

MIL-C-83019 (USAF)
4 November 1968

MILITARY SPECIFICATION

COATING, POLYURETHANE, FOR PROTECTION OF INTEGRAL FUEL TANK SEALING COMPOUND

1. SCOPE

1.1 This specification covers a coating material to be applied over aircraft integral fuel tank sealing compound for protection against fuel and fuel contaminants.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards of the issue in effect on date of invitation for bid form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

QQ-A-250/12	Aluminum Alloy 7075, Plate and Sheet
QQ-A-250/13	Aluminum Alloy Alclad 7075, Plate and Sheet
QQ-S-698	Steel, Sheet and Strip, Low-Carbon
TT-S-735	Standard Test Fluids, Hydrocarbon
TT-T-548	Toluene, Technical
CCC-C-419	Cloth, Duck, Cotton, Unbleached, Plied-Yarns, Army and Numbered
PPP-B-636	Box, Fiberboard
PPP-C-96	Can, Metal, 28 Gage and Lighter

Military

MIL-C-5541	Chemical Films and Chemical Film Materials for Aluminum and Aluminum Alloys
MIL-S-7502	Sealing Compound, Integral Fuel Tanks and Required Cell Cavities, High Adhesion,
MIL-S-8802	Sealing Compound, Temperature-Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion
MIL-C-27725 (USAF)	Coating, Corrosion Preventive, For Aircraft Integral Fuel Tanks
MIL-P-38714 (USAF)	Packaging and Packing of Two Component Materials in Semkits
MIL-C-38736 (USAF)	Cleaning Compound, Solvent, For Use in Integral Fuel Tanks

STANDARDS

Federal

Fed Test Method Std No. 141	Paint, Varnish, Lacquer, and Related Materials, Methods of Inspection, Sampling, and Testing
Fed Test Method Std No. 791	Lubricants, Liquid Fuels, and Related Products, Methods of Testing

FSC 8030

MIL-C-83019 (USAF)Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
USAF Bulletin No. 535	Free Diisocyanate Test Method

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply:

AMERICAN SOCIETY FOR TESTING AND MATERIALS

1323

Test for Mercaptan Sulfur in Aviation Turbine Fuels
(Amperometric and Potentiometric Methods)

BOING MATERIAL SPECIFICATION

BMS 10 - 39 Fuel and Moisture Resistant Finish for Fuel Tanks

3. REQUIREMENTS

3.1 Preproduction tests The coating material furnished under this specification shall be a product which has met the preproduction tests specified herein. If there are any changes in materials or manufacturing processes, new preproduction tests are required.

3.2 Materials The coating material shall be a 2-part polyurethane type formulated from a chemically curing composition of such ingredients as may be necessary to produce a product of high quality which will meet the requirements of this specification. The coating material shall be transparent or translucent.

3.2.1 Appearance The material shall be a uniform compound free of skins, lumps, and gelled or coarse particles. There shall be no separation of ingredients which cannot be readily re-dispersed.

3.2.2 The product formulation and toxicological data available, particularly as related to the intended application, shall be submitted by the supplier for review by competent military medical authorities who will determine whether the available information is sufficient to clearly establish the safety of the material for the proposed use. If the data submitted is not considered sufficient, additional information deemed necessary to determine suitability of the product shall be furnished.

3.3 Properties Properties of the coating material shall be in accordance with the requirements of table I.

Table I. Properties and requirements

Property	Requirement	Test Method
Nonvolatile Content	35% Minimum	4.7.1
Viscosity	15 to 20 seconds	4.7.2
Application Life	Viscosity Measurement 30 seconds, Maximum, at 3 hours	4.7.3
Tack-free-time	4 hours, Maximum	4.7.4
Cure time	Substrate shall not be exposed after 48 hour cure	4.7.5
Resistance to salt water and fuel	(Over MIL-S-8802 Sealing Compound) No blistering, softening, leaching, shrinkage or loss of adhesion	4.7.6
Coating Compatibility	(Over MIL-C-27725 and BMS 10-39 Type I Preventive Coating) No blistering, softening, leaching, shrinkage, or loss of adhesion	4.7.7
Adhesion	(To MIL-S-8802 Sealing Compound) 10 lbs/in., Minimum	4.7.8
Sealing Compound Protection, weight loss	(MIL-S-8802 Sealant) 1.5% Maximum (MIL-S-7502 Sealant) 3.0% Maximum	4.7.9
Resistance to Anti-icing Fluid	No cracking, blistering, softening leaching, shrinkage, or loss of adhesion	4.7.10
Low Temperature Flexibility	No cracking, checking, or loss of adhesion	4.7.11
Free diisocyanate	0.5% Maximum	4.7.12
Storage Stability	Viscosity Measurement 30 seconds, Maximum, at 3 hours	4.7.13
Tack-free time	4 hours, Maximum	
Cure time	Substrate shall not be exposed after 48 hour cure	
Sealing compound protection, weight loss	(MIL-S-8802 Sealing Compound) 1.5% Maximum	

MIL-C-83019 (USAF)

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the 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

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

- a. Preproduction inspection.
- b. Quality conformance inspection

4.3 Preproduction inspection. Preproduction tests shall consist of all the tests specified in 4.7.

4.4 Quality conformance inspection.

4.4.1 Sampling for inspection. Sampling for quality conformance inspection shall be in accordance with MIL-STD-105 except where otherwise indicated herein. Quality conformance tests are required for all production batches of material

4.4.1.1 Lot. Unless otherwise specified, a lot shall consist of all coating material manufactured at one time from one batch, forming part of one contract or order for delivery

4.4.2 Sampling for tests. Approximately one quart of material representative of each lot of coating material on order shall be selected from each lot and subjected to the tests listed below and specified in 4.7.1, 4.7.2, 4.7.3, 4.7.4, 4.7.5, and 4.7.9.

- a. Nonvolatile content
- b. Viscosity
- c. Application life
- d. Tack-free time
- e. Cure time
- f. Sealing compound protection, weight loss (MIL-S-7502 only)

4.4.3 Rejection and retest. When one or more samples of coating material from a lot fail to meet the specification, the lot shall be withheld until the extent and cause of failure have been determined. The contractor shall explain fully to the procuring activity the cause of failure and the action taken to preclude recurrence. After correction, all of the sampling tests shall be repeated.

4.5 Test conditions

4.5.1 Standard conditions. Standard conditions shall be considered as being a temperature of $77^{\circ} \pm 2^{\circ}\text{F}$ ($25^{\circ} \pm 1^{\circ}\text{C}$) and a relative humidity of 50 ± 5 percent. All tests shall be conducted as standard conditions unless otherwise specified.

4.6 Preparation of test specimens

MIL-C-83019 (USAF)

4.6.1 Test panels Panels used in test methods 4.7.4, 4.7.5, 4.7.6, 4.7.8, and 4.7.11 shall be 7075 T6 clad aluminum conforming to QQ-A-250/13. Panels used in test method 4.7.7 shall be 7075 T6 bare aluminum conforming to QQ-A-250/12 with chemical treatment in accordance with MIL-C-5541.

4.6.2 Cleaning of test surfaces Prior to application of sealing compound protection coating all surfaces shall be cleaned by scrubbing and rinsing with soap-free and grease-free rags or paper towels, using solvent formulated in accordance with MIL-C-38736 (USAF). After rinsing, and while still wet, the panels shall be wiped dry with a clean lint-free cloth.

4.6.3 Preparation of sealing compound The quantity of sealing compound conforming to MIL-S-8802, Class B-2, or MIL-S-7502, Class B-2 required for the test shall be mixed thoroughly within a period of 5 minutes using a Semco Model SP-1350 mixer, or a Semkit conforming to MIL-P-38714 (USAF), or equal. Immediately after mixing the sealing compound shall be placed into cartridges for extrusion from the Semco No. 250 gun, or equal. The sealing compound shall be applied to panels or formed into a flow sheet in accordance with the applicable test methods. The sealing compound shall be cured 48 hours at standard conditions followed by 24 hours at $140^{\circ} \pm 2^{\circ}\text{F}$.

4.6.4 Preparation of corrosion preventive coating The components of the material shall be mixed thoroughly in accordance with the instructions of the manufacturer. Four panels, 7075 T6 aluminum alloy conforming to QQ-A-250/12c shall be chemically treated per MIL-C-5541. Two panels shall be coated with MIL-C-27725 coating material and two with BMS-10-39A Type I coating material by spraying or dipping. Cure shall be 48 hours at standard conditions followed by 24 hours at $120^{\circ} \pm 2^{\circ}\text{F}$ and the cured thickness shall be approximately 1 mil.

4.6.5 Preparation of sealing compound protection coating Unless otherwise specified the coating material shall be applied by dipping. For test methods 4.7.4 through 4.7.10 a one-quart metal container shall be filled to within approximately 1/2 inch of the top with mixed coating material. The container shall be allowed to remain uncovered and undisturbed for 2 hours at standard conditions before application of the coating material to the applicable substrates. The coating shall be cured 48 hours at standard conditions.

4.6.6 Formulation of jet reference test fluid The jet reference fluid required for conducting fluid immersion tests shall be formulated as follows:

Toluene (TT-T-548)	30 volumes
Cyclohexane (technical grade)	60 volumes
Iso-octane (TT-S-735, type I)	10 volumes
¹ Tertiary dibutyl disulfide	1 volumes
Tertiary butyl mercaptan	0.015 \pm 0.0015 weight percent of other four components

¹/ The tertiary dibutyl disulfide shall be doctor sweet.

4.6.6.1 When tested for mercaptan and total sulfur in accordance with ASTM Method 1323 and Method 5201 of Federal Test Method Standard No. 791, respectively, the reference fluid shall have the following properties:

- a. Total sulfur content - 0.400 ± 0.005 weight percent
- b. Mercaptan sulfur content - 0.0050 ± 0.0005 weight percent.

The fluid should be stored out of contact with light in containers which are inert to the fluid ingredients. (Welded aluminum, non-galvanized welded steel, or glass containers are suitable.) If not used within 90 days after blending, the fluid should be retested for mercaptan and total sulfur content.

MIL-C-83019 (USAF)

4.7 Test methods

4.7.1 Nonvolatile content. Approximately 10 grams of mixed coating material shall be transferred as rapidly as possible to each of three cups 3 inches in diameter and 3/4 inch deep. A fitted cover shall immediately be placed over each cup and the weight determined accurately. The cups and covers shall be weighed accurately prior to use and subtracted from the gross weights in order to calculate the net sample weights. The covers shall then be removed and material heated at 158°F for 24 hours. The material shall then be cooled, the covers replaced, and the weight determined accurately. The percentage of nonvolatile content shall be calculated as follows:

$$\text{Percentage of nonvolatile content} = \frac{\text{Final weight}}{\text{Initial weight}} \times 100$$

Report the nonvolatile content as the average of the three determinations.

4.7.2 Viscosity. The viscosity test shall be conducted in accordance with Federal Test Method Standard No. 141, Method 4282. The viscosity shall be measured on freshly mixed material within 10 minutes after completion of mixing.

4.7.3 Application life. A 1-quart metal container shall be filled to within approximately 1/2 inch of the top with mixed coating material. The container shall be allowed to remain uncovered and undisturbed for 2 hours at standard conditions. At that time one pint of the material shall be removed for preparation of test specimens for paragraphs 4.7.4 through 4.7.10. The remainder of the material shall be left in the quart container until a total of 3 hours has elapsed from the time of mix. A viscosity test shall be conducted in accordance with Federal Test Method Standard No. 141, Method 4282.

4.7.4 Tack-free-time. An aluminum test panel measuring 0.040 by 2 3/4 by 6 inches shall be cleaned and dipcoated with the coating material. The material shall be allowed to cure at standard conditions for 4 hours. Two 1-inch by 6-inch pieces of polyethylene film 0.004 ± 0.002 inch thick shall be applied to the coating material and held in place at a pressure of 1/2 ounce per square inch for 2 minutes. The strips shall then be slowly and evenly withdrawn at right angles to the coating material surface. The polyethylene shall come away clean and free of coating material.

4.7.5 Cure time. The aluminum panel from the tack-free-time test shall be allowed to cure for a total time of 48 hours at standard conditions. The coating shall be subjected to 50 double strokes at moderate pressure with a gauze pad wet with methyl-ethyl-ketone.

4.7.6 Resistance to salt water and fuel. Two clad aluminum panels 0.040 by 2 3/4 by 6 inches shall be given a 1/8 ± 1/64 inch coating of MIL-S-8802 sealing compound and cured in accordance with 4.6.3. One panel shall be coated with the sealing compound protection coating; the other panel shall serve as a control. After cure of the coating material, both panels shall be immersed in a 2-layer liquid consisting of equal parts jet reference fluid and 3.0 percent aqueous sodium chloride solution for 28 days at 140° ± 2°F with the fluids being changed every 7 days. At the end of the immersion period the panels shall be removed and examined for conformance to table I.

4.7.7 Coating compatibility. Two aluminum alloy panels 0.040 by 2 3/4 by 6 inches shall be coated with MIL-C-27725 and two with BMS 10-39 Type I and cured in accordance with 4.6.4. One panel of each shall be coated with the sealing compound protection coating; the other panel shall serve as a control. After cure of the sealing compound protection coating, the panels shall be immersed and examined as the panels in 4.7.6.

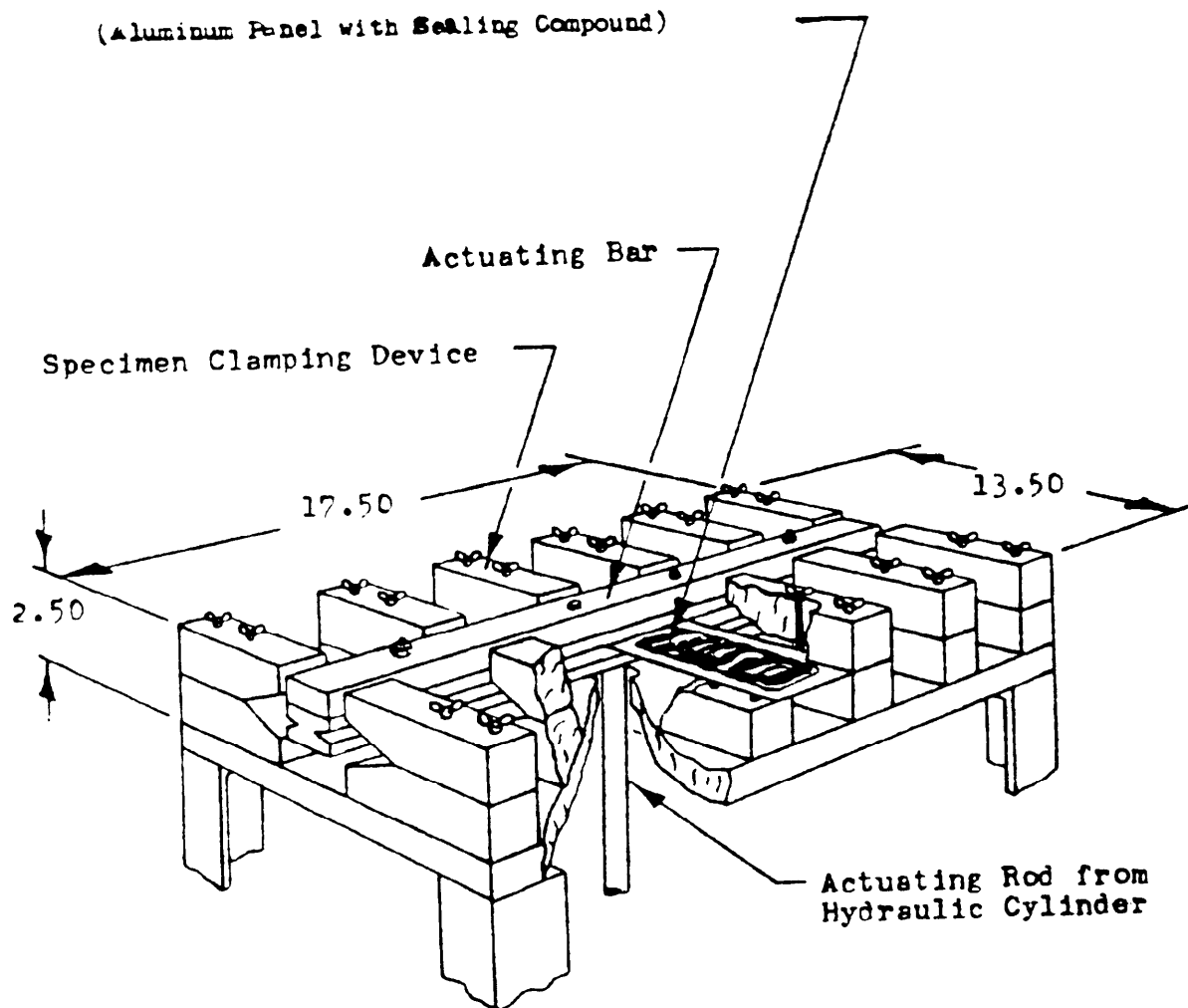
4.7.8 Adhesion Two clad aluminum panels 0.040 by 2 3/4 by 6 inches shall be given a 1/8 ± 1/64 inch coating of MIL-S-8802 sealing compound and cured in accordance with 4.6.3. After curing, the surface of the sealing compound shall be cleaned in accordance with 4.6.2. Three brush coats of the sealing compound protection coating shall be applied allowing 30 minutes drying for each coat. Then, a fourth coating shall be applied and allowed to dry for 5 minutes. A strip of cotton duck 2 3/4 by 12 inches conforming to Type III of CCC-C-419 shall be placed on each panel leaving a loose end 6 inches in length and a heavy coat of the sealing compound protection coating applied. Work out any air bubbles existing underneath the applied fabric, dry 30 minutes, and apply another heavy brush coat. Cure for 48 hours at standard condition. Immerse the panels in jet reference fluid 7 days at 140° ± 2°F. After exposure at 140°F, the panels shall be cooled in the fluid for 24 hours at standard conditions. The adhesion shall be measured within 30 minutes after removal from the fluid. A 1-inch-wide strip shall be cut the length of the panels through the fabric and coating material and into the MIL-S-8802 sealing compound to provide the center inch for the adhesion test. The specimens shall be stripped back at an angle of 180 degrees in a suitable tensile testing machine having a jaw separation rate of 2 inches per minute. The adhesion shall be measured as the pull in pounds per inch to separate the coating material occurs, the value shall not be less than the minimum adhesive requirement. If a cohesive or adhesive failure of the sealing compound occurs at a value less than the minimum adhesive requirement, the test shall be repeated. The results shall be the numerical average of the peak loads.

4.7.9 Sealing compound protection, weight loss Flow sheets of MIL-S-8802 and MIL-S-7502 Class B-2 sealing compound 1/8 ± 1/64 inch thick shall be prepared by pressing between two polyethylene sheets. The top sheet shall be removed after 40 hours and the sheet shall be cured in accordance with 4.6.3. Eight specimens measuring 1 by 2 inches shall be cut from each flow sheet. Four of each shall be coated by dipping in accordance with 4.6.5. After the coating has cured, the specimens shall be weighed and the group of four coated specimens and the group of four uncoated specimens shall each be immersed in 360 cubic centimeters of jet reference fluid at 140° ± 2°F. Immersion shall be 14 days of nine fluid changes for the MIL-S-8802 sealing compounds and 3 days for the MIL-S-7502 sealing compound with no fluid change. At the end of the exposure period, the specimens shall be removed from the fluid and air dried for 72 hours at 140° ± 2°F. The specimens shall then be cooled to standard test temperature in a dessicator and weighed. The average percent weight loss shall be calculated. The uncoated MIL-S-8802 sealing compound shall exhibit a weight loss of 5 to 12 percent and the uncoated MIL-S-7502, a weight loss of more than 20 percent. Failure of the uncoated specimens to show this amount of weight loss shall be cause for investigation and possible repeat of the test.

4.7.10 Resistance to anti-icing fluid Four specimens measuring 1 by 2 inches of MIL-S-8802 sealing compound shall be cut from the flow sheet of 4.7.9. The specimens shall be coated in accordance with 4.6.5. After the coating has cured the specimens shall be immersed in 360 cubic centimeters of a mixture of 75 percent water and 25 percent anti-icing fluid conforming to MIL-I-27686 for 14 days at 72° ± 2°F. After the immersion period the specimens shall be bent around a 1-inch diameter mandrel and examined for conformance to table I.

4.7.11 Low-Temperature flexibility Four aluminum panels 0.040 by 2 3/4 by 6 inches shall be used. Sealing compound 0.094 inch thick by 1 1/2 inches wide by 4 inches long shall be applied to the center of each of the four panels. After curing of the sealing compound in accordance with 4.6.3, two of the panels shall be dipcoated with the coating material and cured. All the panels shall be immersed in jet reference fluid at 140°F for 7 days. Remove the panels from the fluid and place them in a flexibility jig at -67° ± 2°F. The flexibility jig shall consist of a clamp support that will grip both sides of both 6-inch edges of the panel for a distance of 3 inches from one end without touching the sealant. The jig 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. (See FIGURE 1). The panels shall be held at -67° ± 2°F for 2 hours and then flexed through 130 consecutive cycles. The panels shall be examined for cracking, checking or loss of adhesion. The test shall be repeated if the control panels fail.

MIL-C-83019 (USAF)



DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED,
TOLERANCES: ± 0.015

FIGURE 1 - Low Temperature Flexibility Jig

4.7.12 Free diisocyanate the test shall be conducted in accordance with U.S. Air Force Specification Bulletin No. 535.

4.7.13 Storage stability Approximately one quart of the coating material in original containers shall be stored for 14 days at $120^{\circ} \pm 2^{\circ}\text{F}$ in a suitably ventilated oven. After cooling for 24 hours, tests shall be conducted in accordance with 4.7.3, 4.7.4, 4.7.5, and 4.7.9 for application life, tack-free time, cure time, and sealing compound protection, weight loss.

5 PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be Level A or C, as specified (see 6.2).

5.1.1 Level A

5.1.1.1 Unit packaging. The base compound and the curing agent shall each be packaged in their own containers. Each curing agent container shall be packaged with one base compound container in a manner that will prevent accidental separation but will permit easy separation for mixing purposes. The ratio of the quantity contained in the base container to the quantity contained in the curing agent container shall be the same as the recommended mixing ratio of the base compound and curing agent.

5.1.1.1.1 Containers. The base compound and the curing agent shall be furnished in metal cans conforming to Type V, Class 2 of PPP-C-96, except that tinfoil cans with paper labels may be used, unless specifically prohibited. The base compound shall be furnished in 1/2-pint, 1-pint, 1-quart, or 1-gallon metal cans as specified in the contract or order. The total amount of material furnished (base compound and curing agent together) shall be sufficient to fill the base compound container.

5.1.2 Level C. Packaging shall be in accordance with the manufacturer's commercial practice.

5.2 Packing. Unless otherwise specified, all material shall be packed for Level B (see 6.2).

5.2.1 Level A and B. Exterior shipping containers shall conform to PPP-B-636 with a maximum of six 1-gallon cans, nine 1-quart cans, 12 1-pint cans, and 12 1/2-pint cans per shipping container. Use overseas shipping containers for Level A and domestic shipping containers for Level B.

5.3 Marking of shipments. 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, name of manufacturer, date of manufacture (month and year), and recommended storage temperature.

6. NOTES

6.1 Intended use. The coating material covered by this specification is to be used for the protection of aircraft integral fuel tank sealing compound against fuel and fuel contaminants.

6.2 Ordering data. Procurement documents shall specify the following:

- a. Title, number, and date of this specification.
- b. Quantity and container size (see 5.1.1.1.1)
- c. Levels of packaging and packing required (see section 5)
- d. If preproduction tests are required (see 6.3).

MIL-C-83019 (USAF)

6.2.1 When ordering coating material covered by this specification, the quantity of material shall be specified by the number of the particular container volume desired. The coating material shall be supplied on the basis of total combined contents of the two parts.

6.3 Preproduction test. Preproduction tests are required for material furnished to this specification. A copy of the preproduction test report shall be furnished the Air Force Materials Laboratory, Attn: MAAE, Wright-Patterson AFB, Ohio 45433. The preproduction test need not be repeated for new orders or different parts provided the materials and processes have not been changed and a certified statement to this effect is furnished to the procuring activity. The waiving of the preproduction tests will be strictly at the discretion of the procuring activity. Preproduction tests will not be acceptable if they are more than 3 years old.

Custodian:
Air Force - 11

Preparing activity:
Air Force - 11

Reviewer activities:
Air Force - 84, 85

Project Number: 8030-F008

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No 22-R255
<p>INSTRUCTIONS: This sheet is to be filled out by personnel, either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.</p>		
SPECIFICATION		
ORGANIZATION		
CITY AND STATE		CONTRACT NUMBER
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO (If "yes", in what way?)		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity - Optional)		DATE

DD FORM 1426
1 JAN 66

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED

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