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1.0 Purpose

The purpose of this procedure is to provide the process for evaluation and criteria for accepting / rejecting color and color sensitive items.

2.0 Scope

This procedure is applicable to all color sensitive materials submitted for color evaluation and acceptance.

3.0 Reference Documents

- 1.13.3 – Nonconforming Material (Collins internal)
- 1.10.1 – Receiving Inspection (Collins internal)
- 1.4.24 – Cosmetic Standard Process Specification
- 1.4.24.2 - Restraint and Webbing Verification and Acceptance
- 1.10.24.2 – Fabric Acceptance
- 1.10.24.3 – Leather and Sheepskin Acceptance

4.0 Definitions

- 4.1. Original Color Master** – A color sample that is received from the customer / OEM and is used as the base requirement for color evaluation. Original masters are received and scanned into the Color Standards Database for electronic comparison of future materials and Supplier Color Masters.
- 4.2. Supplier Color Master** – A color sample that is received from the supplier of a color sensitive material. Once a supplier color master is approved for use, it is scanned into the Color Standards Database and is used as the Approved Master Sample for that supplier / product.
- 4.3. Approved Master Sample** – The sample that has been approved by Collin’s Quality Department and has went through any applicable inspection and testing. Approved Master Samples are stored and maintained by Quality Inspection.

- 4.4. Color Standards Database – An electronic database that stores color samples in a digital format representing such things as lightness, red/green tinting, and yellow/blue tinting. The color standards database is maintained by Quality Control.
- 4.5. Color Sensitive Material – Any raw material, part, or assembly requiring acceptance to a specific color.
- 4.6. DE_{cmc} – A numeric value indicating the color deviation of a sample from a master on the color spectrum. The DE_{cmc} value is used as the primary electronic criteria for acceptance/rejection of the submitted color samples.
- 4.7. DE₂₀₀₀ – A numeric value indicating the color difference between two color samples on the color spectrum. DE₂₀₀₀ is different from DE_{cmc} in that it provides an overall difference between two colors without regard to which is the master color. DE₂₀₀₀ can be used when evaluating a color that has exceeded a required DE_{cmc} value.

5.0 Maintenance of Color Masters

- 5.1.1. Quality Inspection maintains the color masters.
- 5.1.2. Care is taken when handling color master samples in order to assure the samples are not damaged. Original color masters are stored in a manner that protects the samples from exposure to light. Improper handling or continual exposure to light, chemical fumes, etc., may cause the color of the standards to change.
- 5.1.3. Further storage and handling requirements for Fabric and Leather/Sheepskin are within 1.10.24.2 and 1.10.24.3 respectively.

6.0 Visual Comparison Method - General Acceptance Requirements for Color Verification

6.1. Equipment

- 6.1.1. Lighting to be compliance with section 9.2 of procedure 1.4.24 unless otherwise specified for the type of material being inspected.

6.2. Applicable Materials

- 6.2.1. Fabric
- 6.2.2. Leather
- 6.2.3. Paint
- 6.2.4. Powder Coat
- 6.2.5. Plastic
- 6.2.6. Webbing (Restraint Material)
- 6.2.7. Sheepskin

6.3. Preparation

- 6.3.1. Obtain applicable approved master color sample.

6.3.2. Obtain material (or sample of material) requiring inspection for color approval

6.4. Inspection Process

6.4.1. Receiving inspector visually compares the submitted material to the approved color master sample to determine acceptability of the submitted material.

6.4.1.1. Fabric additional requirements listed in 1.10.24.2

6.4.1.2. Leather and Sheepskin additional requirements listed in 1.10.24.3

6.4.1.3. Restraint webbing additional requirements listed in 1.4.24.2

6.4.2. If determined to be acceptable by the inspector, the material is released for use in accordance with Collins procedure 1.10.1 – Receiving Inspection. Suppliers shall use their own applicable procedure to release for use.

6.4.3. If the material is rejected by the inspector, the sample needs to undergo digital comparison with the spectrophotometer. If the material is not able to be checked with the spectrophotometer, the inspector is to document the rejection on a Quality Notification (QN) and submits the nonconforming material to the MRB Team for evaluation and disposition by the MRB Team (reference procedure 1.13.3 – Nonconforming Material). Suppliers shall use their own applicable procedure to quarantine and review nonconforming material.

7.0 Digital Comparison Method

7.1. Equipment: The Spectrophotometer is used in determining the difference in color between two samples.

7.1.1. Spectrophotometer Set-up – note: the instructions are located in the User Manual

7.1.2. The Spectrophotometer needs to be standardized prior to initial use. The equipment will prompt user through this process using the provided black/white calibration cylinder which houses the NIST traceable standard.

7.1.3. Illumination: D65

7.1.4. Observation: 10 degrees

7.1.5. Specular reflectance: Included

7.1.6. Aperture: Varies

7.1.6.1. Aperture used in color acceptance will be the largest available aperture capable of measuring the sample provided. Care is taken when changing aperture sizes to ensure proper measurement.

7.1.6.2. Aperture size remains consistent within a product type

7.1.7. Color booth will be used when available. Color booth settings are a minimum of daylight (D65) and incandescent (“A”).

7.2. Materials Acceptable for digital comparison. Exceptions include: patterned fabric, sheepskin, product without a flat surface, and any product that is too small to get accurate readings.

7.2.1. Leather & Fabric

7.2.2. Paint & Powdercoat

7.2.3. Opaque Plastics

7.2.4. Webbing (restraint material)

8.0 Creating a color standard for the Color Standards Database.

8.1. Obtain the original color sample for entry into the color standards internal database.

8.2. Access Color internal database and select applicable database for storing sample.

8.3. Using the Spectrophotometer, obtain four readings across the surface of the approved color sample.

8.4. Identify the specific color by Collins color code and store sample in internal database. This action creates a master color sample in digital format used to compare submitted color sensitive materials.

9.0 Inspection of Color Using Spectrophotometer

9.1. Access applicable internal database in the spectrophotometer and select the specific color for comparison inspection.

9.2. Obtain four readings across the surface of the material being inspected.

9.3. The spectrophotometer's internal database compares the submitted sample to the digital master color sample, providing the following information used for determining the acceptability of color sensitive material:

9.3.1. A graphical representation of the submitted sample compared to the selected color master.

9.3.2. A DE_{cmc} value indicating the deviation of the color sample from the color master (in digital format).

9.4. Acceptance/Rejection Criteria (Unless otherwise noted in section 10)

9.4.1. $DE_{cmc} \leq 1.0$ of color master: Submitted sample is approved.

9.4.2. $DE_{cmc} > 1.0$: of color master: Submitted sample is rejected and processed for evaluation/disposition by MRB Team (Collins personnel reference procedure 1.13.3 – Nonconforming Material).

10.0 Accept / Reject Criteria for Specific Product

10.1. Restraint Webbing - Due to the nature of webbing manufacturing and usage (i.e. control of material batches within a ship-set, visual closeness of webbing material to other webbing material, surface finish), the following acceptance criteria is used:

- 10.1.1.** Supplier Master Acceptance: 3.0 DE_{cmc} maximum from the original master (provided the color is visually acceptable)
- 10.1.2.** Supplier Production Lot Acceptance: 1.5 DE_{cmc} maximum unless a separate criteria is established for that specific color.
- 10.1.3.** Within shipset variability: 1.0 DE_{cmc}. Maximum