

INCH-POUND

MIL-C-47244A (MI)

30 October 1990

SUPERSEDING

MIL-C-47244 (MI)

26 July 1974

## MILITARY SPECIFICATION

### COATING, ABLATIVE RESISTANT

This specification is approved for use by the U.S. Army Missile Command, 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 the requirements for a two-component, room temperature curing, filled, thermosetting, modified epoxy resin system that resists abrasion and erosion at extreme temperatures.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army Missile Command, ATTN: AMSMI-RD-SE-TD-ST, Redstone Arsenal, AL 35898-5270 by using the 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.

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## SPECIFICATIONS

## FEDERAL

QQ-A-250/12	-	Aluminum Alloy 7075, Plate and Sheet
TT-S-735	-	Standard Test Fluids, Hydrocarbon
PPP-C-2020	-	Chemicals, Liquid, Dry and Paste: Packaging of

## MILITARY

MIL-H-5606	-	Hydraulic Fluid, Petroleum Base: Aircraft, Missile and Ordnance
MIL-R-6855	-	Rubber, Synthetic Sheets, Strips, Molded or Extruded Shapes, General Specification for
MIL-P-47215	-	Primer, Ablative Resistant Coating

## STANDARDS

## MILITARY

MIL-STD-129	-	Marking for Shipment and Storage
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(Unless otherwise indicated, copies of the federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 568	-	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Flexible Plastics in a Vertical Position
ASTM D 740	-	Standard Specification for Methyl Ethyl Ketone
ASTM D 792	-	Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement

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ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness

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

(Non-Government standards and other publications are normally available from the organizations that prepare or 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 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 First article sample. When required (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with Section 4.

3.2 Material. The material shall be a two-component, room-temperature curing, filled, thermosetting, modified epoxy resin system. The resin system is formulated by mixing a base resin and a curing agent as instructed by the manufacturer.

#### 3.3 Physical properties.

3.3.1 Appearance. The cured resin system shall be continuous and uniform in texture. The color shall not vary from lot to lot.

3.3.2 Specific gravity. The specific gravity of the cured resin system shall be not less than 1.2 nor more than 1.6.

3.3.3 Application time. The application time of the uncured resin system shall be not less than 60 minutes at room temperature, defined as  $25^{\circ} \pm 3^{\circ}$  Celsius (C).

3.3.4 Flow. The flow of the freshly mixed resin system shall be not more than 0.3 inch when a cylindrical section approximately 0.375 inch high and 1.50 inch in diameter is allowed to flow under its own weight on a vertical surface. In addition, the resin system shall retain a flow not more than 0.30 inch throughout the entire application time.

3.3.5 Hardness. Hardness of the cured resin system shall be as specified in table I.

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TABLE I. Hardness requirements.

Curing conditions	Hardness value
<b>Cond 1:</b> Room temperature for $24 \pm 2$ hours	Not less than 40 Shore D
<b>Cond 2:</b> Room temperature for 7 days	Not less than 55 Shore D
<b>Cond 3:</b> Room temperature for 3 hours, followed by $66 \pm 1^\circ\text{C}$ for 3 hours, followed by room temperature for not less than 3 hours	Not less than 55 Shore D

3.3.6 Low temperature stability. The cured resin system shall withstand exposure to a temperature of  $-54^\circ \pm 3^\circ\text{C}$  without cracking, checking, or loss of adhesion.

3.3.7 Humidity and heat resistance. The cured resin system shall withstand simultaneous exposure to a relative humidity of not less than 90 percent and temperature cycling as follows:

- a. A temperature of  $49^\circ \pm 3^\circ\text{C}$  for 3 days
- b. Returned in not less than 3 hours to  $-12^\circ \pm 3^\circ\text{C}$  and maintained at this temperature for not less than 30 minutes
- c. Uncontrolled stabilization at room temperature
- d. Increase to  $88^\circ \pm 3^\circ\text{C}$  in not less than 50 minutes, and maintained at this temperature for 4 hours.

No softening, sponging, blistering, checking, shrinking, or loss of adhesion shall occur. Weight of the resin system shall not increase more than 5 percent. Thickness of the resin system shall not increase or decrease more than 5 percent.

3.3.8 Tread resistance. The cured resin system, after continuous exposure for 72 hours (minimum) to a temperature of  $88^\circ \pm 3^\circ\text{C}$ , shall show no evidence of surface degradation or loss of adhesion as a result of foot traffic.

3.3.9 Low temperature impact resistance. The cured resin system, when stabilized at the temperature specified in 3.3.6, shall not shatter when impacted by a 0.5 pound steel ball dropped from heights up to 20 feet.

3.3.10 Flammability. The cured resin system shall be self extinguishing.

3.3.11 Hydrocarbon resistance. The cured resin system shall not have any loss of adhesion or be adversely affected after exposure to hydrocarbons. The

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hydrocarbon-exposed resin system shall be self-extinguishing in not more than 2 seconds after ignition has been effected.

3.3.12 Blast erosion. The cured resin system shall withstand the erosive effects of a supersonic blast, with erosive loss limited to a thickness of 0.080 inch. Blast conditions shall be as follows:

- a. Temperature and pressure above the surface of the resin system shall be not less than 2830°C and not less than 330 pounds per square inch gage (psig), respectively.
- b. Direction of the blast shall be  $90 \pm 5$  degrees with respect to the surface of the resin system.
- c. The chemical composition (by percent weight  $\pm 5$  percent) of the gas impinging on the resin system shall be:
 

(1) Steam	-	1.01.
(2) Hydrogen	-	3.47.
(3) Carbon monoxide	-	36.88.
(4) Nitrogen	-	7.94.
(5) Hydrogen chloride	-	20.47.
(6) Aluminum oxide	-	30.23.
- d. Duration of blast shall be not less than 90 milliseconds.

3.3.13 Shelf life. The shelf life of the base resin and curing agent shall be not less than 6 months from the date of manufacture when stored in original unopened container at a temperature not greater than 27°C.

3.3.14 Workmanship. The workmanship shall be such as to insure a high quality product which is uniform and in conformance with this specification.

#### 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 (examinations and tests) 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,

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unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection shall be conducted only on the first article sample and shall consist of all the examinations and tests specified herein.

4.4 Quality conformance inspection. Quality conformance inspection for acceptance of the resin system shall consist of the examinations and tests shown in table II.

TABLE II. Quality conformance inspection.

Examination and tests	Requirement paragraph	Test paragraph
Appearance	3.3.1	4.6.1
Specific gravity	3.3.2	4.6.2
Application time	3.3.3	4.6.3
Flow	3.3.4	4.6.4
Hardness	3.3.5	4.6.5

4.4.1 Lot size. Lot size shall consist of all the resin system submitted for acceptance at the same time which has been prepared by the same company without change in materials or processes in one continuous period of operation.

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4.4.2 Sampling. Unless otherwise specified (see 6.2), 1 pint of resin and 1 pint of curing agent from one unit representative of each lot shall be selected at random for quality conformance testing. Each container of resin and curing agent shall be considered as a unit of product. Failure of sample to meet the quality conformance requirements shall be cause for lot rejection.

4.5 Test methods.

4.5.1 Test conditions. Unless otherwise specified in the applicable test, all tests shall be performed at room temperature and at relative humidity between 40 and 60 percent.

4.5.2 Test panels. Unless otherwise specified in the applicable test, test panels shall consist of 9.50 inch squares of 0.50 inch thick aluminum conforming QQ-A-250/12, with the resin system applied to centered 5 inch squares on each aluminum square.

4.5.2.1 Precleaning. Prior to application of the resin system, the aluminum squares shall be cleaned by abrading the surface with 108 to 200 grit sandpaper, washed with methyl ethyl ketone (MEK) solvent conforming to ASTM D 740 and allowed to dry for 20 minutes, minimum.

4.5.2.2 Primer. A primer conforming to MIL-P-47215 shall be brush-coated on the cleaned aluminum squares and allowed to air-dry for not less than 30 minutes.

4.5.2.3 Application of resin system. The quantity of resin system required for testing, not less than 90 grams (g) of base resin, shall be mixed thoroughly in the proportion specified in 3.2 in not longer than 5 minutes, preferably by a standardized mechanical mixing method. Unless otherwise specified, the test panels shall have the resin system troweled on the aluminum squares to a thickness of not less than 0.165 inch nor more than 0.205 inch and cured at room temperature for 7 days. Except for the hardness tests (see 4.6.5), the resin system shall be tested within 3 days after cure.

4.6 Physical property tests.

4.6.1 Appearance. The appearance of the resin system shall be checked visually and shall be as specified in 3.3.1.

4.6.2 Specific gravity. The specific gravity of the resin system shall be determined in accordance with ASTM D 792 and shall be as specified in 3.3.2.

4.6.3 Application time. With the base resin, curing agent, and compound application gun stabilized at the conditions specified in 4.5.1 for not less than 8 hours, 90 grams or more of base resin shall be mixed thoroughly with the curing agent in the proportion specified in 3.2. The mixed resin system shall be promptly used to fill a

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standard 603 Semco compound gun cartridge, or equivalent, having a Semco 254 nozzle with an orifice diameter of not less than 0.120 inch nor greater than 0.130 inch. The gun and resin system shall be maintained at standard conditions throughout the test. The gun shall be attached to a constant supply of air or inert gas at not less than 85 psig not more than 95 psig. From two to three inches of the resin system shall be extruded initially to clear trapped air. At the end of 60 minutes, measured from the time mixing was begun, the resin system shall be extruded onto a suitable receptacle for 1 minute. The amount of resin system extruded during the 1-minute period shall be weighed and shall be not less than 20 g.

4.6.4 Flow. The flow test shall include initial flow and flow at the end of the application time and shall be conducted with a test jig as shown in figure 1. The flow test jig shall be placed on a table with the front face upward and with the plunger depressed to the limit of its travel. The application gun shall be filled and attached to the pressure source as specified in 4.6.3. Within 15 minutes after the beginning of the mixing, enough of the mixed resin system shall be extruded from the application gun to fill the recessed cavity of the jig. The resin system shall not be worked with the gun tip or a spatula but shall be leveled off even with the block by scraping with a spatula in two passes, each starting in the center and moving toward the sides of the jig. Within 10 seconds after the leveling operation, the jig shall be placed on its base and the plunger immediately advanced to the limit of its forward travel. The initial flow measurement shall be taken not less than 25 nor more than 35 minutes after the resin system has been applied to the test jig. The flow shall be measured from the point tangent to the lower edge of the plunger to the farthest point to which flow has occurred. The measured flow shall be not more than 0.3 inch. The flow test shall be repeated not less than 55 nor more than 65 minutes after the beginning of the mixing of the resin system. The final flow measurement shall be taken not less than 25 nor more than 35 minutes after the resin system has been applied to the test jig.

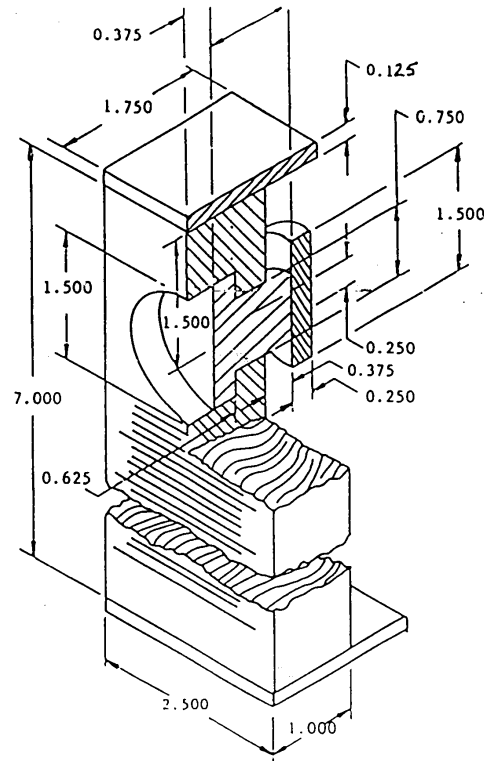
4.6.5 Hardness. Hardness tests for the resin system shall be in accordance with ASTM D 2240, except as follows:

4.6.5.1 Test panels. Test panels for the hardness tests shall be as specified in 4.5.2, except as follows:

- a. Thickness of the cured resin system shall be not less than 0.150 inch nor more than 0.1875 inch.
- b. The resin system shall be cured in accordance with conditions 1 and 2 of table I for first article testing, and in accordance with condition 3 of table I for quality conformance testing.



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MATERIAL: ALUMINUM ALLOY  
 DIMENSIONS ARE IN INCHES.  
 TOLERANCE:  $\pm 0.003$

FIGURE 1 Flow test jig.

4.6.5.2 First article hardness test. Curing conditions and hardness values for first article testing shall be as specified in table I for conditions 1 and 2.

4.6.5.3 Quality conformance hardness test. Curing conditions and hardness value for quality conformance testing shall be as specified in table I for condition 3.

4.6.6 Low temperature stability. Two room-temperaure test panels shall be placed in a temperature chamber for low temperature stability testing. The temperature shall be lowered to  $-54^{\circ} \pm 3^{\circ}\text{C}$  at a rate of 10 per minute. The test panels shall remain at this temperature for not less than 1 hour, after which they shall be examined. There shall be no evidence of cracking, checking, or loss of adhesion.

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4.6.7 Humidity and heat resistance. Two test panels shall be placed in a temperature-humidity chamber and subjected to the relative humidity level and temperature cycling as specified in 3.3.7. At the conclusion of the test period, the test panels shall be visually examined, weighed, and measured to ensure compliance with the requirements of 3.3.7.

4.6.8 Tread resistance. One test panel shall be placed in a temperature chamber and shall be subjected to a temperature of  $88^{\circ} \pm 3^{\circ}\text{C}$  for not less than 72 hours. The test panel shall be transferred directly from the temperature chamber to the platen of a Link spring checker, or equivalent, and a 0.75 inch thick by 3 inch diameter elastomer disk conforming to MIL-R-6855, class 2, grade 70, shall be positioned on the test panel as shown in figure 2. A force of  $200 \pm 10$  pounds shall be applied to the disk. With the disk held rigid, the test panel shall be twisted approximately 45 degrees clockwise, then approximately 90° counter clockwise, followed by approximately 45° clockwise. At the conclusion of the test, the resin system shall be examined and shall show no evidence of surface degradation or loss of adhesion.

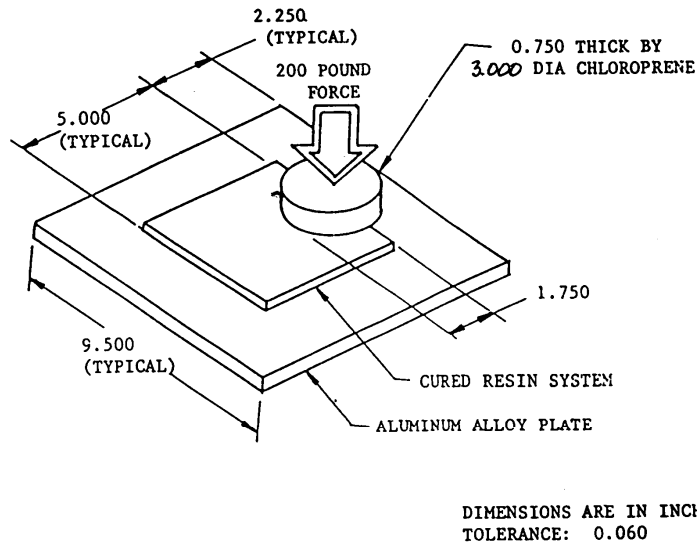
4.6.9 Low temperature impact resistance. Two test panels shall be placed in a temperature chamber and stabilized at  $-54^{\circ} \pm 3^{\circ}\text{C}$ . The test panels, while at this temperature, shall be tested for impact resistance. A steel ball weighing 0.5 pound shall be dropped from successively increasing heights in one foot intervals, starting at one foot until a height of 20 feet is attained. At the conclusion of the test, the resin system shall be examined and shall show no evidence of shattering or fracture.

4.6. Flammability. The cured system shall be tested for flammability in accordance with ASTM D 568. The cured resin system shall be self-extinguishing by this test.

4.6.11 Hydrocarbon resistance.

4.6.11.1 Resistance to hydraulic oil. Two test panels shall be half immersed in hydraulic oil conforming to MIL-H-5606 for not less than 55 minutes nor more than 65 minutes. Upon removal, excess oil shall be wiped from the test panels. A standard 0.375 inch Bunsen burner with air ports open to produce a blue flame approximately 1 inch high shall be placed under the test panel and adjusted so that the flame tip is just in contact with the portion of the resin system that had been immersed. At the end of 30 seconds the flame shall be removed and the test panel allowed to burn. In case the test panel does not continue to burn after the first ignition, the burner shall be placed under the test panel for a second period of 30 seconds immediately after the resin system ceases to burn. A stop watch shall be started when the flame is removed and the time elapsing before the resin system extinguishes itself shall be measured. Burning time shall be not more than 2 seconds.

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FIGURE 2. Tread resistance test setup.

4.6.11.2 Resistance to test fluid. The remaining half of each of the test panels shall be immersed in hydrocarbon test fluid conforming to TT-S-735, Type I, for not less than 25 minutes. Upon removal, the test panel shall be allowed to air-dry for not less than 30 minutes. The test specified in 4.6.11.1 shall be repeated except that the flame shall be applied to the portion of the resin system that had been immersed in the test fluid.

4.6.12 Blast erosion. The blast erosion test shall be performed using a combustion chamber capable of generating exhaust products having the composition and characteristics specified in 3.3.12. The nozzle of the combustion chamber shall have an exit-to-throat area ratio of  $5.5 \pm 0.1$ . A test panel having a known resin system thickness shall be placed in a temperature chamber controlled at  $94^\circ \pm 3^\circ\text{C}$  and allowed to remain at this temperature until stabilized. Within 5 minutes after removal from the temperature chamber, the test panel shall be exposed to the exhaust emanating from the combustion chamber for not less than 90 milliseconds. During exposure, the test panel shall be securely positioned, so that the surface of the resin system is downstream from and normal ( $\pm 5$  degrees) to the flow from the combustion chamber

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nozzle and at a distance of  $7 \pm 1$  nozzle exit diameters from the nozzle exit. The test panel shall be allowed to cool to room temperature. Minimum thickness of the impinged area shall then be measured. Loss of resin system from the test panel shall be not more than 0.080 inch.

4.6.13 Shelf life. The base resin and curing agent shall be tested for conformance with all applicable requirements specified herein after completion of the 6 month storage period. The supplier's certificate of compliance with 3.3.13 may be accepted during the storage period.

4.6.14 Workmanship. The coating covered by this specification shall be homogeneous and free of foreign materials. Containers shall be clean, uniformly filled, well-sealed and legibly marked (see 3.3.14).

4.6.15 Preservation, packaging, packing, and marking. The preservation, packaging, packing, and marking shall be examined to determine compliance with Section 5.

4.6.16 Inspection of packaging. The sampling and inspection of preservation, packaging, and container marking shall be in accordance with the requirements of PPP-C-2020.

## 5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking shall be Level A or B in accordance with PPP-C-2020.

5.2 Marking. In addition to any special marking required by the contract or purchase order (see 6.2), such as shelf life, storage and cure date markings, unit packages, intermediate packages, and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

## 6. NOTES

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

6.1 Intended use. The material covered by this specification is intended for use as an ablative resistant deck coating and thermal insulation. Up to a resin thickness of 0.200 inch can be applied to vertical surfaces without subsequent flow.

6.2 Acquisition requirements. Acquisition documents must specify the following:

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- a. Title, number, and date of the specification
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1)
- c. Whether first article is required, and if so, pertinent details for testing (see 3.1)
- d. Sampling plan if other than specified (see 4.4.2).
- e. Marking requirements, if other than specified in Section 5.

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerers whether the item(s) should be a first article sample, a first production item, or a number of items to be tested as specified in 4.3. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, approval of first article test results and disposition of first articles. Invitations for bids should provide that the government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Metrication. Metric equivalents in accordance with FED-STD-376 are acceptable for use in this specification.

6.5 Subject term (keyword) listing.

Covering materials  
 Paint, deck  
 Plating, ablative  
 Safety footings

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

Custodian:  
 Army - MI

Preparing Activity:  
 Army - MI

Civilian Coordinating Activity:  
 GSA-FSS

Project No. 8030-A129