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			PAGE 1 of 4

TITLE

APPLICATION OF APOLLO COMMAND MODULE THERMAL CONTROL COATING

References: Dwg F01-140003 - Field Site Installation - Spacecraft Apollo
 CSM Complete
 Dwg F01-340003 - Field Site Installation - Spacecraft Apollo
 CSM Complete

LIST OF CONTENTS

Paragraph No.

1. SCOPE
2. APPLICABLE DOCUMENTS AND MATERIALS
3. GENERAL REQUIREMENTS
4. DETAIL REQUIREMENTS
5. QUALITY ASSURANCE

E.O. M522872

E.O. 522872

CODE IDENT. NO. 03953

NUMBER MA0608-013	REVISION LETTER						PAGE 2
	A						

1. **SCOPE:** This specification establishes the requirements and procedures for applying a metallized thermal control coating laminate to Apollo Command Module exterior surfaces where specific thermal radiative characteristics are required.
- 1.1 The thermal control coating laminate specified herein provides a thermal radiative surface having an average solar absorptance (α_s) to infrared emittance (ϵ) ratio of 0.45 or less and an ϵ value not exceeding 0.42.
2. **APPLICABLE DOCUMENTS AND MATERIALS:**
- 2.1 **Documents:** The latest issue of the following document forms a part of this specification to the extent specified herein. In case of conflict between these documents and this specification, this specification shall prevail.
- | | |
|------------|---|
| MA0117-001 | Handling of Flammable and Dangerous Liquids and Chemicals |
|------------|---|
- 2.2 **Materials:**
- | | |
|---|--|
| GT-131 Thermal Control Coating Laminate | G. T. Schjeldahl Co.
Northfield, Minn. |
| O-T-620 | 1, 1, 1-Trichloroethane, Technical,
inhibited (Methyl Chloroform) |
| TT-T-548 | Toluene |
| 281 Adhesive, or equivalent | Dow Corning Corporation
Midland, Michigan |
3. **GENERAL REQUIREMENTS:**
- 3.1 **Safety:** Observe the precautions of MA0117-001 when handling and using hazardous materials specified herein.
- 3.2 **Cleanliness:** The thermal control coating laminate must have optimum adhesion as well as specific absorptance and emittance characteristics to meet the thermal requirements of the Apollo Command Module. Therefore, work area shall be kept clean and extreme care exercised to minimize contamination of any kind during all stages of the processing.
- 3.3 **Handling:** Operators shall wear clean, lint-free nylon gloves and use clean tools when handling the thermal control coating laminate. Avoid scratching, gouging and creasing the laminate before, during and after application. The transparent film protecting the laminate shall not be tampered with or removed until just prior to installation of the Boost Protection Cover.

E.O. 522872

CODE IDENT. NO. 03953

NUMBER MA0608-013	REVISION LETTER					PAGE 3
	A					

4. DETAIL REQUIREMENTS:

4.1 Surface Preparation: Surfaces to be coated shall be lightly wiped with clean cheesecloth dampened with O-T-620 methyl chloroform to remove oil, grease, dust or other foreign matter.

4.2 Coating Laminate Application:

4.2.1 The GT-131 coating laminate shall be carefully pre-cut from a pattern to the proper shapes and sizes to custom fit the exterior Command Module surface areas as specified on the Engineering Drawing. The pattern shall be developed by actual lay-up on the Command Module using aluminum foil or other suitable materials.

NOTE: Do not use GT-131 as the pattern material, as this is a high cost item and excess stock may not be readily available.

4.2.2 The pre-cut coating laminate shall be applied to the prescribed locations by pressure-sensitive adhesive bonding as follows:

4.2.2.1 Adhesive-backed Coating Laminate: If the coating laminate is supplied with a pressure-sensitive adhesive backing, the release liner shall be carefully removed before bonding per 4.2.2.3.

4.2.2.2 Non-adhesive Backed Coating Laminate: If the coating laminate is supplied without an adhesive backing, on-site application of adhesive shall be accomplished as follows:

4.2.2.2.1 Prepare adhesive mixture by thoroughly mixing 100 parts by weight of Dow-Corning 281 Adhesive solution to one part of 281 Catalyst.

4.2.2.2.2 Reduce the adhesive mixture with an equal volume of toluene. Spray or brush a box coat of the thinned material on the appropriate bonding surface of either the vehicle or the coating laminate.

NOTE: The mixture shall not be used after ten days have elapsed from time of mixing of 281 catalyst.

4.2.2.2.3 Allow to air-dry for 2 + 1/2 hours until the adhesive becomes tacky. Heat gun or heat lamp not exceeding 120 F may be used to accelerate solvent removal (this can normally be accomplished in 15 minutes). Proceed with bonding operation per 4.2.2.3.

4.2.2.3 Position the coating laminate correctly and apply firm, uniform pressure with a suitable rubber or plastic roller in a manner which will minimize wrinkles, creases or entrapped air. Make sure all edges and corners adhere properly.

CODE IDENT. NO. 03953

NUMBER	REVISION LETTER						PAGE
	A						
MAC608-013						4	

4. DETAIL REQUIREMENTS: (Continued)

- Ø 4.2.3 The transparent film protecting the aluminized surfaces of the GI-131 coat laminate shall be removed just prior to installation of the Boost Protective Cover. (See reference drawings.) Removal shall be accomplished by gently peeling the transparent film away from the aluminized surface.

5. QUALITY ASSURANCE:

- 5.1 Only trained personnel shall be allowed to perform the operations specified herein.
- 5.2 The thermal control coating laminate shall be properly located and shall exhibit satisfactory adhesion to the surface. Minor wrinkling or bubbles shall not be cause for rejection.