UNIVERSAL™ AVIONICS
an Elbit Systems Company

PROCESS SPECIFICATION

SURFACE FINISH REQUIREMENTS

PS00000020

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01/29/2019

REVISION 03

REVISION LOG

Date	Rev	Author	Description of Changes
7/21/08	00	Rick Williams	1. New release. 2. Consolidates and obsoletes PS98006000, PS98006010, and PS98006030.
12/20/2011	01	Rick Williams	Added Dust and Debris criteria to section 9. Section 8.4, added parenthetical note "Unless otherwise specified…" to accommodate customer specific color requirements.
08/14/2015	02	Rick Williams	Revise section 6 to provide more accurate and uniform powder coat thickness requirements. Corrected section 10.2 from Uncoated to Coated surfaces.
01/29/2019	03	Manuel Valencia	Revised Section 6.2 to account for a replacement paint Part Number.

1. PURPOSE & SCOPE

This document defines the surface finish requirements for all surfaces of machined metal parts, sheet metal parts, painted surfaces and powder coated surfaces to ensure uniform color, reflectivity, and or appearance as applicable.

2. APPLICABLE DOCUMENTS

CIE 1976 L* a* b* Color Space
MIL-PRF-85285 Performance Specification, Coating: Polyurethane, Aircraft and Support Equipment
ASTM-D523 Gloss Specular
ARP 4256 Design Objectives for Liquid Crystal Displays for Part 25 (Transport) Aircraft
PS00000019 Part Marking Standards

3. TERMS AND DEFINITIONS

CIE Commission International de l'Eclairage (International Commission on Illumination), the main international organization concerned with color and color measurement.

L* a* b* Color Space A uniform color space utilizing an Adams-Nickerson cube root formula, adopted by the CIUD in 1976 for use in the Measurement of small color differences.

L* Lightness value

a* Position on red/green axis

b* Position on yellow/blue axis

A/2˚ Type of illumination used to determine L* a* b* readings.

Δ Delta tolerance is the amount the specification may vary from the nominal value. For consistency, the tolerance should be considered +/- Δ /2.

4. GENERAL SURFACE PREPARATION

4.1 All machined surfaces to be painted shall have a maximum Ra 63 microinch surface finish with no tool marks or transition lines.

4.2 Machined surfaces not to be painted shall have a maximum Ra 125 microinch finish.

4.3 All sheet metal surfaces not to be painted or powder coated shall have a surface finish free of all defects when viewed per section 8.

4.4 All aluminum parts shall be chemical conversion coated per section 5 unless otherwise noted on the drawing.

4.5 Stainless Steel parts shall be passivated.

4.6 Acrylic Surfaces shall be cleaned and prepared for the best paint adhesion if required by the paint manufacturer.

5. CHEMICAL CONVERSION COATINGS OF ALUMINUM ALLOYS

5.1 REQUIREMENTS

This section allows for the use of two classes of chemical coatings, Class 1A and Class 3. Application of Chemical Conversion Coatings shall be in accordance with MIL-DTL-5541.
NOTE: Unless otherwise specified on the engineering drawing, the supplier shall use Class 1A coatings.

Definition

Class 1A chemical conversion coatings are primarily used for maximum protection against corrosion for aluminum surfaces. Class 1A chemical conversion coatings are intended to provide corrosion prevention when left unpainted as well as to improve adhesion of paint finish systems on aluminum and aluminum alloys.

Class 3 chemical conversion coatings are primarily used for protection against corrosion where lower electrical resistance is required.

The primary difference between a Class 1A and Class 3 coating is thickness, since current passes more readily through a thinner current resistant barrier (coating). Coating thickness is varied by immersion time and, as a result, the same conversion material can be utilized for both classes. Materials conforming to MIL-DTL-81706 shall be used.

5.2 Base Metal

The base metal shall be free from all defects that will be detrimental to the appearance, performance or function of the coating.

5.2.1 Touch up

Touch ups and repairs shall be done using MIL-C-81706 material and shall not exceed 5 percent of the total item surface area. Mechanical damage shall be kept at a minimum and touch ups shall remain uniform in color and appearance and shall not appear as obvious when viewed from approximately 12 inches.

6. POWDER COAT FINISHES

6.1 Surfaces to be coated White shall use Cardinal Industrial Finishes Part No. T032-WH15.

6.2 Surfaces to be coated Black shall use Cardinal Industrial Finishes Part No. P141-BK03 or Cardinal Industrial Finishes Part No. C241-BK303 (Replacement).

6.3 Surfaces to be coated Gray shall use Cardinal Industrial Finishes Part No. T141-GRAY (LS#4106).

6.4 Coating Thickness shall be .002 + .005 -.00 inches. Finish should be uniform in appearance.

6.5 All powder coatings shall be applied where indicated by fabrication drawings and all areas not to be coated shall be masked to prevent overspray.

6.6 Powder coatings shall be applied and cured per Cardinal Industrial Finishes Technical Data Sheet for each type of coating.

7. Anodize Finishes

7.1 Anodize finishes shall meet MIL-A-8625 Type II, Class 2 color black unless otherwise specified on the drawings.

8. PAINT PERFORMANCE AND REQUIREMENTS

8.1 Paint Preparation

Surfaces to be painted shall be free of contaminates oil or debris prior to surface coating. If priming is required follow paint system guidelines published by the paint manufacturer.

8.2 Non-Laser-Etched Paint Surfaces

Coatings that will not be laser etched must be painted with paint that meets all MIL-PRF-85285 performance specifications.

8.3 Laser-Etched Paint Surfaces

Surfaces that will be laser etched can be painted with a material that does not meet MIL-PRF-85285 performance standards. If the paint does not meet MIL-PRF-85285, it must be covered with a clear coat that will allow the finished surface of the product to meet MIL-PRF-85285 standards.

8.4 Color Requirements for Painted Surfaces (unless otherwise specified by drawing or customer requirements)

This section defines the inspection requirements of painted surfaces. These inspections shall be conducted using a spectrophotometer (x-rite SP60 Series or equivalent) as required.

8.4.1 Universal Gray Surfaces

- Illuminant Tolerance A/2° in.
- Tolerance Type = L* a* b*.
- L* = 42.83 a* = -2.07 b* = -5.18
- Delta Tolerance = ΔL* = 1.75 Δa* = 0.75 Δb* = 0.75

The gloss of the finished product shall measure from 1.0 to 5.0 gloss units using a 60-degree angle per ASTM-D523. If a clear top coat is required to meet this gloss condition, then the clear coat must meet MIL-PRF-85285.

8.4.2 Universal Black Surfaces

- Illuminant Tolerance A/2º in.
- Tolerance Type = L* a* b*.
- L* = 24.46 a* = -0.20 b* = -0.72
- Delta Tolerance = ΔL* = 1.75 Δa* = 0.75 Δb* = 0.75

The gloss of the finished product shall measure from 1.0 to 5.0 gloss units using a 60-degree angle per ASTM-D523. If a clear top coat is required to meet this gloss condition, then the clear coat must meet MIL-PRF-85285.

8.4.3 International Orange

Sherwin-Williams
Polane T Polyurethane Enamel
F63-TXE-12139-4380
(Farwest International Orange)

Paint mixing to be coordinated with:
Sherwin-Williams
Phoenix Color and Finish Match Facility

Reference UASC Part Number: 80100843

8.5 Line work and/or Lettering

Laser-etched or photo-etched parts: The exposed surface shall match low gloss White #37925 (FED STD 595).

Silkscreened parts: Silkscreen with low gloss White #37925 (FED STD 595).

8.6 Physical specifications

The painted surface shall meet all requirements of MIL-PRF-85285 and be chip resistant in accordance with ASTM D3170, chip rating at least 5C. Pencil Hardness shall be in accordance with ASTM D3363, pencil hardness at least H – 2H and Tabor Abrasion resistant in accordance with ASTM D4060, mass loss < .020 grams.

9. LCD Glass & Filter Glass

9.1 Glass surface defects such as scratches, digs, chips, and smudges that appear in the viewing area and can be seen under normal work station lighting, from any view angle and without the aid of magnification or higher intensity lighting are not acceptable.

9.2 If the glass surface defect is visible after cleaning, use table 6-1 to determine accept/reject status. Use of an eye loop with measuring features to determine the size shall be necessary in many cases.

Surface Digs

Surface digs are chips or gouges on the outer glass surface. Surface dig acceptance criteria are shown below:

Accept/ Reject	Size (diameter)	Quantity	Location	View Angle
Reject	Greater than or equal to 1.0mm	More than 1	Viewing area	Any
Reject	Less than or equal to 0.5mm	More than 2	Viewing area	Any
Accept	Less than 1.0mm	Fewer than 5	Perimeter Area	Any

Scratches

Scratches are defined as elongated digs on the outer glass surface and the acceptance criteria are shown below:

Accept/ Reject	Width	Length	Qty	Location	View Angle
Reject	Greater than 0.25mm	Greater than 1.0mm	No more than 1	Viewing area	Any
Reject	Greater than 0.25mm	Less than 1.0mm	No more than 2	Viewing area	Any
Reject	Greater than 0.25mm	Less than or equal to 1.0mm	No more than 1	Viewing Area	Any
Accept	Less than or equal to 0.25mm	Less than 12.5mm	No more than 2	Perimeter Area	Any
Accept	Less than or equal to 0.25mm	Less than or equal to 0.5mm	No more than 2	Viewing Area	Any

Smudges – That will not clean off with IPA water solution

Accept/ Reject	Size (area)	Quantity	Location	View Angle
Reject	Greater than 2.0mm	None	Viewing area	Any
Reject	Less than or equal to 1.0mm	No more than 2	Viewing area	Any
Accept	Less than 2.0mm	No more than 1	Perimeter area	Any
Accept	Less than or equal to 1.5mm	No more than 1	Viewing area	Any

Dust & Debris

(Optically Bonded Glass)

Dust and debris are defined as particles or fibers lodged between layers under surface within glass stack-up layers and are visible in the white screen test mode within the display view area. The acceptance criteria for dust and debris are defined in the below table:

Elongated Particles (lines)			
Width	Cumulative Maximum Length	Maximum Allowable	Minimum Separation
> 0.25	1.0mm	0	N/a
0.10mm to 0.25mm	1.5mm	2	25mm
0.05mm to 0.1mm	3.0mm	5	12.5mm
<0.05	No limit	No limit	N/a
Spot and Spec Particles			
Size / diameter	Maximum Quantity Allowed	Comment	
>0.5mm	0		
0.25 to 0.5mm	2	With ≥5mm separation	

<0.25mm	8	With ≥2mm separation

10. QUALITY CONTROL REQUIREMENTS

10.1 Responsibility for Inspection

Unless otherwise specified in the contract or purchase order, the supplier is responsible for meeting all inspection requirements of this specification prior to shipping parts to UASC or a second value add party.

10.2 Visual Inspection Procedure

Cosmetic inspection of UASC parts shall use the “Time and Distance” inspection methodology. The inspection of coated (paint or powder coat) shall be performed under normal overhead fluorescent lighting conditions at 80 to 150 foot-candles. Surfaces shall be viewed at no less than 12 inches or more than 24 inches within 10 to 20 seconds and viewed without directly reflecting a single light source.

11. Surface Finish Protection – Packaging

11.1 All parts shall be packaged to prevent damage and marring of the surface finishes. Parts should be packaged individually. Use of ESD safe packaging materials is strongly encouraged.

11.2 Refer to UASC document WI-ADM-08.02 for packaging and paperwork requirements.