

NOT MEASUREMENT SENSITIVE
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MIL-C-81904B(AS)  
31 MAY 1991  
SUPERSEDING  
MIL-C-81904A(AS)  
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## MILITARY SPECIFICATION

### COATING COMPOUND, THERMAL-INSULATION, ABLATIVE

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers an ablative coating for the exterior surfaces of aircraft ordnance to provide protection from high-flux thermal environments (see 6.1).

1.2 Classification. This specification covers one grade of asbestos-free thermal-insulating compound furnished in the colors listed below. The FED-STD-595 color number forms a portion of the item part number (see 1.2.1) and shall be specified in the solicitation (see 6.2):

Olive Drab - FED-STD-595 Color No. 24087  
Ghost Gray - FED-STD-595 Color No. 36375

Component B is a colorless liquid; however, for cataloging purposes, its color number identifier shall be 00000 (see 1.2.1).

1.2.1 Part number. For cataloging purposes, part numbers shall be coded in the following manner:

M81904B	-	XXXXX	-	X
Specification identifier		Color number identifier (see 1.2)		1 = Component A 2 = Component B

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Engineering Center, Systems Engineering and Standardization Department (Code 53), Lakehurst, NJ 08733-5100, 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

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## MIL-C-81904B(AS)

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents 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).

## SPECIFICATIONS

## FEDERAL

QQ-A-250/5	Aluminum Alloy, Alclad 2024, Plate and Sheet
QQ-S-698	Steel, Sheet and Strip, Low Carbon
TT-C-490	Cleaning Methods for Ferrous Surfaces and Pretreatment for Organic Coatings
PPP-D-729	Drums, Shipping and Storage, Steel, 55 Gallon (208 Liters)
PPP-P-704	Pails, Metal: (Shipping, Steel, 1 through 12 Gallons)

## MILITARY

MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4, JP-5, and JP-5/JP-8 ST
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-B-26701	Bottle, Screw Cap and Carboys, Polyethylene Plastic
MIL-P-26915	Primer Coating, Zinc Dust Pigmented, for Steel Surfaces
MIL-P-87938	Peroxide, Methyl Ethyl Ketone, Technical

## STANDARDS

## FEDERAL

FED-STD-141	Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing
FED-STD-406	Plastics: Methods of Testing
FED-STD-595	Colors Used in Government Procurement

## MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-147	Palletized and Containerized Unit Loads 40 Inch by 48 Inch Pallets, Skids, Runners, or Pallet Type Base
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-1648	Criteria and Test Procedures for Ordnance Exposed to an Aircraft Fuel Fire
MIL-STD-2105	Hazard Assessment Tests for Navy Non-Nuclear Ordnance

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Naval Publications and Printing Service Office, Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094).

MIL-C-81904B(AS)

2.1.2 Other Government documents and publications. The following other Government documents and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

CODE OF FEDERAL REGULATIONS

29 CFR 1910.1200 Occupational Safety and Health Standards - Hazard Communications

49 CFR 171-178 Department of Transportation Regulations for the Transportation of Explosives and Other Dangerous Articles by Land and Water

(Application for copies of the Code of Federal Regulations (CFR) should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402).

DRAWINGS

DEPARTMENT OF THE NAVY

NAVAL AIR SYSTEMS COMMAND

4902393 Body Assembly, Bomb, GP, 500 Pound, Thermally Protected, MK 82 MOD 2, Loaded

(Application for copies of 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 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 issue(s) of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARD INSTITUTE

ANSI Z129.1 American National Standard for the Precautionary Labeling of Hazardous Industrial Chemicals

(Application for copies of the above listed documents should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018).

## MIL-C-81904B(AS)

2.2 Non-Government publications, continued

## AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM D 522	Mandrel Bend Test of Attached Organic Coatings
ASTM D 638	Tensile Properties of Plastics
ASTM D 1014	Conducting Exterior Exposure Tests of Paints on Steel
ASTM D 1475	Density of Paint, Varnish, Lacquer, and Related Products
ASTM D 1729	Visual Evaluation of Color Differences of Opaque Materials
ASTM D 1951	Ash in Drying Oils and Fatty Acids
ASTM D 2240	Rubber Property, Durometer Hardness
ASTM D 2247	Coated Metal Specimens at 100% Relative Humidity
ASTM D 2471	Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Plastic Compositions

(Application for copies of the above listed documents should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187).

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 Qualification. The coatings furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable Qualified Products List (QPL) at the time set for opening of bids (see 4.3 and 6.3). Any change in the formulation of a qualified product will necessitate its requalification. The material supplied under contract shall be identical, within manufacturing tolerances, to the product(s) receiving qualification.

3.2 Composition. The coating compound furnished under this specification shall consist of two separately packaged components. Component A shall consist of a pigmented, solventless, sprayable polyester resin. Component B, the catalyst, shall consist of a modified methyl-ethyl-ketone peroxide, conforming to 3.4.2.

3.2.1 Mixing ratio. The mixing ratio for spray application of the coating system shall be:

Component	Parts by weight
A (Resin)	35
B (Catalyst)	1

See 6.9 for the recommended mixing ratio for non-spray application.

## MIL-C-81904B(AS)

**3.2.2 Materials.** Materials used in the formulation of this coating compound shall be of such quality to meet all of the requirements of and produce coating compounds conforming to this specification.

**3.3 Toxicity.** The material covered by this specification shall have no adverse effect on the health of personnel when used for its intended purpose and in accordance with the precautions of 5.3.1 and 5.3.2. Material Safety Data Sheets (MSDS) shall be prepared and submitted in accordance with FED-STD-313 and shall meet the requirements of 29 CFR 1910.1200. One copy of the MSDS shall accompany the samples being submitted to the qualifying activity for testing (see 4.3.2). Questions pertinent to the effects of this material on the health of personnel shall be referred, by the contracting agency, to the appropriate departmental medical service who will act as an advisor to the contracting agency (see 4.3.2 and 6.4). The formulation of this coating shall preclude the use of asbestos.

### 3.4 Component requirements.

**3.4.1 Component A (Resin).** Component A shall conform to the requirements specified in 3.4.1.1, 3.4.1.2, and Table I.

**3.4.1.1 Condition in container (Component A).** Component A, when packaged and stored in a closed container and maintained at  $60^{\circ} \pm 20^{\circ}\text{F}$  ( $15^{\circ} \pm 11^{\circ}\text{C}$ ) for a minimum period of six (6) months from the date of delivery to the procuring activity, shall be capable of being mixed by hand with a paddle, to a smooth, homogeneous condition, free of pigment flotation, grit, seeds, skins, or lumps, in accordance with 4.6.2.1. There shall be no evidence of hard or objectionable settling which cannot be readily dispersed. Component A shall spray satisfactorily, as specified in 3.5.2. Skinning will be permitted, provided that its removal does not affect the sprayability of the material.

**3.4.1.2 Accelerated stability (Component A).** Component A, after exposure to the conditions specified in 4.6.2.2, shall be tested for conformance to the requirements specified in 3.4.1.1 and Table I.

TABLE I. Component A requirements.

Characteristics	Requirements		
	Minimum	Maximum	Test Paragraph
Viscosity (centipoise) $150^{\circ} \pm 2^{\circ}\text{F}$ ( $66^{\circ} \pm 1^{\circ}\text{C}$ )	50,000	100,000	4.6.2.3
Density, lbs./gallon ( $\text{g}/\text{cm}^3$ )	11.4 (1.37)	11.8 (1.42)	4.6.2.5
Ash Content (Percent by weight)	27.5	31.5	4.6.2.6

## MIL-C-81904B(AS)

3.4.2 Component B (Catalyst). Component B shall conform to the requirements defined in 3.4.2.1 and MIL-P-87938 grade B or C, with the exceptions noted below:

Characteristic	Requirement
Active oxygen (minimum)	7.5 percent
Specific gravity, 25°C (77°F) (minimum)	1.1
Refractive index, 25°C (77°F) (minimum)	1.45
Flash point and viscosity	Not required

3.4.2.1 Storage stability (Component B). Component B, when packaged and stored in a closed container for a minimum period of six (6) months from the date of delivery to the procuring activity, and maintained at 40° ± 5°F (4° ± 2°C), shall conform to all of the requirements specified in 3.4.2.

### 3.5 Working properties.

3.5.1 Reaction time. Components A and B, when mixed at the ratio specified in 3.2.1 and tested in accordance with 4.6.3.1, shall have a reaction time of 6.5 to 11.5 minutes.

3.5.2 Application. The coating compound, when mixed at the ratio specified in 3.2.1, shall be capable of being sprayed without sag on a vertical surface to a minimum thickness of 0.08 inch (2 mm).

### 3.6 Coating properties.

3.6.1 Thermal efficiency. The thermal efficiency of the coating compound shall be a minimum of 1.0 second per 0.001 inch (0.025 mm) to reach a backface temperature of 500°F (260°C), when tested in accordance with 4.6.4.1 through 4.6.4.1.2.

3.6.2 Tensile properties. The minimum tensile properties of the coating compound, when tested in accordance with 4.6.4.2, shall be as follows:

Temperature	Ultimate Strength	Elongation at break
75°F (24°C)	500 psi (3.45 MPa)	8.0 percent
140°F (60°C)	250 psi (1.73 MPa)	5.0 percent

## MIL-C-81904B(AS)

3.6.3 Color.

3.6.3.1 Olive Drab. The color and gloss of the cured Olive Drab coating compound, when tested in accordance with 4.6.4.3, shall be a good visual match to FED-STD-595 color number 24087.

3.6.3.2 Ghost Gray. The color and gloss of the cured Ghost Gray coating compound, when tested in accordance with 4.6.4.3, shall be a good visual match to FED-STD-595 color number 36375.

3.6.4 Hardness. The cured coating compound, when tested in accordance with 4.6.4.4, shall have a minimum Shore D hardness of 55.

3.6.5 Adhesion. The cured coating compound, when tested in accordance with 4.6.4.5, shall exhibit no adhesive failure. Cracking of the coating is acceptable and shall not be cause for rejection.

3.7 Resistance properties.

3.7.1 Lubricating oil resistance. The coating compound, when tested in accordance with 4.6.5, shall withstand immersion in oil for 4 hours at  $250^{\circ} \pm 4^{\circ}\text{F}$  ( $121^{\circ} \pm 2^{\circ}\text{C}$ ). Four hours after removal, the film shall exhibit no blistering, film softening, or other film defects. Discoloration shall not be cause for rejection.

3.7.2 Impact resistance. The coating compound, when tested in accordance with 4.6.6 through 4.6.6.2, shall require more than 40 inch-pounds (in.-lbs.) (55 Newton-meters (N-m)) on direct (coated surface) impact and 10 in.-lbs. (14 N-m) minimum on reverse impact before cracking or flaking is evident.

3.7.3 Humidity resistance. The coating compound shall be tested for resistance to humidity, in accordance with 4.6.7. Upon removal from the humidity cabinet, the coating shall have a minimum Shore D hardness of 50.

3.7.4 Resistance to temperature shock. The coating compound shall exhibit no evidence of cracking, loss of adhesion, or film deterioration when tested in accordance with 4.6.8.

3.7.5 Weather resistance. The coating compound shall exhibit no evidence of cracking or loss of adhesion after exposure to the conditions specified in 4.6.9.

3.8 Environmental performance requirements.

3.8.1 Temperature and humidity cycling. The coating compound shall exhibit no loss of adhesion, nor any excessive cracking or blistering, when applied to three MK 82, 500 pound bombs in accordance with Naval Air Systems Command Drawing Number 4902393, and tested in accordance with 4.6.10.

## MIL-C-81904B(AS)

3.8.2 Vibration. The three MK 82 bombs subjected to the temperature and humidity cycling test (see 3.8.1) shall be used for testing the coating compound for the requirements specified in 3.8.2.1 through 3.8.2.3.

3.8.2.1 Transportation. The coating compound shall exhibit no loss of adhesion, nor any evidence of excessive cracking or flaking after subjection to the transportation vibration test specified in 4.6.11.

3.8.2.2 Shipboard. The coating compound shall exhibit no loss of adhesion, nor any evidence of excessive cracking or flaking after subjection to the shipboard vibration test specified in 4.6.11.

3.8.2.3 Aircraft. The coating compound shall exhibit no loss of adhesion, nor any evidence of excessive cracking or flaking after subjection to the aircraft vibration test specified in 4.6.11.

3.8.3 Fast cook-off. The three MK 82 bombs subjected to the temperature and humidity cycling (see 3.8.1) and the vibration (see 3.8.2 through 3.8.2.3) tests shall be eight minutes minimum to reaction when tested in accordance with 4.6.12.

3.9 Workmanship. Components A and B shall be processed in a such manner that will produce the highest quality material necessary to meet the requirements of this specification. Each component shall be free of solvents, uniform in quality and consistency after stirring, and free of agglomerates or foreign particles. There shall be no other defects present that would render the end product unsuitable for its intended purpose.

#### 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) specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facility 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all of the requirements specified in 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.



## MIL-C-81904B(AS)

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

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

4.2.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the test method document or the applicable paragraph of this specification.

4.3 Qualification inspection. Qualification inspection shall consist of all the tests specified in section 3 and Table II.

4.3.1 Qualification inspection sample. Qualification inspection samples for each color (see 1.2) shall consist of 1.0 gallon (3.79 liter) of Component A and 0.5 pint (0.24 liter) of Component B. The material shall be furnished in containers of the type to be used in filling contract orders. Samples shall be identified as follows and forwarded to the laboratory designated in the letter of authorization (see 6.3):

- Qualification test samples
- Specification MIL-C-81904B(AS),  
Color \_\_\_\_\_, Component (A or B, as applicable).
- Coating Compound, Thermal-Insulation, Ablative.
- Manufacturer's name and product number.
- Submitted by (name and date) for qualification testing in accordance with authorization (reference authorization letter).

4.3.2 Test report. In addition to the qualification test samples, the manufacturer shall furnish a test report showing that the material satisfactorily conforms to the requirements of this specification. Material safety data sheets shall be prepared and submitted in accordance with FED-STD-313 and 29 CFR 1910.1200 (see 3.3).

4.3.3 Retention of qualification. In order to retain qualification of products approved for inclusion in the Qualified Products List (QPL), the manufacturer shall verify by certification to the qualifying activity that his product(s) comply with the requirements of this specification. Unless otherwise specified by the qualifying activity, the time of periodic verification by certification shall be in two-year intervals from the date of original qualification and shall be initiated by the qualifying activity.

## MIL-C-81904B(AS)

TABLE II. Qualification inspection.

Characteristic	Requirement Paragraph	Test Method Paragraph
<u>Component A</u>		
Condition in container	3.4.1.1	4.6.2.1
Accelerated stability	3.4.1.3	4.6.2.2
Viscosity	Table I	4.6.2.3
Density	Table I	4.6.2.5
Ash content	Table I	4.6.2.6
<u>Component B</u>		
Physical properties	3.4.2	---
Storage stability	3.4.2.1	---
<u>Admixture</u>		
Reaction time	3.5.1	4.6.3.1
Application	3.5.2	---
Thermal efficiency	3.6.1	4.6.4.1
Tensile properties	3.6.2	4.6.4.2
Color	3.6.3	4.6.4.3
Hardness	3.6.4	4.6.4.4
Adhesion	3.6.5	4.6.4.5
Lubricating oil resistance	3.7.1	4.6.5
Impact resistance	3.7.2	4.6.6
Humidity resistance	3.7.3	4.6.7
Resistance to		
temperature shock	3.7.4	4.6.8
Weather resistance	3.7.5	4.6.9
Temperature and		
humidity cycling	3.8.1	4.6.10
Transportation vibration	3.8.2.1	4.6.11
Shipboard vibration	3.8.2.2	4.6.11
Aircraft vibration	3.8.2.3	4.6.11
Fast cook-off	3.8.3	4.6.12

## MIL-C-81904B(AS)

4.4 Quality conformance inspection. Quality conformance inspection shall consist of all examinations specified in Table III.

TABLE III. Quality conformance inspection.

Characteristic	Requirement Paragraph	Test Method Paragraph
<u>Component A</u>		
Condition in container	3.4.1.1	4.6.2.1
Viscosity	Table I	4.6.2.3
Density	Table I	4.6.2.5
Ash content	Table I	4.6.2.6
<u>Component B</u>		
Physical properties	3.4.2	---
<u>Admixture</u>		
Reaction time	3.5.1	4.6.3.1
Color	3.6.3	4.6.4.3
Hardness	3.6.4	4.6.4.4
Adhesion	3.6.5	4.6.4.5
Lubricating oil resistance	3.7.1	4.6.5

4.4.1 Lot formation. A lot shall consist of all the coating compound, of the same color, produced by one manufacturer during a period not to exceed 24 hours, at one plant, from the same materials, and under essentially the same manufacturing conditions, provided that the operation is continuous. In the event that the process is a batch operation, each batch shall constitute a lot (see 4.4.1.1).

4.4.1.1 Batch. A batch is defined as that quantity of material which has been manufactured by some unit chemical process, or subjected to some physical mixing operation, intended to make the final product substantially uniform.

4.4.2 Sampling for tests. Quality conformance test samples shall consist of one gallon (3.79 liter) of Component A and 1/2 pint (0.24 liter) of Component B selected from each lot in accordance with FED-STD-141, Method 1022. Each container shall be labeled with complete information regarding the lot and batch numbers, date of sampling, contract number and applicable specification.

## MIL-C-81904B(AS)

4.4.2.1 Sampling for examination for container fill. A random sample of filled containers shall be selected in accordance with MIL-STD-105, Inspection Level S-4, Acceptable Quality Level (AQL) of 2.5 percent defective for examinations as specified in 4.4.3.2.1.

4.4.2.2 Retention sample. At least one quart (0.94 liter) of each component of the coating material shall be selected at random from each batch by an authorized Government representative and forwarded to the laboratory designated by the procuring activity.

4.4.2.2.1 Batch data. With each sample, the manufacturer shall furnish a certified test report showing that the material satisfactorily meets the quality conformance requirements (4.4). In addition, the manufacturer shall certify that there has been no formulation or process change from that which resulted in the production of the qualification inspection sample.

#### 4.4.3 Examinations.

4.4.3.1 Tests. The quality conformance tests shall consist of all the tests specified in 4.4 and Table III. There shall be no failures. Samples for tests shall consist of one lot of coating compound.

4.4.3.2 Examination of packaging packing and marking. An examination shall be made to determine that packaging, packing and marking comply with the requirements of section 5 of this specification. Samples shall be selected in accordance with 4.4.2. Defects shall be scored in accordance with the list below.

Examination	Defect
Packaging and packing	<ul style="list-style-type: none"> <li>• Container not as specified, closures not accomplished by specified or required methods or materials.</li> <li>• Leakage or seepage of contents.</li> <li>• Non-conforming component, component missing, damaged or otherwise defective component.</li> <li>• Bulged or distorted container.</li> </ul>
Marking	<ul style="list-style-type: none"> <li>• Data, including directions for use, omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.</li> </ul>

Any package having one or more defects shall be rejected. If the number of defective packages exceeds the Acceptable Quality Level (AQL) of 2.5 percent defective, in accordance with MIL-STD-105, the lot shall be rejected.

## MIL-C-81904B(AS)

4.4.3.2.1 Examination for container fill. The sample size shall be as specified in 4.4.2.1, with the exception that the sample size derived from MIL-STD-105 shall be rounded off to the next highest increment of five. At no time shall the sample size be less than five. If the lot consists of less than five containers, all containers shall be used to examine the fill. The lot shall be rejected if the average weight per container is less than that specified.

4.4.3.2.2 Examination of product. Conformance of the coating compound to the requirements for workmanship and any other requirements not covered by specific tests shall be determined by appropriate visual examination.

4.4.3.2.3 Examination for palletization. An examination shall be made to determine that palletization complies with the requirements of section 5 of this specification. Defects shall be scored in accordance with the list below. The sample unit shall be one palletized unit load fully prepared for delivery. The lot size shall be the number of palletized unit loads in the end item inspection lot. The samples for this examination shall be selected at random, in accordance with MIL-STD-105, inspection level S-1 and AQL of 6.5 per 100 units.

Examination	Defect
Finished dimensions	<ul style="list-style-type: none"> <li>Length, width, or height exceeds specified maximum requirement.</li> </ul>
Palletization	<ul style="list-style-type: none"> <li>Not as specified. Pallet pattern not as specified.</li> <li>Interlocking of loads not as specified.</li> <li>Load not bonded with required straps as specified.</li> </ul>
Weight	<ul style="list-style-type: none"> <li>Exceeds maximum load limits.</li> </ul>
Marking	<ul style="list-style-type: none"> <li>Omitted, incorrect, illegible, of improper size, location, sequence or method of application.</li> </ul>

4.4.4 Rejection and retest. Failure in any quality conformance test shall result in rejection of that batch and shall constitute sufficient justification for removal from the qualified products list. Rejected material shall not be resubmitted for acceptance without written approval from the Commander, Naval Air Development Center, Code 6062, Warminster, PA 18974. The application for resubmission shall contain full particulars concerning previous rejections and measures taken to correct these deficiencies. Samples for retest shall be randomly selected, as specified in 4.4.2, and forwarded to the testing activity.

## MIL-C-81904B(AS)

4.5 Test conditions. The laboratory testing conditions shall be in accordance with the specific test method and as described herein.

4.5.1 Test panels. Except as otherwise specified herein, test panels shall be cold-rolled steel, conforming to QQ-S-698, and treated with a zinc-phosphate coating, conforming to TT-C-490, Type I. Test panel dimensions shall be 6.0 in. by 3.0 in. by 0.031 in. (150 mm by 76 mm by 0.8 mm).

4.5.1.1 Application of primer. Primer coating, conforming to MIL-P-26915, Type I, Class B, shall be applied to the test panels to a dry-film thickness of 0.0015 to 0.002 in. (0.038 to 0.051 mm). The primer shall then be cured until tack-free, which will require one hour, or more, at room temperature.

4.5.1.2 Application of coating. Components A and B shall be mixed in the ratio as specified in 3.2.1 and, with a doctor blade, spread to a thickness of  $0.100 \pm 0.010$  in. ( $2.54 \pm 0.25$  mm) on the prepared surface of the test panel. Care shall be exercised to ensure a uniform coating, free from entrapped air bubbles or other film defects. The coated panels shall then be cured for a minimum of thirty minutes at room temperature, followed by a minimum of sixty minutes at  $150^\circ \pm 4^\circ\text{F}$  ( $66 \pm 2^\circ\text{C}$ ).

NOTE: The pot life of the coating compound, when admixed, is approximately ten (10) minutes.

#### 4.6 Test methods.

4.6.1 The tests contained in this specification shall be conducted in accordance with the applicable test method document or as specified herein.

##### 4.6.2 Component A (resin) tests.

4.6.2.1 Condition in container. While stirring the material with a hand paddle, observe the material for smoothness and homogeneity. Observe for absence of pigment flotation, coarse particles, or settling. The condition of Component A in the container shall conform to 3.4.1.1.

4.6.2.2 Accelerated stability. A full, unopened container of Component A shall be stored at  $150^\circ \pm 4^\circ\text{F}$  ( $66^\circ \pm 2^\circ\text{C}$ ) for a period of 6 hours. After the 6 hour storage period, the container shall be cooled to room temperature and examined for conformance to 3.4.1.2.

4.6.2.3 Viscosity. The viscosity of Component A shall be determined in accordance with of FED-STD-141, Method 4287, at  $150^\circ \pm 2^\circ\text{F}$  ( $66^\circ \pm 1^\circ\text{C}$ ). Using a Number 6 spindle and a speed of 10 rpm, record the viscosity after 5 revolutions (30 seconds). The viscosity of Component A shall conform to the requirements of 3.4.1 and Table I.

4.6.2.5 Density. The density of Component A material shall be determined in accordance with ASTM D 1475. The density of Component A shall conform to the requirements of 3.4.1 and Table I.

4.6.2.6 Ash content. The ash content of Component A shall be determined in accordance with ASTM D 1951. The ash content of Component A shall conform to the requirements of 3.4.1 and Table I.

## MIL-C-81904B(AS)

4.6.3 Working properties.

4.6.3.1 Reaction time. The test procedure shall be performed in accordance with ASTM D 2471, with the following exceptions:

- a. The mixture temperature shall be recorded with a continuously recording potentiometer equipped with a 20-gauge thermocouple. The overall accuracy of the thermocouple and potentiometer shall be within 0.3°C (0.5°F).
- b. The time required for the mixture to increase from 38° to 66°C (100° to 150°F) shall be determined to the nearest 0.1 second and reported as the reaction time.

4.6.4 Coating properties.4.6.4.1 Thermal efficiency.

4.6.4.1.1 Panel preparation. The following panels and discs shall be prepared from cold-rolled steel, conforming to QQ-S-698. Prepare six panels, each with dimensions of 3 in. by 3 in. by 0.062 in. (76 mm by 76 mm by 1.6 mm). Prepare six discs, each with a diameter of 0.94 in. (24 mm) and a thickness of 0.062 in. (1.6 mm). Cut a 1.0 in. (25.4 mm) hole in the center of each panel. Cement one disc into each hole with a metal-to-metal type epoxy bonding compound, capable of withstanding high temperatures. (Cementing the discs into the panels reduces the thermal-conductance effects from the edges of the specimen panel). The test panels shall be treated with a zinc-phosphate coating, conforming to TT-C-490, Type I. Primer coating shall then be applied to the test panel in accordance with 4.5.1.1. The coating compound shall be spray-applied to the primer coated test panels and then machined to a uniform film thickness of  $0.150 \pm 0.005$  in. ( $3.81 \pm 0.13$  mm). Set aside two panels for the humidity resistance test (see 4.6.7) and two panels for the weather resistance test (see 4.6.9).

4.6.4.1.2 Procedure. This test exposes the coating to a fire environment where a total flux of 10 BTU/ft<sup>2</sup>-sec (110 kW/m<sup>2</sup>), as measured by an asymptotic calorimeter, is 90 percent radiative in a slightly fuel rich condition. The average emissivity of the source of the radiant heat flux shall be at least 0.9. Aviation fuel, conforming to MIL-T-5624, shall be used to fire the unit. The applied coating compound thickness shall be measured (accuracy of 0.001 inch (0.025 mm)) and recorded. When ready to test, the panel shall be inserted in a transite mask, or any thermally insulated holder which allows the panel to rest on about 0.062 to 0.12 in. (1.6 to 3.2 mm) of the edges of the coated surface. The backside of the test panel shall be insulated with refractory fiber insulation, nominally 6 lbs/ft<sup>3</sup> (96 kg/m<sup>3</sup>). At time,  $T = 0$ , the masked panel shall be placed over the fire box and a thermocouple placed in contact with the back of the disc. Record the temperature rise on the panel, as measured with the thermocouple. The maximum initial panel temperature, prior to fire testing, shall be 90°F (32°C). The flux shall be uniform over the entire panel. The center disc shall be approximately 8-10 percent of the exposed area and shall be representative of a larger, semi-infinite panel. The time-temperature data and the applied coating thickness (measured in 0.001 in. (0.025 mm)) shall be recorded and a report made of the time (in seconds) to reach 500°F (260°C) for the recorded thickness of coating. The test results shall conform to 3.6.1 and the data reported shall be an average of three determinations.



## MIL-C-81904B(AS)

4.6.4.2 Tensile properties. The tensile properties of the applied coating compound shall be determined in accordance with ASTM D 638, at the temperatures specified in 3.6.2. The test specimen shall be in accordance with ASTM D 638, Type I test specimen, 0.25 in. (6.4 mm) maximum sheet, 0.125 in. (3.2 mm) thick.

4.6.4.3 Color. The coating compound shall be prepared and applied to test panels, in accordance with 4.5.1 through 4.5.1.2. The color and gloss of the coating compound shall be tested for conformance to 3.6.3, in accordance with ASTM D 1729.

4.6.4.4 Hardness. Mix Components A and B together in the ratio specified in 3.2.1. Prepare a sample casting with a diameter of 4 inches (101.6 mm) and a thickness of 0.5 inch (12.7 mm). Cure for a minimum of 30 minutes at room temperature followed by a minimum of 60 minutes at  $150^{\circ} \pm 4^{\circ}\text{F}$  ( $66^{\circ} \pm 2^{\circ}\text{C}$ ). Cool samples to room temperature and test for conformance to 3.6.4 in accordance with ASTM D 2240.

4.6.4.5 Adhesion. The coating compound shall be prepared and applied to test panels, in accordance with 4.5.1 through 4.5.1.2. The coated test panels shall be examined for coating adhesion in accordance with ASTM D 522, Test Method B, "Cylindrical Mandrel Test". The test panels shall then be examined for conformance to 3.6.5.

4.6.5 Lubricating oil resistance. The coating compound shall be prepared and applied to test panels, in accordance with 4.5.1 through 4.5.1.2. The test panels shall then be immersed in lubricating oil, conforming to MIL-L-23699, at a temperature of  $250^{\circ} \pm 4^{\circ}\text{F}$  ( $121^{\circ} \pm 2^{\circ}\text{C}$ ) for 4 hours. Four hours after removal from the lubricating oil, the test panels shall be examined for conformance to 3.7.1.

#### 4.6.6 Impact resistance.

4.6.6.1 Panel preparation. Test panels shall be aluminum alloy, conforming to QQ-A-250/5 (O temper), and dimensions of 0.020 in. by 3.0 in. by 6.0 in. (0.5 mm by 76 mm by 150 mm). The test panels shall be anodized in accordance with MIL-A-8625, Type II. The test panels shall be coated in accordance with 4.5.1.1 through 4.5.1.2.

4.6.6.2 Impact test. Place one prepared panel from 4.6.6.1, film side up, over the hole of the cylindrical base of a Gardner Heavy-Duty Impact Tester 1G-1120. Determine the maximum impact resistance at which no failures occur. Repeat the test on the reverse side of another panel from 4.6.6.1, with the film side down. The test panels shall then be examined for conformance to 3.7.2.

4.6.7 Humidity resistance. Two test panels shall be prepared as specified in 4.6.4.1.1. The coated test panels shall be tested for humidity resistance in accordance with ASTM D 2247. Exposure time shall be 336 hours and exposure levels shall be  $120^{\circ}\text{F}$  ( $49^{\circ}\text{C}$ ) and 100 percent relative humidity. After removal from the humidity cabinet, the coating compound shall be tested for hardness in accordance with ASTM D 2240. The hardness of the coating compound shall be in accordance with 3.7.3.



## MIL-C-81904B(AS)

4.6.8 Resistance to temperature shock. Three test panels shall be prepared in accordance with 4.5.1 through 4.5.1.2. The coating compound shall then be tested for conformance to 3.7.4, in accordance with MIL-STD-810, Method 503, with the following exceptions:

- a. The internal hot-chamber temperature shall be maintained at 140°F (60°C) and 95 percent relative humidity.
- b. The internal cold-chamber temperature shall be maintained at -40°F (-40°C).
- c. Panels shall be cycled every 24 hours, in lieu of 4 hours.
- d. The complete test period shall be 28 days.

4.6.9 Weather resistance. Two test panels, prepared in accordance with 4.6.4.1.1, shall be tested for conformance to 3.7.5, in accordance with ASTM D 1014. Exposure conditions shall be as follows: the test panels shall be mounted at 45° from the horizontal, facing south, for twelve continuous months in the vicinity of Key West, FL.

4.6.10 Temperature and humidity cycling. The coating compound shall be tested for conformance to 3.8.1 by subjection to the 28-Day temperature and humidity test of MIL-STD-2105. For the 28-Day temperature and humidity cycling test, the temperature range shall be -40° to +140°F (-40° to +60°C).

4.6.11 Vibration. The transportation, shipboard, and aircraft vibration test procedures and time schedules shall be conducted in accordance with MIL-STD-810, Method 514. The coating shall be examined for conformance to the requirements of 3.8.2 through 3.8.2.3.

4.6.12 Fast cook-off. The coating shall be tested for conformance to 3.8.3, by subjection to the fast cook-off test. The fast cook-off test shall be conducted in accordance with MIL-STD-1648. In addition, the following shall apply:

- a. The quantity of fuel shall be sufficient to cause reaction of the ordnance or to ensure a 15-minute fire. Test fuel shall be JP-4 or JP-5, conforming to MIL-T-5624.
- b. The test pit shall be a minimum of 24 feet by 24 feet (7.3 meters by 7.3 meters).
- c. Flame temperature to the bomb shall reach 1000°F (538°C) within 30 seconds after fire ignition.
- d. The bomb shall be suspended from its suspension lugs with its center  $35 \pm 5.0$  in. ( $0.89 \pm 0.13$  meter) above the fuel.
- e. The test shall not be performed when the wind velocity exceeds 5 knots (9.2 Km/hr).

## MIL-C-81904B(AS)

## 5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be Level A, as specified in 5.1.1 through 5.1.1.2.

5.1.1 Level A.

5.1.1.1 Component A (resin) unit package. The resin shall be packaged in pails conforming to PPP-P-704, Type II, Class 3, or Type III, Class 3 or 4, or in drums conforming to PPP-D-729, Type III or IV, as specified by the procuring activity (see 6.2). The inside surface of the pail or drum shall be treated as required, to prevent contamination of the contents.

5.1.1.2 Component B (catalyst) unit package. Component B shall be packaged in clean, dry, new, polyethylene containers conforming to MIL-B-26701. Net capacity of polyethylene containers shall be 1.0 or 8.0 lbs. (0.5 or 3.6).

5.2 Packing. Packing shall be Level A, as specified in 5.2.1 through 5.2.1.2.

5.2.1 Level A.

5.2.1.1 Component A. Component A (resin), packaged as specified in 5.1.1.1, shall be palletized in accordance with MIL-STD-147.

5.2.1.2 Component B. Component B (catalyst), packaged as specified in 5.1.1.2, shall be packed in corrugated or solid fiberboard boxes, conforming to specifications 12B of 49 CFR 178.205 and 12B of 49 CFR 173.221. The quantity of unit packages per shipping container shall be as specified by the procuring activity (see 6.2) in accordance with the following:

Unit (Component B) Package Capacity (mass)	Unit Quantity Per Shipping Container
1.0 lb. (0.5 Kg)	1 or 25
8.0 lb. (3.6 Kg)	1, 2 or 4

5.3 Marking and labeling. In addition to the marking specified in PPP-P-1892, individual cans and containers shall bear printed labels containing the following:

- Specification MIL-C-81904B(AS).
- Component A - Pigmented Resin, or  
Component B - Catalyst (as applicable).
- Color (name and number).
- Manufacturer's name and product number.
- Date of manufacture (month and year).
- Lot and batch number.
- Flash point.
- Net contents.

## MIL-C-81904B(AS)

5.3.1 Precautionary markings.

5.3.1.1 Component A (resin) containers. In addition to the labeling specified in 49 CFR 171-178, the following labeling shall appear on each container and on each exterior shipping container:

CAUTION

HARMFUL VAPOR.

USE ONLY WITH ADEQUATE VENTILATION.

AVOID PROLONGED BREATHING OF VAPOR.

AVOID PROLONGED OR REPEATED CONTACT WITH SKIN.

KEEP AWAY FROM HEAT AND OPEN FLAME.

STORAGE CONDITIONS

STORE IN AREAS WITH A TEMPERATURE OF  $60^{\circ} \pm 20^{\circ}\text{F}$  ( $15^{\circ} \pm 11^{\circ}\text{C}$ ) (FOR SIX (6) MONTHS STORAGE LIFE). STORAGE AT HIGHER TEMPERATURES, OF UP TO  $90^{\circ}\text{F}$  ( $32^{\circ}\text{C}$ ), WILL LIMIT STORAGE LIFE TO THREE (3) MONTHS.

5.3.1.2 Component B (catalyst) containers. In addition to the labeling specified in 49 CFR 171-178, the following labeling shall appear on each container and on each exterior shipping container:

CAUTION: OXIDIZING MATERIAL, STRONG IRRITANT, HARMFUL IF SWALLOWED.

- ONLY GLASS, POLYETHYLENE, OR CERAMIC CONTAINERS, FUNNELS, AND MEASURING DEVICES SHOULD BE USED WITH THIS MATERIAL; METALS CONTACTING THIS MATERIAL WILL CAUSE DECOMPOSITION.
- AVOID CONTACT WITH SKIN AND EYES. IN CASE OF CONTACT, FLUSH IMMEDIATELY WITH PLENTY OF WATER. FOR EYES, GET MEDICAL ATTENTION. IN CASE OF INGESTION, CALL A PHYSICIAN IMMEDIATELY. IN CASE OF CONTAINER LEAKAGE, REMOVE TO A SAFE PLACE, OUT OF DOORS.

STORAGE CONDITIONS

- STORE IN ORIGINAL CONTAINER, IN AREAS WITH A TEMPERATURE OF  $40^{\circ} \pm 5^{\circ}\text{F}$  ( $4^{\circ} \pm 2^{\circ}\text{C}$ ). STORAGE AT HIGHER TEMPERATURES, OF UP TO  $90^{\circ}\text{F}$  ( $32^{\circ}\text{C}$ ), WILL LIMIT STORAGE LIFE TO THREE (3) MONTHS.
- PROTECT FROM ALL SOURCES OF HEAT, INCLUDING RADIATORS, STEAM PIPES AND DIRECT SUNLIGHT.
- KEEP AWAY FROM SPARKS AND OPEN FLAMES.
- DO NOT ADD TO HOT MATERIALS; VIGOROUS DECOMPOSITION MAY RESULT.
- DO NOT STORE IN THE SAME ROOM AS COMPONENT A OR OTHER RESIN SYSTEMS.

## MIL-C-81904B(AS)

5.3.2 Application instructions. In addition to the labels specified in 5.3.1.1 and 5.3.1.2, each component container shall contain a printed label with the following instructions:

Application

instructions: This is a two component coating which is designed for spraying thirty-five (35) parts of Component A with one (1) part Component B, by weight. This coating compound requires special spray equipment that will separately but simultaneously apply each component.

NOTE: This coating compound may be mechanically mixed in a container for non-spray, "touch-up" application. The mixing ratio for non-spray application is 55 parts of Component A with 1 part Component B, by weight.

CAUTION: MIX ONLY THAT AMOUNT THAT CAN BE APPLIED IN LESS THAN TEN MINUTES. DO NOT OVERMIX. DO NOT MIX TOO VIGOROUSLY.

## 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 thermal-insulating compound covered by this specification is intended for use as an exterior, protective coating on explosive-loaded ordnance items. A list of ordnance items that currently utilize this coating compound is provided in 6.8. This coating is formulated to preclude the use of asbestos, to meet applicable environmental conditions, and to delay an explosive reaction when the coated ordnance item is exposed to high-flux thermal environments.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of the DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.1 and 2.2).
- c. Color number and name (see 1.2).
- d. Toxicological data requirements (see 3.3 and 4.3.2).
- e. Size and quantity of each component desired (see 5.1 and 5.2).
- f. Special marking requirements (see 5.3.1, 5.3.2).
- g. FAR clauses 23.303 and 52.223-3.
- h. Specify if palletization is required.

## MIL-C-81904B(AS)

**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 the suppliers is called to this requirement. Manufacturers are urged to arrange having the products that they propose to offer to the Federal Government tested for qualification, in order that they may be eligible for award of contract(s) or order(s) for the products covered by this specification. The activity responsible for the Qualified Products List is the Commander, Naval Air Systems Command, AIR-5304, Washington, DC 20361; however, information pertaining to qualification may be obtained from the Commander, Naval Air Development Center, Code 6062, Warminster, PA 18974. It is understood that the material furnished under this specification, subsequent to final approval, shall be of the same composition and equal to products upon which approval was originally granted. In the event that the coating furnished under contract is found to deviate from the composition of the approved product, or that the product fails to perform satisfactorily, approval of such products will be subject to immediate withdrawal from the Qualified Products List.

**6.4 Material safety data sheets.** Contracting officers should identify those activities requiring copies of completed Material Safety Data Sheets, prepared in accordance with FED-STD-313 and meeting the requirements of 29 CFR 1910.1200. The pertinent Government mailing addresses, for submission of data, are listed in FED-STD-313, Appendix B.

**6.6 Material storage.**

**6.6.1 Component A.** The recommended storage temperature range for Component A is 40° to 80°F (4° to 26°C). It is recommended that storage temperatures near the lower end of the above temperature range be used.

**6.6.2 Component B.** Component B contains an organic peroxide whose strength cannot be guaranteed for lengthy storage. The recommended storage temperature range of Component B is 35° to 45°F (2° to 6°C). It is recommended that Component B be stored in its original, unopened container, and in a refrigerated area. A three-month inventory, combined with the practice of rotation of stock, is recommended. Storage at the lower end of the recommended storage temperature range should aid in extending its storage life.

**6.7 Subject term (keyword) listing.**

Coating, two-component  
Aircraft ordnance  
Protection, high-flux thermal environment

## MIL-C-81904B(AS)

6.8 Thermally protected bombs. The following is a listing of identified Naval Air Systems Command drawing numbers of ordnance items that utilize thermal protection coatings:

4902393	Body Assy, Bomb, GP, 500 lb, TP, MK 82-2, Ld
923AS100	Body Assy, Bomb, GP, 500 lb, TP, MK 82-2, Inert Ld
923AS554	Body Assy, Bomb, GP, 500 lb, TP, MK 82-3, H-6 Ld
923AS555	Body Assy, Bomb, GP, 500 lb, TP, MK 82-4, H-6 Ld
4902089	Body Assy, Bomb, GP, 1000 lb, TP, MK 83-5, H-6 Ld
923AS109	Body Assy, Bomb, GP, 1000 lb, TP, MK 83-5, Inert Ld
923AS110	Body Assy, Bomb, GP, 2000 lb, TP, MK 84-5, Inert Ld
4902049	Body Assy, Bomb, GP, 2000 lb, TP, MK 84-3, H-6 Ld
923AS107	Body Assy, Bomb, GP, 2000 lb, TP, MK 84-5, H-6 Ld
923AS520	Body Assy, Bomb, GP, 2000 lb, TP, MK 84-6, Inert Ld
923AS519	Body Assy, Bomb, GP, 2000 lb, TP, MK 84-6, H-6 Ld
923AS616	Body Assy, Bomb, Practice, 500 lb, TP, BDU-45/B, Inert Ld
923AS654	Body Assy, Bomb, GP, 1000 lb, TP, BLU-110A/B, PBXN-109, Ld

6.9 Non-spray application of thermal insulation coating. This coating compound may be applied by a hand-trowel method for "touch-up" applications. The mixing ratio for this type of application is 35 to 55 parts of Component A to 1 part Component B, by weight. The exact mixing ratio is highly dependent upon the conditions under which this material is applied. Mix only that amount that can be applied in less than ten (10) minutes.

6.10 Storage life extension. The original maximum length of storage for this coating compound is six (6) months, when stored at the recommended storage temperatures. The storage life of the coating compound may be extended, however, three (3) months at a time beyond the original six month period, until the material is no longer capable of meeting the requirements listed below. For the material to be recertified and the storage life extended, the coating compound must successfully pass the following requirements:

Requirement	Paragraph	Test Paragraph
Condition in container	3.4.1.1	4.6.2.1
Reaction time	3.5.1	4.6.3.1
Hardness	3.6.4	4.6.4.4

6.11 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.

Preparing Activity:

Navy - AS

(Project 8030-N115)