

MIL-P-149D
4 June 1984
SUPERSEDING
MIL-P-149C
12 September 1979

MILITARY SPECIFICATION

PLASTIC COATING COMPOUND, STRIPPABLE
(HOT DIPPING)

This specification is approved for use by the Army Materials and Mechanics Research Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers a strippable plastic coating for use in the preservation and packaging of metallic parts (see 6.1).

1.2 Classification. The strippable plastic compound shall be of the following types as specified:

Type I - Ethyl cellulose (see 6.1.1 and 6.5.1)

Type II - Cellulose acetate butyrate (see 6.1.2 and 6.5.2)

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials and Mechanics Research Center, ATTN: DRXMK-SMS, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

/ FSC 8030 /

MIL-P-149D

SPECIFICATIONS

FEDERAL

- P-D-680 - Dry Cleaning Solvent
- PPP-B-636 - Box, Shipping Fiberboard
- QQ-C-576 - Copper Flat Products with Slit, Slit and Edge-rolled, Sheared, Sawed or Machined Edges (Plate, Bar, Sheet and Strip)

STANDARDS

FEDERAL

- FED-STD-313 - Material Safety Data Sheets Preparation and Submission of

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

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

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D92 - Test for Flash and Fire Points by Cleveland Open Cup
- D1748 - Test for Rust Protection by Metal Preservatives in the Humidity Cabinet
- A109 - Steel, Carbon, Cold-Rolled Strip
- A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality
- B209 - Aluminum and Aluminum-Alloy Sheet and Plate

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

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification

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

National Motor Freight Traffic Association, Inc.

National Motor Freight Classification

MIL-P-149D

(Application for copies should be addressed to the American Trucking Association, Inc., 1616 P Street, N.W., Washington, DC 20036.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Qualification. The plastic coating compounds furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.6.1 and 6.3). Any change in the formulation of a qualified product will necessitate its requalification. The material supplied under the contract shall be identical, within manufacturing tolerances, to the product receiving qualification.

3.2 Material. The raw materials shall be such as to produce a compound conforming to the requirements of this specification. The material in either the liquid or solid state shall be free from all foreign substances, such as grit and dirt, and ingredient lumps or agglomerates which do not become uniformly part of the compound.

3.2.1 Material Safety Data Sheet. When specified (see 6.2), a material safety data sheet (MSDS) shall be prepared and submitted in accordance with Federal Standard 313. Section IV of the MSDS shall include flash point and fire point data for any distillate by-products produced by heating the compounds.

3.3 Fire point. When tested in accordance with 4.7.1, the fire point of the compound shall be not less than 410°F (210°C).

3.4 Homogeneity. When examined as described in 4.7.3, the material shall show no phase separation or gelling during the melting-down or conditioning periods. If the compound skins, the skin shall be heavy and strong enough to be removable in one piece or if light, the skin shall melt uniformly into the hot homogeneous compound.

3.5 Brittleness. When tested in accordance with 4.7.5, there shall be no cracking, flaking or separation of the coating.

3.6 Film forming characteristics. Coating stripped from test panels as described in 4.7.6 shall have a maximum thickness of 0.10 inch (0.25 cm) for initial material. The thickness of coating of aged material (4.6.2.2.2) shall not vary more than 20 percent from the coating thickness of the initial material. The variation of coating thickness among panels shall not exceed 0.01 inch (0.025 cm).

3.7 Transparency (Type II only). When the Type II coating is tested as described in 4.7.7 the typing shall be legible through the coating.

3.8 Exudation (loss of liquid and volatile constituents). When tested as described in 4.7.8, the percentage loss of liquid and volatile constituents shall be not less than 1 nor more than 5 percent by weight.

MIL-P-149D

3.9 Strippability and flexibility.

3.9.1 At room temperature. When tested in accordance with 4.7.9.1, the coating shall come loose easily in one continuous sheet. There shall be no breaking or cracking of the coating during the lifting and there shall be no portions of the coating remaining on the surfaces of the test panels. The removed coating shall show no evidence of fracture when bent 180 degrees around a 1/8-inch (0.32-cm) diameter rod.

3.9.2 At minus 65°F (-54°C) and after oxygen bomb test (Type II only). The Type II coating when tested in accordance with 4.7.9.2 and 4.7.9.3 shall come loose easily in one continuous sheet. There shall be no breaking or cracking of the coating during the lifting and there shall be no portions of the coating remaining on the surfaces of the test panels. The coating at minus 65°F (-56°C), when bent 180° around a 1/8-inch (0.32-cm) diameter rod, shall show no evidence of fracture.

3.10 Corrosion resistance.

3.10.1 Resistance to humidity. When tested in accordance with 4.7.10.1, there shall be no corrosion on the surfaces of the panels.

3.10.2 Resistance to cycling. When tested in accordance with 4.7.10.2, there shall be no corrosion on the surface of the panels.

3.10.3 Resistance to oxygen bomb and humidity (Type II only). When the Type II compound is tested in accordance with 4.7.10.3, there shall be no corrosion on the surfaces of the panels.

3.11 Impact resistance (Type II only). When the Type II compound is tested in accordance with 4.7.11, there shall be no cracking or shattering of the coating.

3.12 Tensile strength and elongation. The tensile strength and elongation shall conform to the requirements of Table I when tested in accordance with 4.7.12.

TABLE I. Tensile and Elongation Requirements

Requirements	Type I		Type II	
	Initial	Aged	Initial	Aged
Tensile strength, psi (MPa), minimum	350 (2.41)	350 (2.41)	300 (2.07)	300 (2.07)
Elongation, percent, minimum	70	50	90	70

3.13 Plasticity. When tested in accordance with 4.7.13, the height of the resulting cylinders shall be not less than 0.15 inch (0.38 cm) for Type I or 0.30 inch (0.76 cm) for Type II compounds.

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 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 Lot. For the purpose of sampling and inspection, a lot shall consist of compound from one batch offered for delivery at one time. A batch is defined as that quantity of material which has been subjected to some unit, chemical or physical mixing process, intended to make the final product substantially uniform.

4.3 Examination of Preparation for Delivery. An examination shall be made to determine compliance with the requirements of Section 5. The sample unit shall be one shipping container fully prepared for delivery. Sampling shall be in accordance with MIL-STD-105. The inspection level shall be S-2 with an AQL of 4.0 expressed in terms of percent defective.

4.4 Sampling for tests. From each inspection lot, two containers shall be selected at random. From each of the two containers, a total sample of 9 lb (4.0 kg) shall be taken and placed in a separate clean container. The sample containers shall be properly marked for identification by batch and type and forwarded to the testing laboratory.

4.5 Lot acceptance tests. The samples selected in accordance with 4.4 shall be subjected to the tests specified in 4.6.2 for acceptance testing.

4.6 Classification of tests. The testing of the protective compound shall be classified as follows:

- (a) Qualification tests.
- (b) Quality conformance tests.

4.6.1 Qualification tests. The qualification tests shall consist of tests for all requirements specified in Section 3 (see 6.3).

4.6.2 Quality conformance tests. Quality conformance tests for acceptance of individual lots shall consist of tests for all requirements specified in Section 3 with the exception of the corrosion resistance (3.10 and 4.7.10) and strippability after oxygen bomb test (3.9.2 and 4.7.9.3).

4.7 Test methods. The following tests shall be conducted as required in this specification. Table II is included for information and guidance in conducting the applicable tests.

4.7.1 Fire point. The fire point of the material shall be determined in

MIL-P-149D

accordance with ASTM Method D-92, "Test for Flash and Fire Points by Cleveland Open Cup", except that the melted compound in the cup shall be stirred with the thermometer during the test. The thermometer shall be hung in the position specified and then given a circular motion of 2 cycles per second. The stirring shall be interrupted momentarily for every 5°F (3°C) rise in temperature to permit passage of the test flame across the surface of the compound.

4.7.2 Preparation of compounds.

4.7.2.1 Melting down. At least 3,000 grams of compound shall be cut into cubes approximately 1/2 to 1 inch (1.27 to 2.54 cm) to a side. Five-hundred grams shall be placed in each of three 1,000-milliliter Griffin beakers and placed in a forced draft oven thermostatically maintained at $375 \pm 3^{\circ}\text{F}$ ($191 \pm 2^{\circ}\text{C}$) for Type I and $350 \pm 3^{\circ}\text{F}$ ($177 \pm 2^{\circ}\text{C}$) for Type II. When the material has melted down, an additional 500 grams shall be added to each beaker. Temperature observation shall be made by means of a thermometer placed in the center of the beaker with the bottom of the bulb 2 inches (5.0 cm) above the bottom of the beaker. Temperature readings should not be made unless the thermometer has been in the beaker for 2 hours previous to the reading. During this operation, the first homogeneity observation shall be made (see 3.4).

4.7.2.2 Conditioning. Conditioning shall be done in a thermostatically controlled oven at a temperature of $375 \pm 3^{\circ}\text{F}$ ($191 \pm 2^{\circ}\text{C}$) for Type I and $350 \pm 3^{\circ}\text{F}$ ($177 \pm 2^{\circ}\text{C}$) for Type II. Prior to making the tests specified, material shall be conditioned for the determination of "initial" and "aged" properties as follows:

4.7.2.2.1 Initial material. For evaluation of "initial properties", two beakers containing 1000 gm each of melted-down compound shall be used. The material shall be heated in the oven for a period of 16 to 18 hours. During the melting-down period and 2 hours before the end of the period, homogeneity observation of the "initial material" shall be made (see 3.4). One hour before the end of the period, the material shall be removed from the oven, stirred, and replaced in the oven. The presence of skins, lumps, or gelling is cause for rejection. The compound prepared in this manner shall hereinafter be referred to as "initial material".

4.7.2.2.2 Aged material. For evaluation of "aged" properties, one stainless-steel beaker containing approximately 1,000 gms of melted-down compound shall be used. The material shall be heated in the oven for a period of 64 to 66 hours. Two hours before the end of the period, homogeneity observation of the "aged material" shall be made (see 3.4). One hour before the end of the period, the material shall be removed from the oven, stirred, and strained to remove skins. Any type of paint strainer shall be suitable for this purpose. The formation of lumps or gelling shall be cause for rejection. Compound prepared in this manner will hereinafter be referred to as "aged material".

TABLE II. Index of Tests

Tests	Tests and Panels Applicable to Each Type Material (X)										Number of panels required ^{1/}
	Requirement paragraph	Test paragraph		Type I		Type II		Aged	Initial	Aged	
		Initial	Aged	Initial	Aged						
Fire point	3.3	4.7.1	X	....	X	....	....	....	....	....	....
Homogeneity	3.4	4.7.3	X	X	X	X	....	....	....	....	....
Brittleness	3.5	4.7.5	X	....	X	....	....	....	....	....	....
Film forming characteristics	3.6	4.7.6	X	X	X	X	....	....	....	....	2 steel bars 6s
Transparency	3.7	4.7.7	....	....	X	....	....	....	....	....	....
Exudation	3.8	4.7.8	X	....	X	....	....	....	....	....	....
Strippability and flexibility	3.9	4.7.9	....	....	....	....	....	....	....	....	....
At room temperature	3.9.1	4.7.9.1	X	X	X	X	....	....	....	....	6s
At minus 65OF	3.9.2	4.7.9.2	....	....	....	....	....	....	....	....	3s
After oxygen bomb test	3.9.2	4.7.9.3	....	....	X	....	....	....	....	....	2s*
Corrosion resistance	3.10	4.7.10	....	....	....	....	....	....	....	....	....
Resistance to humidity	3.10.1	4.7.10.1	X	....	X	....	....	....	....	....	3s*, 3c*, 3a*
Resistance to cycling	3.10.2	4.7.10.2	X	....	X	....	....	....	....	....	3s*
Resistance to oxygen bomb and humidity	3.10.3	4.7.10.3	....	....	X	....	....	....	....	....	2s*, 2c*, 2a*
Impact resistance	3.11	4.7.11	....	....	....	....	....	....	....	....	6s
Tensile strength	3.12	4.7.12	X	X	X	X	....	....	....	....	....
Elongation	3.12	4.7.12	X	X	X	X	....	....	....	....	....
Plasticity	3.13	4.7.13	X	....	X	....	....	....	....	....	....

^{1/}s - steel panels; c - copper panels; a - aluminum panels * - double dipped panels (4.7.4.2.2).

MIL-P-149D

4.7.3 Homogeneity. The coating compound shall be visually examined as it is being melted, in accordance with 4.7.2.2.1 and 4.7.2.2.2.

4.7.4 Preparation of coated test specimens.

4.7.4.1 Preparation of aluminum, copper and steel test panels. Panels shall be 2 by 3 by 1/8 inch (5.0 by 7.62 by 0.32 cm) with rounded corners and edges. A 1/4-inch (0.63-cm) hole shall be drilled in each panel 1/4 inch (0.63 cm) from the edge of the panel on the center line of the two inch (5.0 cm) width. Steel and copper panels shall be polished using a number 320A wet or dry silicon carbide paper. The copper panels shall also be polished with number 00 steel wool. The aluminum panels shall be polished using aluminum oxide abrasive paper no. 320, followed by aluminum oxide abrasive paper No. 600. After polishing, the panels shall be washed with a volatile solvent, such as Stoddard solvent and wiped dry in such a manner as to leave no lint on the surface. Panels shall be fitted with a suspension wire made by passing a double strand of copper wire through the holes, twisting it securely in place and forming an eyelet approximately 3/8 inch (0.95 cm) in diameter above a 0.5 inch (1.27 cm) twisted shank. The panels with suspension wire shall be washed with 120°F (49°C), 50 percent aqueous ethyl alcohol, rinsed with absolute alcohol, and allowed to attain room temperature, 70 to 77°F (21 to 25°C) in a calcium chloride desiccator. The specification requirements for the metal panels shall be as indicated in Table III.

TABLE III. Test Panel Requirements

Type panel	Specification which metal shall conform to
Steel	ASTM A 109 or ASTM A366
Copper	QQ-C-576
Aluminum	ASTM B209, Alloy 2024

4.7.4.2 Application of coating. The test panels shall be dip coated as described in the following paragraphs by either a single dip or a double dip operation as applicable. The compound during preparation of the test specimens by dipping shall be maintained at a temperature of $375 \pm 3^{\circ}\text{F}$ ($191 \pm 2^{\circ}\text{C}$) for Type I and $350 \pm 3^{\circ}\text{F}$ ($177 \pm 2^{\circ}\text{C}$) for Type II. The panels shall remain submerged in the compound for a period of 5 ± 0.5 seconds.

4.7.4.2.1 Single dip. The panels at room temperature (70° to 77°F) (21° to 25°C) shall be suspended using a hook in the suspension wire and submerged vertically in the compound. After dipping the panels shall be allowed to cool and set.

4.7.4.2.2 Double dip. The panels shall be coated in a double dip so that the overlap at the center will be from 0.5 to 1 inch (1.27 to 2.54 cm) wide. In double dipping, the end of the panels carrying the suspension wire shall be dipped first while holding the panel with forceps to avoid fingerprinting. The coating thickness shall not be greater than 0.10 inch (.25 cm) except at the overlap portion. After dipping the panels shall be allowed to cool and set.

MIL-P-149D

4.7.5 Brittleness. Two steel bars, 1 by 3/8 by 10 inches (2.54 by 0.93 by 25.40 cm), shall be polished and all edges and corners left square but without any burrs or knife edges. The polished bars shall be washed with a volatile solvent, such as P-D-680, and wiped dry with a clean cloth without leaving any lint on the bar surface. The bars shall be double dipped with "initial material" as described in 4.7.4.2.2. The bars shall be maintained at $160 \pm 3^{\circ}\text{F}$ ($71 \pm 2^{\circ}\text{C}$) for 24 hours, cooled to room temperature and then placed in a cold chamber at minus $40 \pm 3^{\circ}\text{F}$ (-40°C) for Type I and at minus $65 \pm 3^{\circ}\text{F}$ (-54°C) for Type II for 24 hours. Observations shall be made on the bars while still in the cold chamber for evidence of cracking or flaking on flat surfaces or corners and any indication of separation of the coating at the overlap.

4.7.6 Film forming characteristics. Three steel panels coated with "initial material" and three coated with "aged material" as described in 4.7.4.2.1 shall be maintained at room temperature for 24 hours, the coatings stripped carefully from the panels and the thickness measured at the midsection of the test strip. The midsection of the strip shall be the area bounded by lines 1/8 inch (0.32 cm) on either side of the horizontal centerline and 3/8 inch (0.93 cm) in from each edge. The coatings stripped from the test panels of "initial material" shall be used for the transparency and exudation tests (see 4.7.7 and 4.7.8).

4.7.7 Transparency (Type II only). The stripped initial film from the film forming characteristics panels described in paragraph 4.7.6 shall be placed over a white typewritten sheet of paper. The typing must be clearly legible through the film.

4.7.8 Exudation (loss of liquid and volatile constituents). Three test pieces of the compound from "initial material" (see 4.6.6), approximately 2 inches by 3 inches by 0.050 inch (5.0 by 7.62 by 0.12 cm) to 0.100 inch (0.25 cm) in thickness shall be carefully blotted or wiped, weighed, and then hung in an oven at $160 \pm 3^{\circ}\text{F}$ (71°C) for a period of 24 hours. At the end of this period, the test pieces shall be removed from the oven, cooled to room temperature, and any free liquid on the surface of the pieces carefully wiped off by means of a soft absorbent cloth. After wiping, the test pieces shall be reweighed and the percentage loss of liquid and volatile constituents calculated from the loss in weight. The average loss of the 3 test pieces shall be reported.

4.7.9 Strippability and flexibility.

4.7.9.1 At room temperature. Three steel panels coated with "initial material" and 3 coated with "aged material" in accordance with 4.7.4.2.1 shall be maintained at room temperature (70° to 77°F) (21° to 25°C) for 24 hours. The coating shall then be stripped from the panels by removing the coating from the bottom and side edges with a pen-knife, then inserting the blade of the knife under the coating for a distance of not more than 0.5 inch (1.27 cm) to start the stripping. After stripping, the coating shall be bent through an angle of 180° over a 1/8-inch (0.32-cm) mandrel.

4.7.9.2 At minus 65°F (-54°C) (Type II only). Three steel panels coated

MIL-P-149D

with "aged material" in accordance with 4.7.4.2.1 shall be maintained at room temperature for 24 hours, then placed in a cold box at minus $65 \pm 3^{\circ}\text{F}$ (-54°C) for 2 hours. Strip the panels as described in 4.7.9.1. After stripping, the coating shall be bent through an angle of 180° over a 1/8-inch (0.32-cm) mandrel. The mandrel and asbestos gloves used in the bend test shall be placed in the cold chamber and cooled to the temperature of the test panels.

4.7.9.3 After oxygen bomb test (Type II only). Two steel panels coated with "initial material" in accordance with 4.7.4.2.2 shall be maintained at room temperature for 24 hours, then placed in an oxygen bomb for 72 hours. The oxygen bomb shall be maintained at an oxygen pressure of 100 ± 3 pounds per square inch (0.69 ± 0.02 MPa) and a temperature of $160 \pm 3^{\circ}\text{F}$ ($71 \pm 2^{\circ}\text{C}$). The panels shall be stripped as described in 4.7.9.1.

4.7.10 Corrosion resistance.

4.7.10.1 Resistance to humidity. Three panels each of steel, copper, and aluminum coated with "initial material" as described in 4.7.4.2.2 shall be subjected to a temperature of $100 \pm 3^{\circ}\text{F}$ ($38 \pm 2^{\circ}\text{C}$) and a relative humidity of 100 percent for 720 hours in a humidity cabinet conforming to Appendix I of ASTM D1748. The coating shall then be removed and the panels examined for evidence of corrosion.

4.7.10.2 Resistance to cycling. Three steel panels coated with "initial material" in accordance with 4.7.4.2.2 shall be subjected to the following cycle for 10 days:

- (a) 16 hours at $100^{\circ} \pm 3^{\circ}\text{F}$ ($38^{\circ} \pm 2^{\circ}\text{C}$) and 100 percent relative humidity (see 4.6.10.1).
- (b) 3 hours at minus $40^{\circ} \pm 3^{\circ}\text{F}$ ($-40^{\circ} \pm 2^{\circ}\text{C}$).
- (c) 2 hours at $160^{\circ} \pm 3^{\circ}\text{F}$ ($71^{\circ} \pm 2^{\circ}\text{C}$).
- (d) 3 hours immersion in a 5 percent (by weight) sodium chloride solution at room temperature (70° to 77°F) (21° to 25°).

If it is necessary to interrupt this cycle for 24 hours, the panels may be left in the 100°F (38°C) temperature and 100 percent humidity cabinet. Not more than two interruptions shall be permitted; the interruptions shall not be counted as part of the 10 day cycle. After 10 complete cycles, the coating shall be removed and the panels examined for evidence of corrosion.

4.7.10.3 Resistance to oxygen bomb and humidity (Type II only). Two panels each of steel, copper and aluminum coated with Type II "initial material" in accordance with 4.7.4.2.2 shall be maintained at room temperature for 24 hours then placed in an oxygen bomb for 72 hours. The oxygen bomb shall be maintained at an oxygen pressure of 100 ± 3 psi (0.69 ± 0.02 MPa) and a temperature of $160 \pm 3^{\circ}\text{F}$ ($71 \pm 2^{\circ}\text{C}$). After removal from the oxygen bomb, the panels shall be placed in a humidity cabinet maintained at $100 \pm 3^{\circ}\text{F}$ (38

+ 2°C) and 100 percent relative humidity. After 120 hours in the humidity cabinet, the panels shall be removed, the coating stripped, and the metal examined for evidence of corrosion.

4.7.11 Impact test (Type II only). Six steel panels coated with "aged material" in accordance with 4.7.4.2.1 shall be placed in a cold chamber at minus 65 + 3°F (-54 + 2°C) for 24 hours. A steel ball weighing 430 grams (15.5 oz) 1-7/8 in. diameter (4.75 cm) shall be dropped from a height of 60-62 inches (152.40-157.48 cm) on the coated panel. The panel shall be supported on a flat concrete floor and the elapsed time between removal of the panel from the cold chamber and the dropping of the ball shall not exceed 5 seconds. The coating shall be examined for compliance with 3.11.

4.7.12 Tensile strength and elongation.

4.7.12.1 Preparation of test strips. Tensile strips of both "initial material" and "aged material" shall be cast on flat-plate glass approximately 24 by 48 inches (60.96 by 120.92 cm) using an applicator^{1/} which consists of a bronze bushing or hollow cylinder (about 3 in. (7.62 cm) in diam.), one end (the bottom) of which has a portion of the rim milled out to the necessary depth. The applicator with the opening in the rear is set on the plate glass. Some of the conditioned coating compound at the temperature specified in 4.7.2.2 is put into the applicator and it is then moved over the uncoated space at a uniform rate. When the applicator and glass plate are cold, the tensile specimens may be porous; in which case the plate is warmed by making several casts. A sufficient quantity without flaws shall be cast to permit the cutting of at least 10 specimens of both the "initial" and "aged" materials. The cast strips shall be allowed to cool and set. After approximately 2 hours the strips shall be placed on blotting paper backed by a clean, smooth wood surface and cut with a sharp die to form a dumbbell. The central narrow part of the cut strip shall be at least 2-1/2 inches (6.35 cm) long, 7/16 to 9/16 of an inch (1.10 to 1.42 cm) wide and 0.030 to 0.050 of an inch (0.76 to 0.12 cm) thick. The allowable variation in any one cut strip shall be not more than 0.002 inch (0.005 cm) in thickness and 0.005 inch (0.012 cm) in width. Actual measurements for the cross sectional area shall be made to the nearest 0.001 inch (0.002 cm), and the smallest measured dimensions shall be used for calculating the cross section of the specimen. The portions to be placed in the jaws of the machine shall be substantially wider than the remainder of the specimen to ensure a break in the measured central portion of the piece. Test specimens having air bubbles, depressions, scratches, holes, sudden changes of direction, or any similar flaw shall be discarded since they will cause breaking of the sample at the flaw and at loads much lower than the normal capacity of the material. The specimens shall be conditioned at a temperature of 73.4 + 2°F (23 + 1°C) and a relative humidity of 50 + percent for 24 hours prior to being tested.

^{1/}An instrument of this type (Parks Film-O-Graph) is described in "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors", Gardner and Sward.

MIL-P-149D

4.7.12.2 Test procedure. Specimens shall be tested in any tensile testing machine which is available provided the applied loads may be read to an accuracy of plus or minus two percent. (Machines such as the "Scott Film Tester" or equivalent will be suitable.) An interval of two inches (5.08 cm) shall be accurately marked off along the narrow part of the dumbbell shaped specimen by means of a soft crayon pencil or india ink so as not to scratch the surface. The test load shall be applied at a rate which will cause an elongation of 0.5 inch (1.27 cm) every 10 plus or minus 2 seconds. The increase in length of the interval and the amount of tension shall be measured at the instant of breaking and the percent elongation calculated. The final tensile and elongation readings shall be an average of ten specimens breaking within the two inch (5.08 cm) interval. If only one result is more than ten percent lower than the arithmetic average, the average shall be accepted. If two or more individual results are more than ten percent lower than the arithmetic average, five additional specimens shall be tested and the new arithmetic average shall be computed.

4.7.13 Plasticity. At least 5 cylinders of the "initial material", 0.5 ± 0.003 inch (1.27 ± 0.007 cm) in diameter and 0.5 ± 0.003 inch (1.27 ± 0.007 cm) in height shall be cast in a suitable mold. Suitable molds can be made by drilling 0.5 inch (1.27 cm) diameter holes through 2.5 inch (6.35 cm) long bar stock 0.5 inch (1.27 cm) thick. Excess compound shall be cast into and over these holes so that after cooling and cutting there will be no pockets or depressions in the cylinders. Cylinders thus prepared shall be heated in an oven at $160 \pm 3^{\circ}\text{F}$ ($71 \pm 2^{\circ}\text{C}$) for a period of 24 hours. While the cylinders are still in the oven, a total load of 11 pounds (5 kg) shall be applied to the upper surface of each cylinder by means of a suitable fixture also heated in the oven at 160°F (71°C) for at least 1 hour. The load shall be applied vertically and evenly by means of the fixture which shall have freely moving parallel plates at least 3 inches (7.62 cm) in diameter. (A Williams plastometer or similar equipment will be suitable.) After 5 minutes of load application, the height of each cylinder shall be measured at 160°F (71°C) and under load. The average compressed thickness of the 5 cylinders shall be reported.

4.8 Rejection.

4.8.1 Rejection by examination of filled containers. Any container in the sample having one or more defects of under required fill shall be rejected. If the number of defective containers in any sample exceeds the acceptance number of the appropriate sampling plan of MIL-STD-105, the lot represented by the sample shall be rejected.

4.8.2 Rejection by testing. A lot shall be rejected for failure of the sample to comply with any requirement of Section 3 when tested in accordance with 4.7.

4.9 Reinspection.

4.9.1 Re-examination after rejection (see 4.8.1). Re-examination shall be performed in accordance with MIL-STD-105.

4.9.2 Retesting after revision (see 4.8.2). Rejected lots may be resubmitted for acceptance tests provided the contractor has removed or reworked all nonconforming products. Coating compound rejected after retest shall not be resubmitted without specific approval of the procuring agency.

4.10 Comparison inspection. Compounds shall be subjected to comparison inspection which shall comprise all the tests of this specification. These tests may be conducted any time after the date of original qualification and failure to comply with the requirements will be considered as a basis for removal of the product from the Qualified Products List. These tests may be conducted on inspection samples or on samples requested of the manufacturer.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or commercial as specified (see 6.2).

5.1.1 Level A. The coating compound shall be supplied in block form in one of the following manners, as specified in the contract or order (see 6.2). When no block size is specified, large blocks shall be supplied.

5.1.1.1 Large blocks. Each block shall not exceed 14 inches (35.56 cm) in length, 10 inches (25.40 cm) in width and 5 inches (12.70 cm) in thickness and shall not exceed 15 pounds (6.75 kg) in weight. Each block shall be wrapped with greaseproof barrier material or 0.0015 inch (0.0038 cm) minimum thickness aluminum foil and packaged in a fiberboard box conforming to PPP-B-636, class weather resistant. At the option of the manufacturer, the compound shall be poured directly into aluminum foil lined fiberboard boxes.

5.1.1.2 Small blocks. Blocks shall be supplied in size and weight as specified in the contract or order (see 6.2 and 6.4). A maximum of 50 pounds (22.50 kg) of the blocks shall be packaged in a container conforming to PPP-B-636, class weather resistant which is lined with greaseproof barrier material or aluminum foil. Closure of the boxes shall be in accordance with the appendix to PPP-B-636.

5.1.2 Commercial. The coating compound shall be packaged in accordance with normal commercial practice. The complete package shall be designed to protect the compound against damage during shipment, handling and storage.

5.2 Packing. Packing shall be level A or commercial, as specified (see 6.2).

5.2.1 Level A. The coating compound, packaged as specified in 5.1.1, shall be packed in a close fitting box conforming to PPP-B-636, class weather resistant. The box shall be closed, waterproofed and reinforced in accordance with the appendix of PPP-B-636.

5.2.2 Commercial. The coating compound, packaged as specified in 5.1.2, shall be packed in a manner that will insure acceptance by common carrier and

MIL-P-149D

provide product protection against loss and damage during multiple shipments, handling and storage. The shipping container shall be in compliance with the National Motor Freight Classification and Uniform Freight Classification.

5.3 Marking. Marking shall be as specified in the contract or order.

6. NOTES

6.1 Intended use. The coating compound described in this specification is a strippable protective compound for the preservation and packaging of metallic parts made from copper, steel or aluminum; such as gears, dies, drill bits, bearings, etc.

6.1.1 Type I. Type I compounds should be used when expected ambient temperatures range from 10°F (-12°C) to 160°F (71°C). Parts preserved and packaged with Type I compounds will withstand temperatures lower than 10°F (-12°C) but no excessive or rough handling at the lower temperatures. Type I compound ranges in color from near transparent to practically opaque, therefore, should be used when an exterior label or the size and shape of an object will serve to identify it.

6.1.2 Type II. Type II compounds should be used when expected ambient temperatures range from minus 65°F (-54°C) to 160°F (71°C) and where transparency is required.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Type of strippable coating compound required (see 1.2).
- (c) Both the level of packaging and the level of packing required (see 5.1 and 5.2).
- (d) Size and weight of block desired if other than large blocks (see 5.1.1.2).
- (e) Special marking if required (see 5.3).
- (f) When a material safety data sheet is required (see 3.2.1).

6.3 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 suppliers is called to this requirement and manufacturers are urged to arrange to have products that they propose to offer the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the product covered by this specification. The activity responsible for the Qualified Products List is the U.S. Army Belvoir Research and Development Center, Materials, Fuels Lubricants Laboratory, ATTN: Organic and Chemical Coatings Research Group, STRBE-V0. Information pertaining to qualification of products may be obtained from that activity.

6.4 Large size blocks as specified in paragraph 5.1.1.1 are recommended for long term storage rather than the smaller size blocks which are less stable due to exudation and oxidation. The smaller size blocks although more

expensive are desirable because they melt faster when added to a hot dipping tank and eliminate premelt cutting. Blocks approximately 2 by 2 by 1/2 inch (5.08 by 5.08 by 1.27 cm) and weighing 2 ounces (56 g) have been supplied by industry, as well as larger blocks of one pound (0.45 kg) or more.

6.5 Formulations.

6.5.1 Type I. Compounds which have met the Type I requirements of this specification have contained approximately 25 percent ethyl cellulose.

6.5.2 Type II. Compounds which have met the Type II requirements of this specification have been formulated using cellulose acetate butyrate. The formulas listed in Table IV for Type II coating compound were found to produce materials which conformed to the requirements of this specification. However, the Government assumes no responsibility for the acceptance of a product claimed to be manufactured under any identical formula.

TABLE IV. Type II Formulation

Ingredients	Formulation, % by weight				
	A	B	C	D	E
Cellulose acetate butyrate (EAB 500-5)	42.8	42.8	42.8	42.8	42.8
Polyethylene glycol di-2 ethylhexoate (Flexol 4G0)	47.6	....	....	....	23.8
Di-2 ethylhexyl adipate	....	47.6	....	23.8	18.9
Di-octyl sebacate	....	....	47.6	23.8	....
Di-butyl sebacate	....	....	....	....	4.9
Neutral oil (Zerice)	8.9	8.9	8.9	8.9	8.9
Antioxidant (American Cyanamid #2246)	0.5	0.5	0.5	0.5	0.5
Pour point depressant (Enjay-Paraflow)	0.2	0.2	0.2	0.2	0.2

6.5.2.1 Caution. Heating Type II compounds can produce highly combustible distillate by-products with fire points considerably lower than the fire point of the compound. Exhaust ventilation systems should have fire prevention provisions to adequately handle these highly combustible by-products.

6.6 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement (ABC-NAVY-STD-17). When amendment, revision or cancellation of this specification is proposed which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization office, if required.

MIL-P-149D

Custodian:

Army - MR
Air Force - 99

Review Activities:

Army - GL, ME, ER

User activities:

Navy - AS, MC, OS, AR,

Preparing activity:

Army - MR

Project No. 8030-0511

(KBWP# ID-0373A/DISK 0109A. FOR AMMRC USE ONLY)

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification 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.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE ARMY



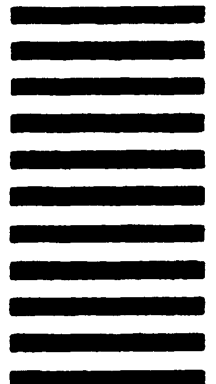
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO 12062 WASHINGTON D C

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE ARMY

Director
US Army Materials & Mechanics Research Center
ATTN: DRXMR-SMS
Watertown, MA 02172



STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL (See Instructions - Reverse Side)	
1. DOCUMENT NUMBER MIL-P-149D	2. DOCUMENT TITLE
3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION (Mark one) <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____
b. ADDRESS (Street, City, State, ZIP Code)	
5. PROBLEM AREAS	
a. Paragraph Number and Wording:	
b. Recommended Wording:	
c. Reason/Rationale for Recommendation:	
6. REMARKS	
7a. NAME OF SUBMITTER (Last, First, MI) - Optional	b. WORK TELEPHONE NUMBER (Include Area Code) - Optional
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional	8. DATE OF SUBMISSION (YYMMDD)