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MILITARY SPECIFICATION

COATINGS, LUSTERLESS, FOR HELMETS AND LINERS

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

1. SCOPE

1.1 Scope. This specification covers material and procedures for finishing hard shell steel and plastic helmets and liners (see 6.1).

1.2 Classification. The finishing systems covered by this specification shall be of the following types:

Type I - Finishing system for military steel helmets.

Type II - Finishing system for plastic helmets and helmet liners possessing ballistic properties.

Class A - For ground troops helmets and liners.

Class B - For Army flyers' helmets.

FSC 8010

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Mobility Equipment Research and Development Command, ATTN: DRDME-DS, Fort Belvoir, VA 22060 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of the specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

- | | |
|----------|---|
| TT-C-490 | - Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings. |
| TT-E-527 | - Enamel, Alkyd, Lusterless. |
| TT-P-636 | - Primer Coating, Synthetic, Wood and Ferrous Metal. |
| TT-P-664 | - Primer Coating, Synthetic, Rust-Inhibiting, Lacquer Resisting. |

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| MIL-E-46096 | - Enamel, Lusterless, Quick Drying, Styrenated Alkyd Type, Solar Heat Reflecting, Olive Drab. |
|-------------|---|

STANDARDS

FEDERAL

- | | |
|-------------------|--|
| FED. STD. No. 141 | - Paint, Varnish, Lacquer and Related Material; Methods of Inspection, Sampling and Testing. |
| FED. STD. No. 595 | - Colors. |

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| MIL-STD-105 | - Sampling Procedures and Tables for Inspection by Attributes. |
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(Copies of specifications and standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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

SOUTHERN CALIFORNIA AIR POLLUTION CONTROL DISTRICT

Rule 102 - Photochemically Reactive Solvents.

(Application for copies should be addressed to the Southern California Air Pollution Control District, 434 South San Pedro Street, Los Angeles, CA 90013.)

3. REQUIREMENTS

3.1 Standard sample except for Type II, Class B. The contractor shall submit to the contracting officer, an 18- by 4-inch standard panel to be used for determining color, gloss, and texture. This standard reference panel shall be prepared as specified in 4.3.1. After approval by the contracting officer, the 18- by 4-inch panel shall be cut into three panels approximately 6 by 4 inches. One panel shall be furnished to the contractor and the other two panels shall be retained by the Government for use in verification testing. These 6- by 4-inch panels shall constitute the reference panels for color, gloss, and texture. The textured coating on these panels shall be indicative of the approximate spacing of texturing particles and of the approximate textured surface appearance.

3.2 Materials.

3.2.1 Primer.

3.2.1.1 For Type I finishing system. The primer for the steel helmets shall conform to TT-P-636 or TT-P-664, Composition G or L as applicable.

3.2.1.2 For Type II. When a primer is used at the option of the contractor, it shall be specifically formulated to have good adhesion to the plastic liner or helmet. When applicable, the solvent composition of the primer shall conform to the provisions of Rule 102, Southern California Air Pollution Control District or to any other state or local air pollution regulation which may be applicable for the district in which the primer is to be applied.

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3.2.2 Top coatings.

3.2.2.1 Enamel for Type I finishing system. The top coating for the steel helmets shall be an enamel which conforms to TT-E-527, Color No. 34098 of FED. STD. No. 595. For the final textured coat on the helmet exterior, the enamel shall have blended into it the sand aggregate specified in 3.2.3.1. Composition G or L shall be used where applicable.

3.2.2.2 Top coating for Type II finishing system.

3.2.2.2.1 Class A. The top coating for the helmet or helmet liner shall be a lacquer or enamel with wide latitude given in the selection of materials, providing requirements of this specification are met (see 6.3). For the final coating on the shell, the coating shall have blended into it the texturing material specified in 3.2.3.2. The color of the textured final coating, after application and drying, shall match No. 34098 of FED. STD. No. 595. When applicable, the solvent composition shall conform to the provisions of Rule 102, Southern California Air Pollution Control District, or to any other state or local air pollution regulation which may be applicable for the district in which the enamel is to be applied.

3.2.2.2.2 Class B. The top coating shall be an untextured enamel conforming to MIL-E-46096, Composition G or L, as applicable.

3.2.3 Texturing material.

3.2.3.1 For Type I finishing system. Texturing material incorporated in second coat of enamel on the exterior of the helmet shall be banding silica sand, water washed and kiln dried, free of salts and deleterious matter and containing not more than 1.5 percent of dirt or foreign matter. The sand shall be that known commercially as No. 70 (average size) and shall have a screen analysis as follows:

<u>Sieve No. (U.S. Std)</u>	<u>Percent Accumulated</u>
No. 40	0.5 maximum
No. 50	6.0 +3
No. 70	34.0 +5
No. 100	82.0 +5
No. 140	97.0 +3-5

3.2.3.2 For Type II, Class A. Texturing material blended into the final coating applied to the plastic helmets and liners shall be 40/100 mesh walnut shell flour, contained at the rate of 10 ounces per gallon of textured coating. Alternatively 80/100 mesh micarta dust may be used at the rate of 7-1/4 ounces per gallon of textured coating.

3.3 Finishing procedure.

3.3.1 Type I finishing system.

3.3.1.1 Surface preparation. The entire surface of each helmet body with hinged loops and edging attached shall be thoroughly cleaned and given a phosphate coating conforming to Type I of TT-C-490. The final drying operation shall be conducted in such a manner as to assure thorough drying within the edging and hinged loop assembly.

3.3.1.2 Organic finish. Following the surface preparation specified in 3.3.1.1, a coat of primer specified in 3.2.1.1 shall be applied to a dried film thickness of 0.9 to 1.1 mils and dried. Following the priming, a coat of enamel as specified in 3.2.2.1, thick enough to hide the primer, shall be applied to both inside and outside surfaces. Immediately after the enamel becomes tacky, a coat of the same enamel containing aggregate specified in 3.2.3.1 shall be applied on the outside surface. The enamel-sand mixture shall contain 6 pounds of sand to one base gallon of enamel and shall be reduced to spraying consistency. The finishing equipment shall be suitable for application of the same enamel to obtain the specified textured appearance consistently, and shall accordingly provide against settling of the sand, clogging of nozzle or lines with sand, or other condition which would produce non-uniform appearance. The finish shall be baked for a time-temperature cycle recommended by the contractor of the enamel to a dry hard condition as defined in the Definition of Terms Section of FED. STD. No. 141. There shall be no sand particles on the inside of the helmet body.

3.3.2 Type II finishing system.

3.3.2.1 Outside surface preparation. Prior to application of protective coating, fill all permissible surface gaps and pits with epoxy resin composition, to provide a smooth and continuous helmet or liner shell surface. Cutting and filling of blisters of any size is not permissible. The outside surface of the shell shall be prepared for painting as may be required to meet the performance requirements for finish. If surface preparation includes abrading, abrading to the point where nylon fibers become visibly cut and raised shall be prohibited and dust from the abrading operation shall be completely removed before application of the coating.

3.3.2.1.1 Rivet heads. Before or after assembly of rivets, rivet heads shall be abraded in a manner to produce a uniform matte, mechanically etched surface. If rivets are dark oxide coated, the abrading may be omitted.

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3.3.2.2 Organic finish.

3.3.2.2.1 Class A. After surface preparation specified above, the entire exterior surface of the liner and helmet, except for the helmet's rubber edging shall be coated with the protective coating specified in 3.2.2.2.1. The finishing equipment shall be suitable for application of the textured enamel to obtain the specified textured appearance consistently, and shall accordingly provide against settling of the texturing material, clogging of nozzle or lines with texturizing material, or other condition which would produce non-uniform appearance. A primer specified in 3.2.1.2 may be used to improve the adhesion and to serve as a base for the textured top coating. As many coating applications as required shall be used to produce the coating meeting the requirements of this specification. The coating shall be either air dried, or force dried. No visible distortion of the shell shall take place because of force drying.

3.3.2.2.2 Class B. The requirements for Class B finish shall be the same as for Class A finish except for texturing requirements and except that the coating material shall be as specified in 3.2.2.2.2.

3.4 Performance.

3.4.1 For Types I and II, except for Type II, Class B finishes.

3.4.1.1 Appearance. After drying and curing, the exterior finish on the helmets and liners shall be uniform in texture and appearance and shall approximate the approved reference panel prepared as specified in 4.3.1 in gloss, color and texture (see 3.1). The final finish shall be free of sags, runs, wrinkles, blistering or other defect characteristic of improper application or cure of the coating.

3.4.2 Cure and application. After drying and curing, the exterior finish on the helmets and liners shall not be tacky or soft. When rubbed with a white cloth, there shall be no more than a small amount of transfer to the cloth, indicative of dry spray or loose texturing material.

3.4.3 Impact resistance (Type II, Class A). When helmets and liners are impacted with 40 foot pounds as specified in 4.3.3, the exterior finish shall show no flaking, peeling, loss of adhesion or other failure of the finish except in the immediate, imprinted area of impact.

3.4.4 Resistance to blistering. When the helmets and liners are tested as specified in 4.3.2, the exterior finish shall show no blistering (see 6.4).

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3.5 Properties of textured coating.

3.5.1 Brushing properties. When tested as specified in 4.3.4, the coating shall be capable of being brushed and laid off quickly. When dry, the brushed surface shall be free from sags and runs. Slight brush marks will be permitted.

3.5.2 Spraying properties. When tested as specified in 4.3.5, the coating shall spray satisfactorily and show no tendencies to orange peel, crepe, run, or sag. The coating shall level out to a uniform textured film.

3.5.3 Dilution stability. When tested as specified in 4.3.6, the coating shall remain stable and uniform showing no evidence of incompatibility or precipitation. Settling of the texturing material will be permitted.

3.5.4 Condition of textured enamel in container. When tested as specified in 4.3.7, the textured coating shall show no excessive hard settling in a freshly opened full container and shall readily mix to a smooth homogeneous state. The coating shall show no curdling, livering, hard caking or tough gummy sediment and shall be free from skins and lumps (except for texturing material).

3.5.5 Storage stability.

3.5.5.1 Partially filled container. When tested as specified in 4.3.8.1, in a three-quarter filled, closed 8-ounce glass jar of the textured coating, it shall show no livering, curdling, hard caking or tough, gummy sediment and shall readily mix to a smooth homogeneous state when tested as specified in 4.2.3.3. Any skin formed shall be continuous and shall be easy to remove.

3.6 Workmanship. The coatings on the helmets and liners shall show no blistering, flaking, runs, wrinkles, or peeling.

3.7 Special markings. Each container shall be legibly marked with the following instructions:

Thinning directions - For application, the manufacturer shall include on the label thinning recommendations and solvent required.

Caution - Flammable liquid. No smoking. During application, avoid skin contact and inhalation of vapors.

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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.

4.1.1 Certificate of compliance. Where certificates of compliance are submitted the Government reserves the right to check test such items to determine the validity of the certification.

4.2 Inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

4.2.1 In-process inspection. Inspection shall be made at any point or during any phase of the manufacturing process whether the finishing operations are in accordance with the requirements specified under 3.3.1 and 3.3.2 regarding surface preparation and coating application. The Government reserves the right to exclude from consideration for acceptance any material or service for which in-process inspection has indicated nonconformance.

4.2.2 Inspection of materials and components. In accordance with 4.1 above, materials and components shall be inspected and tested in accordance with all the requirements of referenced specifications and standards unless otherwise excluded, amended, modified or qualified in this specification or applicable purchase documents.

4.2.3 Inspection of the end item. Sampling and inspection shall be as specified in the specifications for the helmets and helmet liners on which the coatings, described in this specification are used. Coatings on the helmets and liners shall be as specified in 3.6.

4.2.4 Testing of the end item. The coatings of the helmets and helmet liners shall be tested for the characteristics as specified in their respective specifications and as indicated in Table I if the test is not already specified in their respective specifications. If the test listed in Table I is specified in the end item specification, that test method should be followed in lieu of the test method specified herein. For the tests in Table I, the lot size for the purpose of determining the sample size shall be expressed in units of one helmet liner. The sample unit shall be one helmet. The inspection level shall be S-2 and the AQL shall be 2.5.

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Table I. Testing of the End Item

Characteristic	Specification reference	Requirements applicable	No. of deter- minations per sample unit	Results reported as	
	Require- ment	Test method		Pass or fail	
Protective coating texture	3.4.1.1	Visual <u>1/</u>	X	1	X
Gloss	3.4.1.1	6101 <u>2/</u>	X	1	X
Color	3.4.1.1	Visual <u>1/</u>	X	1	X
Blistering	3.4.4	4.3.2	X	1	X
Impact	3.4.3	4.3.3	X	1	X

1/ Determine by visual comparison with flat panel described in 4.3.1.

2/ Test is performed in accordance with FED. STD. No. 141.

4.2.5 Special markings. Special marking shall be as specified in 3.7.

4.3 Tests.

4.3.1 Reference panels.

4.3.1.1 For Type I finish. A reference panel shall be prepared for Type I coating in the same way as described in 4.3.1.2 except that the sand textured enamel as specified in 3.2.2.1 shall be used.

4.3.1.2 For Type II finish. A reference panel shall be prepared for comparing the color, gloss, and texture of the Type II, Class A coatings on the helmets and helmet liners. The enamel or lacquer shall be well mixed with 40/100 mesh walnut shell flour at the rate of 10 ounces of the flour per gallon. As an alternate, texturing material 80/100 mesh micarta dust may be used at the rate of 7-1/4 pounces per gallon of enamel or lacquer. This mixture shall be adjusted to a viscosity of 18-25 seconds on the No. 4 Ford Cup. The mixture shall be then flowed, while the shell flour is completely suspended onto the surface of a metal or glass panel approximately

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18 by 4 inches, held at approximately 120 degrees to the horizontal. The coated panel shall be allowed to drain and dry. Presence of fatty edges or concentration of texturing material on the outer edges of the coated panel shall be ignored. The color of the panel shall match number FED. STD. No. 595 and the gloss rating shall not exceed 4 when tested as specified in Method 6101 of FED. STD. No. 141.

4.3.2 Resistance to blistering (see 6.4). When the finish is dried and cured, the shell shall be partly immersed in distilled water at 60 to 80° F for 16 hours. The finish shall then be examined for presence of blisters of any size as specified in 3.4.4.

4.3.3 Impact test (Type II). The coated helmet or liner to be tested shall be placed on a hard surface. An 8-pound iron ball shall be dropped vertically from a height of 5 feet to impact the center area of the helmet crown. A 5-foot pipe may be used to direct and to contain the ball. The height of 5 feet shall have been measured from the bottom of the ball to the crown of the helmet. Examine the helmet for damage to the coating as specified in 3.4.3.

4.3.4 Brushing properties. Apply the textured coating by thinning as recommended by the manufacturer with a 2-1/2 inch brush. Nonconformance to 3.5.1 shall constitute failure of this test.

4.3.5 Spraying properties. The textured coating shall be thinned as recommended by the manufacturer. More than one spray application will be permitted to obtain a uniformly textured film. The coated panel shall be examined for satisfactory spraying properties after each application. Nonconformance to 3.5.2 shall constitute failure of this test.

4.3.6 Dilution stability. Reduce slowly 3 parts by volume of the textured coating with 1 part by volume of the recommended thinner. The reduced coating shall stand for 15 minutes. Nonconformance to 3.5.3 shall constitute failure of this test.

4.3.7 Condition in container. Determine package condition in accordance with Method 3011 of FED. TEST METHOD STD. No. 141. Nonconformance to 3.5.4 shall constitute failure of this test.

4.3.8 Storage stability.

4.3.8.1 Partially full container. Determine 48 hour skinning in accordance with Method 3021 of FED. TEST METHOD STD. No. 141, and observe for compliance with 3.5.5.1. Reseal and age for 7 days at 60° C. Nonconformance to 3.5.5.1 shall constitute failure of this test.

5. PACKAGING

5.1 Not applicable.

6. NOTES

6.1 Intended use. The finishing systems specified herein are intended for use on helmets and helmet liners. Type I finishing system is intended for use on soldier's steel helmets conforming to MIL-H-1988 and on Navy helmets. Type II, Class A finishing system is intended for use on the combat vehicle crewman's helmet and on the combat soldier's helmet liner conforming to MIL-L-41800. Type II, Class B finish is intended for use on the Army flyer's helmet conforming to MIL-H-43388.

6.2 Ordering data. Not applicable.6.3 Type II finishing system.

6.3.1 A satisfactory adherent finish has been obtained, after proper cleaning and abrading of the surface, through the use of an amine cured epoxy type enamel and through the use of an alkyd nitrocellulose type of lacquer enamel. Application of an unduly thick coat will generally result in lessened impact resistance of the coating. Forced air drying or cure has been effected at temperatures of 150° F or below without damage to the shell assembly.

6.3.2 Mold release compounds must be completely removed from the surface of the helmet or liner and the surface must not then be recontaminated by fingerprints or other foreign matter, to insure good adhesion of the protective coating.

6.4 It is understood that this test is intended primarily as a test of the quality of surface preparation (see 3.3.1.1 and 3.3.2.1).

6.5 The dried spray dust of lusterless enamels represents an extreme fire hazard. The danger can be materially reduced by the use of water wash spray booths. Spray dust should not be allowed to accumulate in booths but should be removed daily.

Custodians:

Army - ME

Air Force - 99

Preparing activity:

Army - ME

Project 8010-0874

Review activities:

Army - MD, MR, GL

User activity:

Navy - MC



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