laminate. Nylon peel ply (or other type) is acceptable. Install peel ply to bag surface of laminate. Apply full vacuum (28" Hg, Min.) and 85 PSIG (587 kPa) pressure. Heat to 225°F (107°C) at 1°F to 4°F (.55°C to 2.2°C) per minute. Hold at 225°F (107°C) for 60 minutes. Heat to 350°F (177°C) at 1°F to 4°F (.55°C to 2.2°C) per minute. Hold at 350°F ±10°F (177°C ±5.5°C) for 120 minutes. Cool to 150°F (66°C) while maintaining vacuum and pressure. Remove peel ply.

4.6.2 Cleaning of test panels. All test panels shall be cleaned by scrubbing and rinsing using MIL-C-38736 solvent and AMS 3819 cleaning cloths which are free of sizing or any other contaminant. The panels will then be wiped dry immediately with cleaning cloths.

NOTE: All coatings are to be cleaned as described above before the sealant is applied, with one exception. Do not clean after the AMS 3100 adhesion promoter is applied. Doing so will remove the adhesion promoter.

4.6.2.1 Special cleaning of stainless steel panels. Two stainless steel panels that are used for peel strength testing have to receive special cleaning. These are the panels that are immersed in jet reference fluid/salt water for 7 days (see table VII). The special cleaning shall be scrubbing with abrasive mats and MIL-C-38736 solvent. After scrubbing, the panels shall be rinsed using MIL-C-38736 solvent and clean gauze. The panels shall be wiped dry. The abrasive mats shall conform to MIL-A-9962, type I, class 1, grade A. After final cleaning, AMS 3100 adhesion promoter shall be applied.

4.6.2.2 Special cleaning of graphite epoxy panels. The graphite epoxy panels shall be cleaned by first solvent wiping with MIL-C-38736 cleaner. Then scuff sand with abrasive mats conforming to MIL-A-9962, type I, class I, grade A. Solvent clean with MIL-C-38736 cleaner wiping dry with cleaning cloths.

4.6.3 AMS 3100 adhesion promoter. When specified, the panel surface shall be treated with AMS 3100 adhesion promoter. This shall be done immediately after the panel has been cleaned (4.6.2). The AMS 3100 shall be applied by wetting a clean gauze with AMS 3100 and wiping the surface or by spraying. Allow the AMS 3100 to air dry at least 30 minutes but not more than two hours before applying sealant. If more than two hours have elapsed, re-clean and re-apply the AMS 3100 before applying sealant.

4.6.4 Preparation of sealing compound. The quantity of sealing compound required for the test shall be mixed as thoroughly as practicable. A Semco Model 1394 or Model SP-1350 mixer, or equal, shall be used for Class B-2, and B-4. Class A-1/2, A-1 and A-2, C-20 and C-80 shall be hand mixed. Class B-1/2 and B-1 shall be hand mixed or machine mixed at the discretion of the manufacturer. The mixed sealing compound shall have a minimum inclusion of air. Where applicable, the sealing compound immediately after mixing, shall be placed into cartridges for extrusion from the Semco No. 250 gun, or equal. Sealing compound in sectional-type containers (see 5.1.1.1.2) are to be machine mixed using a Semco Model 285 mixer, or equal.

4.6.5 Application of sealing compound. Unless otherwise specified herein, test panels shall be given an application of sealing compound to produce a coating having a thickness of 1/8 ±1/64 inch (3 ±0.5mm) cured. Class A materials shall be built up by 3 applications, allowing a period of time equal to the application life between applications to permit release of solvents. Unless otherwise specified, test specimens shall receive a 14-day cure at 77°F ±2°F (25°C ±1°C) and 50 ±5 percent relative humidity, except that C-80 specimens shall be cured 28 days at those conditions. Tests on the cured sealing compound shall commence not later than 2 days after completion of the specified cure.

4.6.6 Chemical conversion coating application

4.6.6.1 Coating preparation. A chemical conversion coating conforming to MIL-C-81706, Class 1A, Form II, Method C shall be used. It shall be prepared according to the manufacturer's instructions. The PH of the resulting solution is adjusted to 1.5 using nitric acid.

4.6.6.2 Panel preparation

a. Vapor degrease using 1-1-1 trichloroethane or solvent degrease using trichloroethane or ketone.

b. Alkaline detergent clean using MIL-C-87936 material or an equivalent commercially available alkaline cleaner. The 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°F to 100°F, (16°C to 38°C) and check for cleanliness by observing for waterbreak free surface. If a waterbreak occurs on the panel surfaces, return them to the detergent solution and repeat cleaning procedure until a waterbreak free surface is obtained.

c. Immediately transfer the cleaned panels to a deoxidizing solution consisting of the following:

Butyl alcohol (TT-B-846) - 35 percent by weight
Distilled or deionized water (ASTM D1125) - 22 percent by weight
Isopropyl alcohol (TT-I-735) - 25 percent by weight
Phosphoric Acid ($H_3 PO_4$) (0-0-670, Class 1) - 18 percent by weight

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

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

NOTE: Mix the conversion coating solution in either 18-8 stainless steel, polyethylene or other compatible plastic containers. DO NOT MIX IN GLASS CONTAINERS.

4.7 Jet reference fluid. The jet reference fluid required for conducting fluid immersion tests shall conform to AMS 2629. Type I fluid shall be used for conducting all tests requiring fluid except for the chalking test (4.8.18.3). Type II fluid shall be used for the chalking test.

4.8 Test methods

4.8.1 Specific gravity. Three specimens approximately 1/8- by 1- by 1-inch (3 by 25 by 25 mm) in size shall be cut with a sharp razor blade from a sheet of the sealing compound (see 4.8.5.2) that has been cured for 14 days as per 4.6.4. The specimens shall be weighed accurately to 3 decimal places in grams after which they shall be

dipped in methyl alcohol and then, while wet, immediately suspended in distilled water at standard conditions and reweighed. The specific gravity (see 3.4.1) shall be computed from the following formula:

$$\frac{\text{weight in air}}{\text{weight in air minus weight in water}} = \text{Specific gravity}$$

4.8.2 Nonvolatile content. Within 5 minutes after mixing or warming to application temperature, 11 to 12 grams of mixed sealing compound shall be transferred as rapidly as possible to a previously weighed (W_1) aluminum dish approximately 2.25 inch (57 mm) in diameter. The Class A and Class C sealant shall be poured in the dish. The Class B sealant shall be extruded from a plastic cartridge fitted with a .125" orifice nozzle, filling the bottom of the dish to a uniform depth. The initial weight (W_2) shall be determined using an analytical balance accurate within ±1 mg. Immediately following weighing, the sample and dish shall be placed in a circulating air oven preheated to 160°F ±5°F, and allowed to dwell for 168 +2-0 hours (7 days). Following dwell, the sample and dish shall be removed from the oven and allowed to cool in a desiccator to room temperature. Final weight (W_3) shall be determined on the same balance used for initial weights. All weights shall be recorded to the nearest miligram.

Percent nonvolatile shall be determined from the average of three (3) samples calculated as follows:

$$\text{Percent Nonvolatile} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

4.8.3 Viscosity of base compound. The viscosity shall be determined with base compound (see 3.4.3) placed in a 1-quart (1-liter) can. The can shall be filled with base compound to within 1/2 inch (10mm) of the top; covered and stored at room temperature for at least 8 hours. The base compound shall then be thoroughly mixed by stirring slowly for 3 minutes after which the can shall then be closed and the material allowed to stand for 1 hour. The Brookfield Model RVF viscosimeter, or equal, shall be used and the reading obtained converted to poises. For Class A base materials, the No. 6 spindle at 10 revolutions per minute (rpm) shall be used; for Class B material, the No. 7 spindle at 2 rpm shall be used; for Class C material. the No. 6 spindle at 2 rpm shall be used. The highest reading shall be taken after the instrument has run in the material for 1 minute.

4.8.4 Viscosity of curing compound (catalyst). The viscosity of the curing compound shall be determined in accordance with 4.8.3 except a No. 7 spindle at 10 revolutions per minute shall be used.

4.8.5 Flow (Class B and C only)

4.8.5.1 Class B. A standard Semco sealant gun cartridge, or equal, fitted with a nozzle, shall be filled with freshly mixed Class B sealing compound. The gun and sealing compound shall be maintained at standard conditions throughout the test. The test shall be conducted with a flow-test fixture as shown on figure 1 and under flow conditions specified in 3.4.5. Depth of plunger tolerance is critical and shall be controlled within the tolerance during all tests. The flow-test fixture shall be placed on a table with the front face upward and plunger depressed to the limit of its travel. Within 15 minutes after the beginning of mixing, enough of the mixed sealing compound shall be extruded from the application gun to fill the recessed cavity of the fixture and leveled off even with the block. The test at this interval shall be considered the initial flow of the sealing compound. Within 10 seconds after the leveling operation, the fixture shall be placed on its end and plunger immediately advanced to the limit of its forward travel. The flow measurement shall be taken 30 $\pm$1 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 farthest point to which flow has advanced. As the sealing compound progresses in its application time, the flow-test shall be repeated at the time intervals specified in table VI. All time intervals, other than for the initial test, shall be measured from the end of the mixing period.

4.8.5.2 Class C. A 0.015 to 0.020-inch (0.40 to 0.50 mm) layer of freshly mixed sealant shall be applied to a QQ-A-250/13 T6 aluminum panel measuring 0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm). Immediately place the panel in a vertical position and allow to stand for a period equivalent to the rated tack-free time (see 3.4.8). Measure the sealant for compliance with 3.4.5.2.

4.8.6 Application time

4.8.6.1 Class A sealing compound. The base compound and accelerator shall be stabilized at standard conditions for at least 8 hours before a sample of base compound is mixed with the proper amount of accelerator sufficient to fill a standard 1/2-pint can (1/3 liter) 2-7/8 inches in diameter by 2-7/8 inches high (73 mm by 73 mm) to within 1/2 inch (10 mm) of the top. This can shall be tightly covered except when testing the viscosity. At the end of the rated application time (see 3.4.6), measured from the beginning of the mixing period, the sealing compound shall be tested for viscosity using a Brookfield Model RVF viscosimeter or equal, with a No. 7 spindle at 10 rpm. One reading shall be taken after the instrument has run in the material for 1 minute.

TABLE VI. Flow-test intervals.

Minimum specified application time	Intervals at which flow tests shall be conducted.
1/2 hour	Initial reading only
1 hour	Initial
	50 minutes
2 hours	Initial
	50 minutes
	90 minutes
4 hours	Initial
	2 hours
	3-1/2 hours

4.8.6.2 Class B and Class C sealing compound. The base compound, accelerator, and application gun shall be stabilized at standard conditions for at least 8 hours before a minimum of 250 grams of base compound are mixed with the proper amount of accelerator. The mixed sealing compound shall be promptly used to fill a standard Semco sealing compound gun cartridge, or equal, having a Semco 440 nozzle with an orifice diameter of 0.125 ±0.005 inch (3.18 ±0.13 mm). The gun and sealing compound shall be maintained at standard conditions throughout the test. The gun shall be attached to a constant air supply of 90 ±5 psi (620 ±35 K Pa). From 2 to 3 inches (5 to 8 centimeters [cm]) of sealing compound shall be extruded initially to clear trapped air. At the end of the rated application time, measured from the beginning of the mixing period, the sealing compound shall be extruded onto a suitable receptacle for 1 minute and the amount of extruded sealing compound determined.

4.8.7 Assembly time (Class C only). Six test panels 0.040 by 1-1/2 by 4 inches (1.00 by 38 by 100 mm) in size shall be prepared from aluminum alloy conforming to temper T6 of QQ-A-250/13. Drill two holes with a number 11 drill, 1/2 inch (12.7 mm) from one end with centers 3/4 inch (20 mm) apart and 3/8 inch (10 mm) from each side. Deburr and clean with MIL-C-38736 cleaner. Accurately determine the thickness of the panels around the holes. Apply approximately 0.015 inches (0.40 mm) of freshly mixed sealant to the drilled end of three specimens and allow to cure for 1/2 hour. Place the other cleaned panels on those with sealant so that the holes line up and results in a one-inch (25 mm) overlap. Sealant shall cover the entire

one-inch (25 mm) faying surface overlap area. Insert two steel bolts (10-32) that have been heat treated to at least 160,000 psi (1.10 Megapascals [MPa]) into the holes and tighten nuts (NAS 679-A3) only until sealant starts to squeeze out. The thickness of the assembly shall be measured at this time and the thickness of the sealant shall be 0.010 to 0.015 inch (0.25 to 0.40 mm). Allow the specimens to be exposed to standard conditions for 20 hours for Class C-20 material and 80 hours for Class C-80 material. Tighten nuts to a torque value of 40 inch lb (4.15 Newton meter [N.m]). Measure the thickness of the assembly at the bolts with a micrometer and from this thickness subtract the thickness of the panels.

4.8.8 Tack-free time. An aluminum test panel conforming to temper T6 of QQ-A-250/13 and measuring 0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm) in size shall be cleaned in accordance with 4.6.2 and covered with freshly mixed sealing compound to a depth of 1/8 ±1/64 inch (3 ±0.4 mm). The sealing compound shall be allowed to cure at standard conditions. At the end of the specified tack-free time (see 3.4.8), two 1-inch by 6-inch (25 by 150 mm) pieces of polyethylene film 0.004 ±0.002 inch (0.10 ±0.05 mm) thick shall be applied to the sealing compound and held in place using light finger pressure for 2 minutes. The strips shall then be slowly and evenly withdrawn at right angles to the sealing compound surface. The polyethylene shall come away clean and free of sealing compound.

4.8.9 Standard curing rate (Classes A and B only). The instantaneous hardness shall be determined in accordance with method 3021 of FED-STD-601 after the sealing compound is allowed to cure as specified in 3.4.9. The reading shall be taken on a doubled back-to-back 0.12 inch (3 mm) thick specimen.

4.8.10 Fluid immersed curing rate (Classes A-1/2, and B-1/2 only). An aluminum test panel conforming to temper T6 of QQ-A-250/13 and measuring 0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm) shall be cleaned in accordance with 4.6.2 and covered with sealing compound to a depth of 1/8-inch (3 mm). After curing at standard conditions for 6 hours, the test panel shall be immersed in jet reference fluid (see 4.7) at 77°F ±2°F (25°C ±1°C). The hardness shall be determined after a total of 48 hours (42 hours in fluid) and after a total of 120 hours (114 hours in fluid) in accordance with method 3021 of FED-STD-601.

4.8.11 Resistance to thermal rupture. Two specimens shall be prepared, each having a fillet 1/8-inch (3 mm) thick by 2 inches (50 mm) in diameter applied to a test panel. The sealant shall be cured in accordance with 4.6.5. The test panels shall be aluminum alloy conforming to temper T6 of QQ-A-250/13. They shall be 0.040 by 3-1/2 by 3-1/2 inches (1.00 by 90 by 90 mm) in size with a hole 1/4-inch (6 mm) in diameter in the center of the panel. One of the panels shall be placed in jet reference fluid at 140°F ±2°F (60°C ±1°C) for 168 hours. The panel shall be removed from

the fluid and immediately applied, using a suitable gasket, to the clamp fixture shown in figure 2. The panel shall be so positioned on the fixture that the sealing compound is within the fixture chamber. The fixture shall be placed in an oven at 250°F ±2°F (121°C ±1°C). Air pressure, 10 psi (69 kPa), shall then be applied using an air regulator. The clamp fixture shall be maintained in the oven for 1 hour after the pressure is applied. After testing as described, both the panel that was immersed and the unimmersed panel shall conform to the requirements of 3.4.11.

4.8.12 Low-temperature flexibility. Four test panels 0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm) is size shall be prepared from aluminum alloy conforming to temper T6 of QQ-A-250/13. A coating of the sealing compound 0.098 inch (2.5 mm) thick by 1-1/2 inches (40 mm) wide by 4 inches (100 mm) long shall be applied to the center of each of the 4 panels. Care shall be taken to maintain an accurate sample thickness of 0.098 inch (2.5 mm). At the end of a 14-day cure, as specified in 4.6.5, two of the panels shall be conditioned at 250°F ±2°F (121°C ±1°C) for an additional 7 days. All four panels shall then be immediately placed in a low-temperature flexibility fixture consisting of a clamp support that will grip both sides of both 6-inch (150 mm) edges of the panel for a distance of 3 inches (75 mm) from one end without touching the sealant (see figure 3). The fixture shall be capable of flexing the panel through a 30 degree arc (15 degrees each side of the center) at a constant speed of 1 cycle per 5 seconds. The temperature shall be reduced to -67°F ±2°F (55°C ±1°C), stabilized at this temperature for 2 hours, and the panels flexed through 130 consecutive cycles (see 3.4.12).

4.8.13 Hydrolytic stability. A cured specimen of approximately 1/2 inch thick by 3 inches (1 by 7.5 cm) in diameter, shall be exposed for 120 days ±4 hours in an environment of 160°F ±2°F (70°C ±1°C) and 95% relative humidity. At the end of this period, the specimen shall be held at standard conditions for 14 days. The instantaneous hardness shall then be determined.

4.8.14 Shear strength (Class C only). Six test panels 0.040 by 1 by 3 inches (1.00 by 25 by 75 mm) is size shall be prepared from aluminum alloy conforming to temper T6 of QQ-A-250/13. Apply a coat of sealant 0.010 to 0.020 inch (0.25 to 0.50 mm) thick to one end of three panels covering approximately 1 inch (2.5 cm) on each panel. Overlap the sealant with another panel making a 1 square inch (6.45 cm^2) lap-shear test specimen. Reduce the thickness of the sealant to 0.005 to 0.010 inch (0.13 to 0.25 mm). Cure the sealant as per 4.6.5 and determine the shear strength by pulling in shear at a speed of 2 inches (50 mm) per minute.

4.8.15 Corrosion. One aluminum panel conforming to QQ-A250/12 and measuring 0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm) in size shall be prepared with two parallel sealing compound fillets approximately 1 inch (2.5 cm) apart. The fillets

shall be applied 3/16 inch thick by 3/4 inch wide by 5 inches long (5 mm by 2 cm by 12 cm), and shall extend to within 1/2 inch (1 cm) of the edges of the panel. The panel shall have a 14-day cure as per 4.6.5. At least 48 hours before cure time has expired, the panel shall be dipped in a sealing compound topcoat conforming to MIL-S-4383 and the cure allowed to continue. At the end of the 14 day curing period, the fillets shall be cut down to 1/16 inch (2 mm) and immersed vertically for 20 days in a covered glass vessel containing a 2-layer liquid consisting of 3 percent aqueous sodium chloride solution and jet reference fluid (see 4.7) with 1-5/8 inches (4 cm) exposed to the salt mixture, 1-5/8 inches (4 cm) exposed to the air-vapor mixture. The temperature during the test shall be maintained at 140°F ±2°F (60°C ±1°C). Immediately upon removal from the liquid, the sealant shall be removed by mechanical means using a plastic scraper and the panel shall be examined for compliance with the requirements of 3.4.15.

4.8.16 Radiographic density

4.8.16.1 Preparation of test panels. A 6-inch (52 mm) square plate, 1/4 inch (6 mm) thick, shall be prepared from clad 7075 T-6 aluminum alloy conforming to QQ-A-250/13. A notch 1/4 inch (6 mm) wide shall be milled to a depth of 1/8 inch (3 mm) half way across the plate. A continuation of this notch shall be milled completely through the remaining half so as to form a slot in the plate.

4.8.16.2 Application of sealant. A sample of the sealant to be tested shall be machine mixed, after which a strip 1 inch (25 mm) wide and 1/8 inch thick (3 mm) shall be applied over the entire length of the notched portion and slot in the test plate. A mold shall be used during the application of the sealant to the plate to assure uniform thickness of the sealant.

4.8.16.3 Test procedure. The test plate prepared in accordance with 4.8.16.1 and 4.8.16.2 shall be radiographed in accordance with MIL-STD-453 to obtain a 2 percent sensitivity through the plate at an H&D density of 2.5 ±0.2, using Dupont 510, Kodak M film, or equal. Density shall be measured by means of an Ansco-Sweet densitometer, or equal. All density measurements shall be an average of 5 readings.

4.8.17 Peel strength. The panels listed in table VII shall be used for evaluation of peel strength. At least 5 inches (12 cm) of the panels shall be coated on one side with a 1/8 inch ±1/64 inch (3 ±0.5 mm) thickness of sealing compound. A 2-3/4 by 12 inch (7 by 30 cm) strip of wire screen (20- to 40-mesh aluminum or monel wire fabric) or cotton duck conforming to Type III of CCC-C-419 shall be impregnated with sealant, so that approximately 5 inches (12 cm) at one end is completely covered on both sides. The sealant must be worked well into the fabric. The sealant-impregnated end of the fabric shall be placed on the sealant coated panel, and smoothed

down on the layer of the sealant, taking care not to trap air beneath the fabric. An additional 1/32 inch (1 mm) thick coating of sealing compound shall be applied over the fabric. After cure, as per 4.6.5, the panels shall be completely immersed in covered glass vessels in the fluids and under the conditions listed in table VII. (Immersion in wide-mouth quart jars with 2 panels in each jar is suitable.) After specified exposure at 140°F ±2°F (60°C ±1°C), the panels shall be cooled in the fluid for 24 hours at standard conditions. The peel strength shall be measured within 10 minutes after removal from the test fluid. Two 1-inch (2.5 cm) wide sections shall be cut through the fabric and sealing compound on each panel. The specimens shall be stripped back at an angle of 180 degree to the metal panel in a suitable tensile testing machine having a jaw separation rate of 2 inches (50mm) per minute. During the peel strength testing, three cuts shall be make through the sealing compound to the panel in an attempt to promote adhesive failure. The cuts shall be at approximate 1-inch (2.5 cm) intervals. The results shall be the numerical average of the peak loads. Failures of the sealing compound to the fabric shall not be included in the peel strength values.

4.8.17.1 Peel strength (Classes A-1/2, and B-1/2 only). Two 0.040 inch by 2-3/4 inches by 6 inches (1.00 by 70 by 150 mm) aluminum alloy panels which conform to QQ-A-250/12, with temper T6, shall be used. These panels shall be sulfuric acid anodized in accordance with MIL-A-8625, Type II, Class 1 (dichromate sealed) and coated with material conforming to MIL-C-27725. Sealing compound shall be applied according to 4.8.17. After curing at standard conditions for 10 hours, the test panels shall be immersed in jet reference fluid (see 4.7) at 77°F ±2°F (25°C ±1°C) for 7 days. The panels shall then be tested according to 4.8.17.

4.8.18 Resistance to hydrocarbons

4.8.18.1 Weight loss and flexibility. Four 1/8 by 1 by 5-inches (3 by 25 by 125 mm) specimens shall be cut from a sheet of the sealing compound that has been cured for 14 days as per 4.6.5. The specimens shall be weighed and immersed in 900 cubic centimeters (cc) of jet reference fluid at 140°F ±2°F (60°C ±1°C) in a closed container for a period of seven days. At the end of the exposure period, the specimens shall be removed from the fluid and air dried for 72 hours at 120°F ±2°F (49°C ±1°C). The specimens shall then be cooled to standard test temperature in a desiccator and weighed. After weighing, the specimens shall be bent 180 degrees over a 1/8 -inch (3 mm) mandrel and examined for evidence of cracking.

TABLE VII. Peel strength panels.

Quantity Required	Panel	Immersion medium at 140°±2°F (60°±1°C)
4	0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm) aluminum alloy, QQ-A-250/13, T6	2 panels into jet reference fluid for 7 days. 2 panels into equal parts jet reference fluid and 3% aqueous sodium chloride solution for 7 days.
4	0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm) aluminum alloy, QQ-A-250/12, T6 chemical treated in accordance with MIL-C-5541 (see 4.6.6)	2 panels into jet reference fluid for 7 days. 2 panels into jet reference fluid/salt water for 7 days.
NOTE: The MIL-C-5541 coating should not be more than 48 hours old before sealant application.		
4	0.040 by 2-3/4 by 6 inches (1.00 by 70 by 150 mm) aluminum alloy, QQ-A-250/12 T6 sulfuric acid anodized in accordance with MIL-A-8625, Type II, Class 1 (dichromate sealed).	2 panels into jet reference fluid for 7 days. 2 panels into jet reference fluid/salt water for 7 days.
4	0.025 to 0.040 by 2-3/4 by 6 inches (0.6 to 1.00 by 70 by 150 mm), stainless steel, MIL-S-5059, Composition 304, annealed, finish 2B.	2 panels into jet reference fluid for 7 days. 2 panels into jet reference fluid /salt water for 7 days.
4	0.025 to 0.040 by 2-3/4 by 6 inches, (0.6 to 1.00 by 70 by 150 mm), titanium, MIL-T-9046, Type III, Composition C.	2 panels into jet reference fluid/salt water for 7 days. 2 panels into jet reference fluid/salt water for 7 days.

TABLE VII. Peel strength panels. - Continued

Quantity Required	Panel	Immersion medium at 140°F±2°F (60°C±1°C)
8	0.040 inch by 2-3/4 inches by 6 inches (1.00 by 70 by 150 mm) aluminum alloy, QQ-A-250/12, T6 sulfuric acid anodized in accordance with MIL-A-8625, Type II, Class 1 (dichromate sealed), coated with material conforming to MIL-C-27725.	2 panels into jet reference fluid for 7 days. 2 panels into equal parts jet reference fluid and 3% aqueous sodium chloride solution for 7 days. 2 panels into jet reference fluid for 70 days with fluid change every 14 days. 2 panels into jet reference fluid\salt water for 70 days with fluid change every 14 days.
4	0.040 inch by 2-3/4 inches by 6 inches (1.00 by 70 by 150 mm), aluminum alloy, QQ-A250/12, T6 sulfuric acid anodized in accordance with MIL-A-8625, Type II, Class 1 (dichromate sealed), coated with material conforming to MIL-C-27725. Before sealant application, topcoat shall be cleaned as per 4.6.1 and adhesion promote AMS 3100 by applied as per 4.6.3.	2 panels into jet reference fluid for 7 days. 2 panels into jet reference fluid/salt water for 7 days.
8	0.040 inch by 2-3/4 inches by 6 inches (1.00 by 70 by 150 mm), AS 4/3501-6 graphite epoxy, (0, 45,90,135) symmetrical (8 ply unidirectional tape) test both peel ply side and tool side but do not test both sides of the same panels.	4 panels into jet reference fluid for 7 days (2 peel ply side, 2 tool side) 4 panels into jet reference fluid/salt water for 7 days (2 peel ply side, 2 tool side).

TABLE VII. Peel strength panels. - Continued

Quality Required	Panel	Immersion medium at 140°F± 2°F (60°C± 1°C)
8	0.040 inch by 2-3/4 inches by 6 inches (1.00 by 70 by 150 mm), aluminum alloy, QQ-A-250/12, T6 chemical treated in accordance with MIL-C-5541 coated with MIL-P-23377 primer. 4 panels with primer, cured 7 days at standard conditions. 4 panels with primer, cured 2 hours at 200°F (95°C).	4 panels into salt water for 7 days. (2 panels R.T. cured, 2 panels 200°F (95°C) cured. 4 panels into distilled water for 7 days, 2 panels R.T. cured, 2 panels 200°F (95°C) cured.

4.8.18.2 Tensile strength and elongation (Class B only). Mixed sealing compound 0.125 ±0.015 inch (3.2 ±0.4 mm) thick shall be prepared by pressing between 2 polyethylene sheets, removing the top sheet at the end of the rated tack-free time (see 3.4.8) and allowing the sealing compound to cure at standard conditions as per 4.6.5. Fifteen tensile test specimens shall be cut from the sheet using a die C as specified in ASTM D412. Three specimens shall be exposed to each of the environmental conditions specified in 3.4.18.2 and table III. Where fluid immersion is specified, the 3 specimens shall be immersed in 400 cc of the fluid. Specimens that are tested immediately after the fluid immersion shall be cooled for 24 hours at standard conditions and tested within 5 minutes after removal from the fluid. Specimens that are tested immediatley after oven aging shall be allowed to cool for 16 to 48 hours at standard conditions.

4.8.18.2.1 Test procedure. The tensile and elongation tests shall be conducted at standard conditions in accordance with ASTM D412 at a jaw separation rate of 20 ±1 inch (50 ±2 cm) per minute.

4.8.18.3 Chalking. Four 1/8 by 1/8 by 5 inch (3 by 3 by 125 mm) specimens shall be cut from a sheet of the sealing compound that has been cured for 14 days as per 4.6.5. The specimens shall be suspended on nylon cord in a closed glass container with 900 ml of jet references fluid conforming to AMS 2629 Type II so that the specimens are totaly immersed in the fluid. Aluminum foil shall be used to seal the lids of the containers. No metal items shall be allowed to be in contact with the fluid or specimens during the immersion period. The specimens shall not touch each other, so that all sides are exposed to the fluid. The immersion temperature shall be 77°F ±2°F. The tests will be started on a Wednesday and the fluid changed on the following Friday. The specimens shall be examined for chalking on the following Monday. Remove specimens from the fluid and allow the fluid to evaporate. The specimens are not to be blotted or wiped. Examine strips in a well lighted area. Use an original specimen for comparison with the specimens under test.

4.8.19 Repairability. Aluminum-alloy peel panels conforming to QQ-A-250/13, that contains no tab, 2 each of the material being qualified and, Class B-2 of all other material previously qualified to this specification, shall be prepared in accordance with 4.8.17. After a 14-day cure, as per 4.6.5, 1 panel shall be exposed to jet reference fluid for 3 days at 140°F ±2°F (60°C±1°C), followed by 3 days air drying at 120°F ±2°F (49°C±1°C), then 7 days air-aging at 250°F ±2°F (121°C±1°C). The conditioned panels and the panels that received no aging shall be tested as follows: The sealant on the panels shall be cleaned in accordance with 4.6.2, and a thickness of 1/8 ±1/64 inch (3 ±0.5 mm) of newly mixed sealing compound shall be applied over the existing compound. A peel strength panel shall then be prepared in accordance with method specified in 4.8.17. After a 14-day cure, the specimens shall be tested in a peel as specified in 4.8.17 and shall comply with 3.4.19.

4.8.20 Accelerated storage. An original, unopened, 1-quart (1-liter) container of base compound and an original, unopened container of the curing compound shall be stored for 14 days at 120°F ±2°F (49°C ±1°C) in a suitably ventilated oven. After cooling at standard conditions for at least 24 hours, tests shall be conducted in accordance with 4.8.5, 4.8.6, 4.8.7, and 4.8.8. Two QQ-A-250/13 aluminum-alloy peel panels shall also be prepared and tested, without fuel immersion, in accordance with 4.8.17. After storage, the base compound shall conform to 3.4.20.

4.8.21 Long term storage. Three original, unopened 1-pint kits (1/2 liter) of sealing compound (12 fluid ounces of base compound in each kit and the appropriate amount of curing compound) shall be stored at standard conditions (see 4.5) for nine months. At the end of this time, tests shall be conducted in accordance with 4.8.5, 4.8.6, 4.8.7 and 4.8.8. The sealing compound shall conform to table IV and V.

4.8.22 Air content (Class B only). The equipment used for the air content test shall be:

SEMCO Cartridge 3-1/2 ounce
SEMCO Nozzle #254
SEMCO Dasher Rod (6 ounce #220278)

with valve assembly, separate plug and ram rod

The test method shall conform to the following steps and shall refer to figure 4 for the various steps:

1. Test shall be performed at standard laboratory condition: 77°F ±2°F (25°C ±1°C) and 50 ±5 percent relative humidity.

2. Test sealant material shall be stabilized at the standard condition in (1) for at least 8 hours prior to the test.

3. Fill sealant into cartridge being careful not to introduce air. Attach a #254 SEMCO nozzle with 1-1/8" cut off the tip. Extrude approximately two inches of sealant out, to remove entrapped air.

4. Prior to starting the test, the dasher rod should have the seal ring just contacting the dasher end and the valve is not closed.

5. Insert the tip of the filled cartridge firmly into the handle of the dasher rod and deliver sealant slowly until dasher is about 3/4 full. The sealant, however, should be filled completely into the handle end of the dasher.

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 with a gauze pad wet with methyl ethyl ketone.

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 curve sealant bead at the other end of the dasher rod (length "X", as shown in diagram.

8. Insert ramrod into the dasher rod and push until the valve is in full open position (as shown in diagram).

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

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

11. Lightly insert the ramrod again into the dasher until it just touches the top of the plug. Make a mark "B" on the ramrod at the handle end of the dasher.

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".

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

CALCULATION;

The percentage of air present in the sealant material can be calculated by determining the following ratio:

$$\% \text{ air present} = \frac{\text{Distance of the 2 marks (BC) on the ramrod X 100\%}}{\text{Original length of sealant in dasher rod}}$$

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

NOTE: Sample to be used for this compression test shall not be obtained from the sealant at the top of each drum or container.

4.9 Packaging, packing, and marking. Preparation for delivery shall be examined for compliance with section 5.

5. PACKAGING

5.1 Preservation and packaging. Preservation and packaging shall be Level A and C as specified (see 6.2).

5.1.1 Level A

5.1.1.1 Unit packaging. The base compound and the curing compound shall be packaged in separate or sectional containers. The containers, closure, lining, or space fillers shall not interact physically or chemically with the contents of the containers so as to alter quantity, strength, quality of purity of the container contents. The ratio of the quantity contained in the base compound container or section to the quantity contained in the curing compound container or section shall be the same as the recommended mixing ratio of the base and curing compounds.

5.1.1.1.1 Individual containers. The correct amount of curing compound and base compound shall be packaged in separate containers to form a unit of issue kit. The kit shall be properly identified and securely attached to prevent accidental separation or mis-identification in the case of separation. The base compound shall be furnished in 1/2-pint, 1-pint, 1-quart and 1-gallon metal cans conforming to Type V, Class 2 PPP-C-96 or in 5-gallon pails conforming to PPP-P-704, or in 55-gallon drums conforming to PPP-D-729, Type III, except that tin plate cans with paper labels may be used unless otherwise specified. The base compound cans through 1-gallon sizes shall be filled to 75 percent capacity with a volume tolerance of ±1.6 percent. The air in the unfilled space shall be replaced with nitrogen gas or carbon dioxide gas immediately prior to closing the container. Five-gallon pails shall contain 5 gallons of base compound unless otherwise specified by the procuring agency, and 55-gallon drums shall contain 50 gallons of base compound. The curing compound shall be furnished in the ratio quantity required by its own unit of issue base compound quantity. It shall be packaged in glass or plastic containers of adequate commercial quality and grade for the 1/2-pint, 1-pint, 1-quart, and 1-gallon sizes. The curing compound for the 5-gallon pails shall be packaged in gallon cans conforming to Type V, Class 2, PPP-C-96 and for the 55-gallon drums the curing compound shall be packaged in pails conforming to PPP-P-704. The curing compound glass or plastic containers shall have vertical smooth inside walls and no internal projection or lips exceeding 1/16 inch (1.5 mm).

The exterior configuration of all curing compound containers shall not preclude the container to form a kit for a unit of issue. Curing compound containers shall be secured to the top of its own base compound containers in such a manner as to prevent accidental separation. The curing compound containers for base compound packaged in pails or drum shall be packaged together with base compound containers in containers conforming to PPP-B-636, Type CF, Class Weather Resistant, Variety SW in a manner that will prevent movement and damage to each other. The glass jars shall be closed with enamelled metal or plastic continuous thread screw caps tightened adequately and further sealed with cellulose bands of commercial quality, or equivalent.

5.1.1.1.2 Sectional-type containers. The base compound and curing agent shall be furnished in sectional-type 2-1/2 ounce or 6-ounce nonmetal containers, conforming to MIL-P-38714, as specified in the contract or order. The total content of base compound and curing agent contained in each sectional-type container shall be as follows:

Size of container	Total content (base and curing)	Volume tolerance
2-1/2 ounce	2 fluid ounce	±1/8 fluid ounce
6 ounce	3-1/2 fluid ounce	±1/8 fluid ounce

5.1.2 Level C. The unit quantity of base compound specified (see 6.3) with its ratio of curing compound shall be packaged in accordance with the manufacturer's best commercial practice.

5.2 Packing. Packing shall be level A, B, C or as specified (see 6.3).

5.2.1 Levels A and B. The base and curing compound shall be packed in accordance with the appendix to PPP-C-96 for filled cans and MIL-P-38714 for the sectional-type containers. Pail and drums shall be palletized in accordance with MIL-STD-147.

5.2.2 Level C., The base and curing compound packaged in compliance with 5.2 as specified (see 6.3), shall be packed in a manner to insure acceptance with safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification Rules or Regulations of carrier applicable to the modes of transportation.

5.3 Marking of shipment. In addition, to any special marking required by the contract or order, interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129. Marking shall include specification number, applicable class and dash number, name of manufacturer, date of manufacture (month and year), batch number, mixing instructions, and store below 80°F (26°C). The date of manufacture is defined as the date the quality conformance tests are completed by the sealant manufacturer.

6. NOTES

6.1 Intended use. The sealing compound covered by this specification is intended for sealing areas of integral fuel tanks and fuel cell cavities that may be subjected to a service temperature range of -65°F to +250°F (-54°C to +121°C).

6.2 Storage life. The storage life of materials conforming to this specification is 9 months when stored at temperatures of 80°F or less.

6.3 Ordering data. Procurement documents should specify the following:

a. Title, number (including latest revision letter), and date of the specification.

b. Type of sealing compound, class, and dash number (see 1.2 and 1.2.1).

c. Quantity desired.

d. Size of container (see 5.1.1.1.1 and 5.1.1.1.2).

e. Applicable levels of packaging and packing (see 5.1 and 5.2).

f. Special marking if required (see 5.3).

g. Source inspection required (see 3.4.19).

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Air Force Wright Aeronautical Laboratories, ATTN: MLSE, Wright-Patterson AFB OH 45433-6533, and information pertaining to qualification of products may be obtained from that activity.

6.5 Supersedure data. MIL-S-8802, Class A-1/2, A-2, B-1/2, B-2, and B-4 are replacement items for the respective classes and dash numbers in MIL-S-7502 which has been cancelled.

6.6 Type designation. Where Type I or Type II material is not specified, either type may be used to satisfy the drawing/specification requirements.

6.7 Subject term (key words) listing

Adhesion
Fuel tanks
Polysulfide
Resistant
Sealant
Sealing compound
Temperature

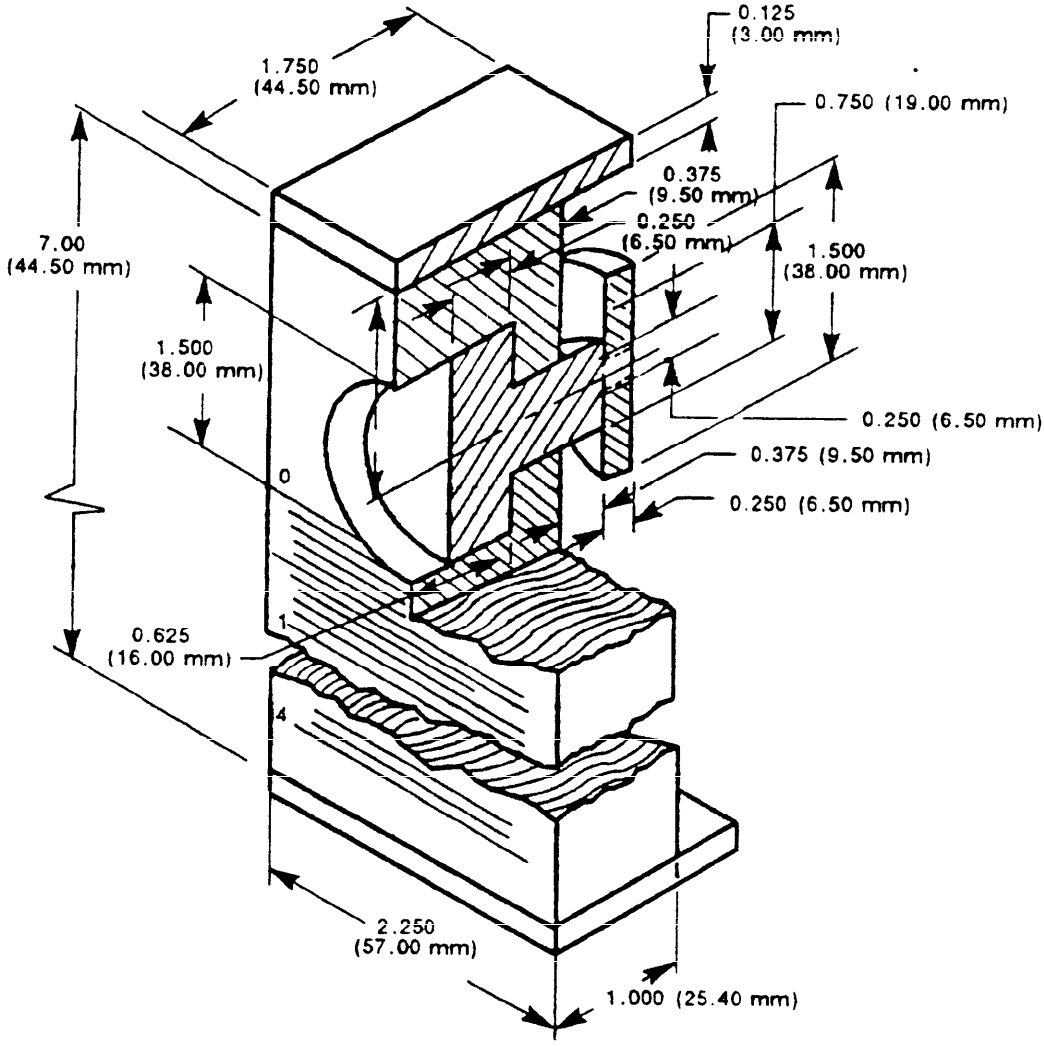
6.8 Change from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - MR
Navy - AS
Air Force -11

Reviewer activities:
Army - MI, AR, AT
Navy - SH, OS
Air Force - 84, 99
DNA - DS

Preparing activity:
Air Force - 11

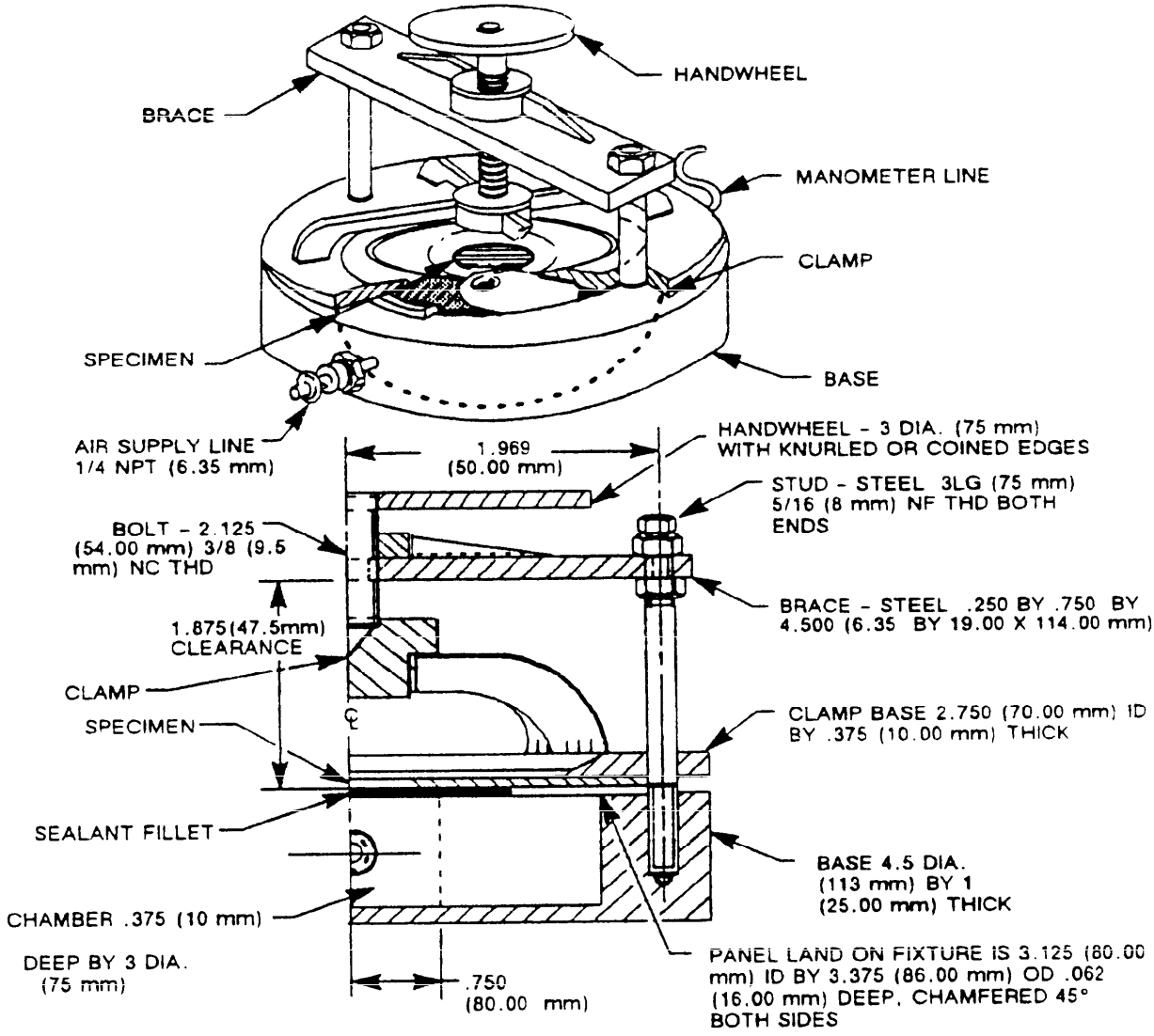
Project No. 8030-0555



MATERIAL: ALUMINUM ALLOY
DIMENSIONS IN INCHES (MILLIMETERS)
UNLESS OTHERWISE SPECIFIED, TOLERANCES:
DECIMALS ± 0.016 INCH (± 0.40 MM).

(NOT TO SCALE)

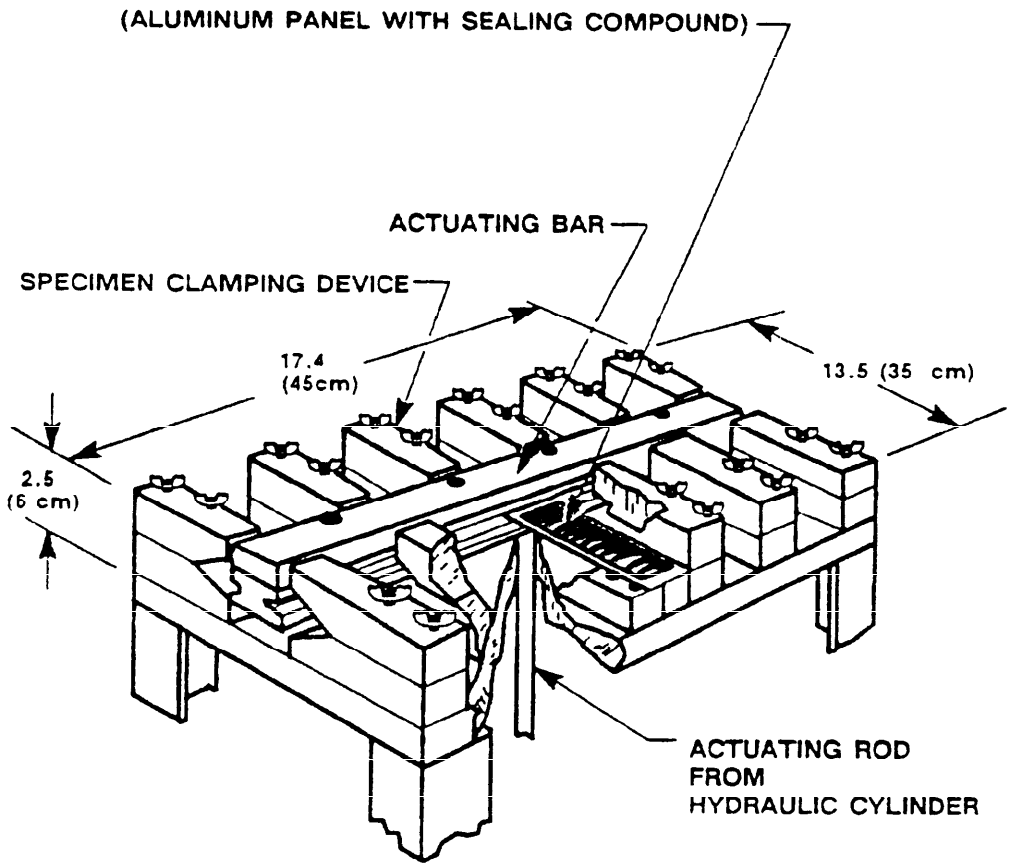
FIGURE 1. Flow-test fixture.



DIMENSIONS ARE IN INCHES (MILLIMETERS). UNLESS OTHERWISE SPECIFIED.
TOLERANCES: DECIMALS ± 0.016 INCH (± 0.40MM) DEGREES ± 1.

(NOT TO SCALE)

FIGURE 2. Thermal rupture fixture.



DIMENSIONS IN INCHES (CENTIMETERS).

FIGURE 3. Low temperature flexibility fixture.

DIAGRAM OF STAGES IN FILLING SEMCO DASHER

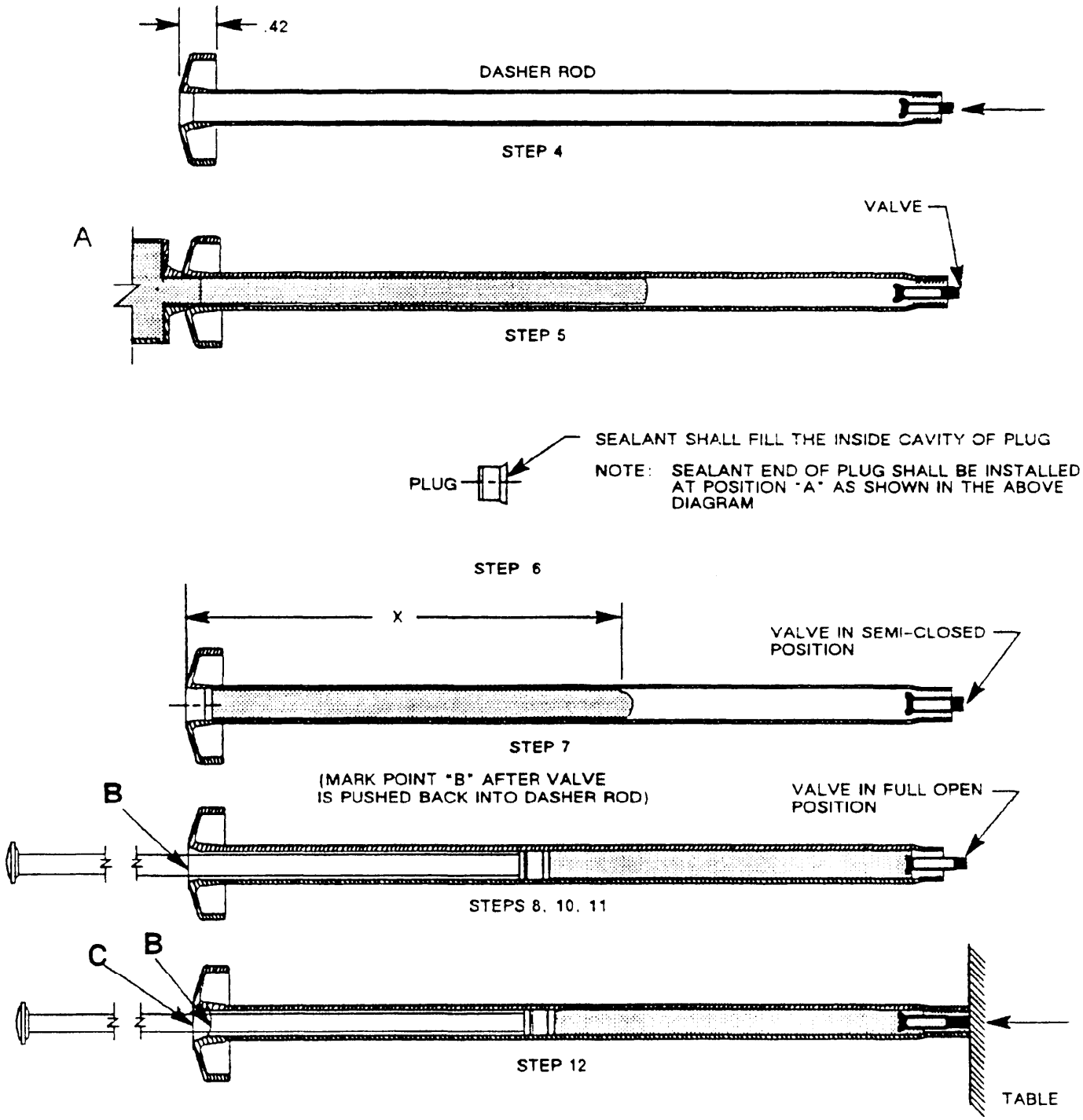


FIGURE 4. Diagram of stages in filling SEMCO dasher rod.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-S-8802F	900307

3. DOCUMENT TITLE

Sealing Compound, Temperature-Resistant, Integral Fuel Tanks and Fuel Cell Cavities

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code) (1) Commercial	(2) AUTOVON
ASD/ENES	(513) 255-6295	785-6295
c. ADDRESS (Include Zip Code) Wright-Patterson AFB OH 45433-6503	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	