

INCH-POUND

MIL-PRF-3043C
13 February 1998
Superseding
MIL-R-3043B
5 January 1972

PERFORMANCE SPECIFICATION

RESIN COATING, PERMANENT, FOR ENGINE COMPONENTS AND METAL PARTS

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

1. SCOPE

1.1 Scope. This specification covers one type of permanent resin coating for surfaces of engine components and metal parts.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the applicable issues of these documents are those listed in the specific issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

TT-S-735

Standard Test Fluids; Hydrocarbon

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: WR-ALC/LKJE, 460 2nd Street, STE 221, Robins AFB, GA 31098-1640 by using the Standardization Document Improvement Proposal (DD form 1426) appearing at the end of this document or by letter.

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DEPARTMENT OF DEFENSE

MIL-PRF-7808	Lubricating Oil, Aircraft Turbine, Synthetic Base, NATO Code Number 0 - 148
MIL-M-3171	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on

STANDARDS

FEDERAL

FED-STD-313	Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
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(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, Pennsylvania 19111-5094.)

2.3 Non Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the applicable issues of the documents that have been adopted by the DoD are those listed in the specific issue of the DoDISS cited in the solicitation. Unless otherwise specified, the documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 117	Standard Guide for Sampling, Test Methods, Specifications, and Guide for Electrical Insulating Oils of Petroleum Origin (DoD adopted)
ASTM D 1308	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes (DoD adopted)
ASTM D 1748	Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet (IP 366/84) (DoD adopted)
ASTM D 2196	Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer (DoD adopted)
ASTM D 2369	Standard Test Method for Volatile Content of Coatings (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials 100 Barr Harbor Drive, West Conshohocken PA 19428-2959.)

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SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 1546	Compound, Carbon Removing, Orthodichlorobenzene for Engine Parts (DoD adopted)
SAE AMS 4377	Sheet and Plate, Magnesium Alloy 3.0Al - 1.0Zn - 0.20Mn (AZ31B - H24) Cold Rolled, Partially Annealed (DoD adopted)
SAE AMS 5046	Sheet, Strip, and Plate, Carbon Steel (SAE 1020 and 1025) (Annealed) (DoD adopted)

(Application for copies should be addressed to SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The resin coating furnished under this specification shall be authorized by the qualifying activity before contract award.

3.2 Material. The base material shall be a thermosetting resin, free from drying and non-drying oils and cellulose.

3.2.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Toxicity. The material shall have no adverse effect on the health of personnel when used for its intended purpose. The material shall not contain any hazardous compound as defined in FED-STD-313, nor shall it contain any chemical listed in the current report of known carcinogens of the National Toxicology Program (see 4.3).

3.4 Color. The material shall be blue when sprayed onto metallic surfaces. After the baking period, the coating shall exhibit a green transparent coloration so that the metal surface underneath the film will be clearly discernible (see 4.4).

3.5 Solids content. The solids content of the coating as furnished shall be 25 to 30 percent by weight (see 4.5).

3.6 Viscosity. The viscosity shall be 0.4 poise or less at 77°F ±2°F (see 4.6).

3.7 Photochemical requirements. The manufacturer shall certify that materials used in the adhesive are non-photochemical reactive (see 4.2).

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3.8 Coating requirements.

3.8.1 Application. The material shall be capable of being applied to metallic surfaces by dip or spray at room temperature. Room temperature shall be defined as the temperature range of 65°F to 85°F and a relative humidity of 50 ±10 percent (see 4.8.1).

3.8.2 Drying time.

3.8.2.1 Air dry. Maximum time for the coating to dry to the touch at room temperature shall not exceed 30 minutes (see 4.8.2.1).

3.8.2.2 Oil bake. The coating air dried at room temperature 16 to 24 hours shall bake hard and tough and be free of bubbles, pinholes, or other film irregularities when immersed in hot lubricating oil (see 4.8.2.2).

3.8.2.3 Oven bake. The coating shall bake hard and tough and be free of bubbles, pinholes, or other film irregularities after baking. Test panels prepared for test of spray application, especially shall be examined for these defects. A slight orange peel effect on these panels is acceptable (see 4.8.2.3).

3.9 Flexibility requirements.

3.9.1 Bending flexibility. The coating on a finished panel, shall show satisfactory anchorage at the bend when rapidly bent over a 0.250 inch rod. It shall show no tendency to chip off in large pieces or peel when scratched or scored with a sharp knife. Slight cracking at the bend will be permitted (see 4.9.1).

3.9.2 Abrasive flexibility. The film on a specimen shall show no sign of chipping or peeling when subjected to sandblasting. However, wearing away of the film by abrasion will be permitted (see 4.9.2).

3.10 Environmental requirements.

3.10.1 Humidity resistance. The film shall show no evidence of corrosion or spread of corrosion beyond that in the scratches cut in the finish. Additionally, the film shall show no softening, peeling, blistering, chipping, or loss of adhesion (see 4.10.1).

3.10.2 High humidity (cold cycle). The film shall show no sign of corrosion beyond that in the scratches cut in the finish. Additionally, the film shall show no softening, peeling, blistering, chipping, or loss of adhesion (see 4.10.2).

3.10.3 Salt spray resistance. The film shall show no evidence of corrosion or spread of corrosion beyond that in the scratches cut in the finish. Additionally, the film shall show no evidence of softening, peeling, blistering, chipping, or loss of adhesion (see 4.10.3).

3.10.4 Aromatic hydrocarbon resistance. The film shall show no evidence of failure. The change in weight shall not exceed 0.002 gram (see 4.10.4).

3.10.5 Salt water hydrocarbon resistance. The film shall show no evidence of softening, blistering, leaching, or loss of adhesion. There shall be no evidence of corrosion on the metal (see 4.10.5).

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3.10.6 Hot oil resistance. The film shall show no evidence of film failure and the change in weight of the specified test panel shall not exceed 0.005 gram. Darkening of the film shall not be cause for rejection (see 4.10.6).

3.10.7 Carbon remover resistance. The film shall show no flaking or peeling (see 4.10.7).

3.11 Removability. Films shall be completely removable and corrosion-free (see 4.11).

3.12 Storage stability. The resin coating shall have a minimum shelf life storage of one year. The coating shall be capable of meeting all of the requirements of this specification (see 4.12).

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2)
- b. Conformance inspection (see 4.2)

4.2 Qualification and conformance inspection. Qualification and conformance tests shall consist of all of the tests specified in this section. The manufacturer shall provide a certificate of conformance with any lot of resin coating sold to the Government. The certificate shall verify that the manufacturer's product satisfies the requirements as outlined in this specification. A lot is defined as all the resin coating offered at one time for procurement by the Government.

4.3 Material Safety Data Sheet (MSDS). An MSDS shall be prepared in accordance with FED-STD-313 and submitted with each lot of resin coating (see 3.2).

4.4 Color verification. The resin coating shall be examined on the test panels after they have air dried. The coating shall be examined again after the test panels have been oven baked (see 3.4).

4.5 Solids content test. Solids content shall be determined by ASTM D 2369 (see 3.5).

4.6 Viscosity test. Viscosity of resin coating shall be determined using a Model LVF Brookfield Viscometer, or its equivalent in accordance with ASTM D 2196. Readings shall be taken after the spindle has been operating for a minimum of three minutes (see 3.6).

4.7 Test panels.

4.7.1 Test panels composition. Test panels shall be of steel and magnesium. Specifically, the steel shall be in accordance with SAE AMS 5046. The magnesium shall be in accordance with SAE AMS 4377 (AZ31B-H24), surface treated in accordance with MIL-M-3171, Type III.

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4.7.2 Test panel sizes. The size and thickness of panels, in inches (ins.), for each test shall be as follows:

<u>Test Panels</u>	<u>Test Size ins.</u>	<u>Thickness ins.</u>
Spray application	6 X 12	0.014 - 0.030
Dip application	optional	
Drying time	optional	
Baking in oil	1.250 X 4	0.063 - 0.125
Oven baking	6 X 12	0.014 - 0.030
Bending flexibility	3 X 6	0.014 - 0.030
Abrasive flexibility	3 X 6	0.014 - 0.030
Humidity	2 X 4	0.063 - 0.125
High humidity (cold cycle)	2 X 4	0.063 - 0.125
Salt spray	3 X 6	0.014 - 0.030
Aromatic hydrocarbon	1.250 X 4	0.063 - 0.125
Salt water hydrocarbon	3 X 4	0.014 - 0.030
Cold cycle	2 X 4	0.063 - 0.125
Hot Oil	1.250 X 4	0.063 - 0.125
Removability	optional	
Sandblast	optional	
Carbon remover	3 X 6	0.014 - 0.030
Storage stability	6 X 12	0.014 - 0.030

4.7.3 Test panel preparation. All edges shall be rounded and a 0.250 inch hole shall be drilled on the center line near one end for all panels except the 2 X 4 inch panels. Remove all edges, burrs, and corners (including those at the edges of holes). The 1.250 X 4 inch and the 2 X 4 inch panels shall be surface ground to a roughness of 10 to 16 micro-inches root mean square. The 3 X 6 inch and 4 X 12 inch panels shall be smoothly finished with a 320 grit paper. All panels not used immediately shall be preserved in an atmosphere having a relative humidity of 20 percent or less. Prior to use, the panels shall be thoroughly cleaned and dried with lintless cloths. After drying, the panels shall be submerged in boiling 95 percent methanol. Care should be taken during cleaning and preparation to avoid fingerprint contamination.

4.8 Performance requirement tests.

4.8.1 Coating application. All test panels except the spray application test panels shall be prepared by dip coating in a temperature range of 65°F to 85°F and a relative humidity of 50 ±10 percent. The clean test panels shall be withdrawn vertically at a rate so as to produce a dry film coating thickness of 0.5 to 0.7 mils for all tests except the flexibility test which shall be maintained with 0.2 to 0.3 mils. The 6 X 12 inch panels shall be coated by spraying to a film thickness of 0.5 ±0.2 mil. These panels shall then be allowed to air dry for not less than one hour at the above ambient conditions. All panels except the Baking in oil and the Oven baking test panels shall be baked prior to test at 325°F ±5°F for 30 ±5 minutes (see 3.8.1).

4.8.2 Drying time tests.

4.8.2.1 Air dry test. Coated test panels air dried at room temperature at 75°F ±10°F for 30 minutes shall be dry to the touch with no transfer of coating (see 3.8.2.1).

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4.8.2.2 Oil bake test. Coated test panels air dried for 16 to 24 hours shall be immersed to a depth of approximately 2/3 of their length in hot lubricating oil conforming to MIL-PRF-7808 at 350°F ±10°F for 15 minutes. The panels shall then be removed, rinsed clean, and the finish examined for film irregularities. Darkening of the finish or difference of color in the immersed and unimmersed portion shall not be cause for rejection (see 3.8.2.2).

4.8.2.3 Oven bake test. The test panels, coated by spraying and air dried for not less than 1 hour shall be placed in an oven and baked for 30 ±5 minutes at 325°F ±5°F (see 3.8.2.3).

4.9 Flexibility requirements.

4.9.1 Bending flexibility test. Condition the dry coated test panels at 73°F ±2°F and a relative humidity of 50 ±4 percent for at least 30 minutes. While at this temperature, the test panels shall be placed with the coated side uppermost on a 4 inch diameter mandrel at a point equally distant from the top and bottom edges of the panels, and bend the panels double in approximately 1 second. The film shall be examined under a magnification of 7 diameters, using diffused light having a color temperature of 6,500°K and an intensity of about 165 foot-candles. (For those not equipped with a standard illuminant, viewing the test coating at a north window illuminated by a fairly light overcast sky will approximate these conditions.) Cracks occurring at either end and extending no more than 0.250 inch shall be disregarded (see 3.9.1).

4.9.2 Abrasive flexibility. The coating on a test panel shall be subjected to a sandblast provided by any suitable means. The sandblast shall be at a minimum of 40 psig and shall be such that it abrades the coating (see 3.9.2).

4.10 Environmental requirement tests.

4.10.1 Humidity resistance test. The test panels shall be exposed in a humidity cabinet in accordance with ASTM D 1748. One face of the oven baked test panels and one face of the oil baked test panels shall be cross scratched (i.e. "X" scratched) with a sharp instrument so that the underlying metal is exposed at least 2 inches along the scratch and suspended in the humidity cabinet in an atmosphere of 100 percent relative humidity at 120°F ±2°F for 240 hours. Upon removal, the panels shall be wiped dry with lintless cloths and examined for corrosion and failure of the film (see 3.10.1).

4.10.2 High humidity (cold cycle) test. The test panel shall be exposed in a humidity cabinet in accordance with ASTM D 1748. The test panels cross scratched (i.e., "X" scratched) on one face with a sharp instrument shall be subjected to a cycle of 8 hours in an atmosphere of 100 percent relative humidity at 120°F ±2°F followed by 16 hours at -65°F for 168 hours. The test cycle may be interrupted to conform to work periods; however, this break should occur only after the cold period. Upon completion of this test, the panels shall be examined (see 3.10.2).

4.10.3 Salt spray resistance test. The test shall be performed in accordance with ASTM D 117. The test panels shall be inclined 15° from the vertical cross hatched (i.e., "X" scratched) on one face with a sharp instrument so that the underlying metal is exposed at least 2 inches along the scratch and shall be subjected to a 5 percent salt spray test for 240 hours (see 3.10.3).

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4.10.4 Aromatic hydrocarbon resistance test. The test shall be performed in accordance with ASTM D 1308. The test panels shall be weighed and then immersed in a flask containing hydrocarbon test fluid conforming to TT-S-735, Type III. The flask shall be connected to a reflux at 8 hours each for a total of 24 hours, without removal of the panels. At the completion of the test the panels shall be removed, air dried 1 hour and weighed (see 3.10.4).

4.10.5 Salt water hydrocarbon resistance. The test shall be performed in accordance with ASTM D 1308. The test panels shall be immersed vertically for 168 hours in a covered glass vessel containing a 2 layer liquid, consisting of a 3 percent aqueous sodium chloride solution and hydrocarbon test fluid conforming to TT-S-735, Type III, so that 2 inches of the panel is exposed to the salt mixture, 2 inches of the panel exposed to the aromatic hydrocarbon test fluid, and the balance of the panel exposed to the air vapor mixture. The temperature during the test shall be maintained at 95°F to 100°F. Immediately upon removal from the liquid, the panel shall be examined (see 3.10.5).

4.10.6 Hot oil resistance test. The test shall be performed in accordance with ASTM D 1308. Weighed test panels shall be immersed in lubricating oil conforming to MIL-PRF-7808, and heated to 395°F ±10°F in less than 2 hours and maintained at that temperature for 3 periods of 6 hours each. The panels shall remain immersed in the oil between heatings. At the completion of the tests, the panels shall be removed, the oil cleaned off, air dried for 1 hour, and weighed. The change in weight shall not exceed 0.005 gram (see 3.10.6).

4.10.7 Carbon remover resistance test. The test shall be performed in accordance with ASTM D 1308. The test panels shall be immersed in material conforming to SAE AMS 1546 maintained at 140°F ±5°F for 3 successive periods of 6 hours each. At the end of these immersions, the panels shall be observed for defects (see 3.10.7).

4.11 Removability test. The coated panels shall be stripped using a silicate paint remover. A soft bristle brush may be used to facilitate the removal of the loosened finish. The panels shall be cleaned after the coating is removed. The panel shall be examined for completeness of coating removal and evidence of corrosion (see 3.11).

4.12 Storage stability evaluation. A container of the resin coating shall be stored for one year at a temperature of 75°F ±15°F. At the end of the storage, the container of resin coating shall be sprayed on the test panels at a thickness of 0.5 ±0.2 mil and examined for loss of air drying ability (see 3.12).

5. PACKAGING

5.1 General. For acquisition purposes, the packaging requirements shall be specified in the contract or order. When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point packaging activity within the Military Department of Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department or Defense Agency automated packaging files, CD-ROM products, or by contacting the responsible packaging activity (see 6.2).

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6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. The material covered by this specification is intended for use as a permanent corrosion preventive, oil-resistant coating for metallic nonbearing surfaces of engine parts and other components. This material may also be applied to gear teeth and such other bearing surfaces where wearing off of the film will cause no detrimental effects and where tolerances greater than 0.002 inch are encountered.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2)
- c. Volume procured in gallons.
- d. Packaging requirements (see 5.1).

6.3 Marking. Unless specified otherwise, containers and boxes for coating shall be marked with appropriate precautionary statements in accordance with the manufacturers standard commercial practice (see 6.2).

6.4 Subject term (key word) listing.

Flexibility
Hot Oil
Hydrocarbon
Humidity
Oil Bake
Oven bake
Removability

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:

Army - MR
Navy - SH
Air Force - 99

Preparing activity:

Air Force - 84

Agent:

Air Force - 99

Review activities:

Air Force - 11
Army - AT, AV
Navy - AS, OS, SA

(Project 8030-0748)

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
MIL-PRF-3043C

 2. DOCUMENT DATE (YYMMDD)
98/02/13

3. DOCUMENT TITLE

RESIN COATING, PERMANENT, FOR ENGINE COMPONENTS AND METAL PARTS

 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)*

 e. DATE SUBMITTED
(YYMMDD)

(1) Commercial

 (2) AUTOVON
(If applicable)
8. PREPARING ACTIVITY

a. NAME

WR-ALC/LKJE

 b. TELEPHONE *(Include Area Code)*

(1) Commercial

(912) 926-6630

(2) AUTOVON

468-6630

 c. ADDRESS *(Include Zip Code)*

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IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

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5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
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