


<b>SULLAIR</b>  <b>QMS PROCEDURE</b>  	REV. #	00	DOCUMENT NUMBER: FQA089	
	PAGE:	1	OF 10	EFFECTIVE DATE: 04/18/13
	OWNER:	Quality Assurance-Supplier Quality		
	TITLE:	<b>PAINT APPEARANCE (VISUAL STANDARD)</b>		

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## 1.0 Purpose and Scope

- 1.1 The purpose of this work instruction is to provide definitions for classification of parts and inspection instructions corresponding to these appearance classifications.

## 2.0 Scope

- 2.1 This procedure applies to all product produced by Sullair LLC and its Suppliers unless otherwise specified.

## 3.0 Roles and Responsibilities

Role	Responsibility
Associate	Inspection of parts using the following criteria
Engineer	Manufacturing of the products per customer's needs
Quality	Inspection of parts using the following criteria

## 4.0 Definitions


- 4.1 **Class** — Level of inspection criteria that determines acceptance of aesthetic surfaces

### 4.2 Powder Coat / Paint Defects

- 4.2.1 Blister— Enclosed raised spot resembling a blister
- 4.2.2 Chips / Voids — Areas of surface that have been broken, chipped or missing paint
- 4.2.3 Color — Color is not consistent from surface or within the same surface or does not match the applicable observational standards.
- 4.2.4 Fish Eye — Craters caused by organic and/or inorganic contamination
- 4.2.5 Foreign Material — Dirt, lint and/or other particles trapped in the paint
- 4.2.6 Gloss, Uneven — Gloss not consistent from surface to surface or within the same surface or within the range specified on the drawing
- 4.2.7 Orange Peel — An irregular or rough surface resembling the peel of an orange
- 4.2.8 Poor Painting Touch-Up — Defects hidden by use of touch-up paint, either spray or brush
- 4.2.9 Paint Runs, Sags, or Excessive Paint Build-Up — Areas where paint is applied so heavily that gravity causes it to flow downward.
- 4.2.10 Peeling and Flaking — Lack of paint adhesion
- 4.2.11 Scratches/Abrasions — Scratches and scuff marks on the surface
- 4.2.12 Texture, Non-Uniform — Texture is not consistent from surface to surface or within the same surface or does not match the applicable observational standard as specified on the drawing

### 4.3 Plating Defects

- 4.3.1 Blisters — Bubbling in or under plating
- 4.3.2 Burned Deposits — Rough plating on corners, and edges, produced by application of an excessive current density
- 4.3.3 Chemical Bleed Out — Leaching of plating process chemicals, generally from spot welded seams
- 4.3.4 Insufficient Plating — Lack of plating thickness, per applicable standards/specification


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- 4.3.5 Peeling / Flaking — Faulty adhesion, usually caused by contamination in the plating process
- 4.3.6 Plating Touch-Up — Areas where insufficient plating or defects have been touched up by brush plating, or paints
- 4.3.7 Poor Conversion Coat — Powdery chromate coating or coating missing in areas
- 4.3.8 Scratches/Abrasions — Scratches and scuff marks on the surface
- 4.3.9 Stain Spots — Stains of random size and distribution, usually caused by poor rinsing
  
- 4.4 **Base Metal Defects**
  - 4.4.1 Burrs or Sharp Edges — Protrusions and sharp edges that may cut flesh/skin in areas normally accessible to hands
  - 4.4.2 Flatness — Bowed, or wavy appearance, exceeding customer specifications or drawing requirements
  - 4.4.3 Grind Marks — Scratches and swirls from sanding and/ or grinding or abrasions left on the surface during the manufacturing process
  - 4.4.4 Spot Welds — Indentations or rough surfaces from spot welding that exceed drawing specifications
  - 4.4.5 Tool Marks — Creases or other indentations from tooling
  - 4.4.6 Weld Porosity — Pinholes in welds
  - 4.4.7 Weld Spatter — Small pieces of weld slag or metal particles attached to surface adjacent to welds
  - 4.4.8 Gouges — Deep marks in material from rubbing, wearing and/or impact
  - 4.4.9 Scratches — Light marks in material from rubbing, wearing and/or impact
  
- 4.5 **Screen Print Defects**
  - 4.5.1 Bleeding / Running — Area where ink extends beyond the edge of a characteristic onto substrate
  - 4.5.2 Breaks — Area where there is no ink on substrate which leaves characteristic incomplete
  - 4.5.3 Smudge / Smear — Area where ink has come into contact with foreign object and is distorted
  - 4.5.4 Legible — Characteristics are discernible at viewing distance
  - 4.5.5 Crisp / Clean — Edges of characteristics are in line, straight and not erratic
  - 4.5.6 Foreign Material / Hickey — Dirt, lint and/or other particles trapped in the ink
  - 4.5.7 Cracking — Irregular lines in ink
  - 4.5.8 Blobbing — excessive amount of ink on characteristic
  
- 4.6 **Appearance Classifications (Class A, B, or C)**
  - 4.6.1 Parts and surfaces can be divided into three classes as follows. Exceptions to the standard are to be indicated in job notes on the traveler (if applicable) and the master drawing if necessary.

**Table 1**

<b>Class A</b>	<b>Critical-</b> surfaces are of primary aesthetics including all outer surfaces painted Sullair Green, CAT Yellow, and CAT White; plus any outer surface of a component produced with 10 gauge or less material. This also includes the Fabricated Rails, any Screen Prints, and Metal Louvers
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<b>Class B</b>	<b>Semi-Critical-</b> surfaces that are not normally visible including all black-painted outer surfaces on heavy fabricated parts heavier than 10 gauge. Example: Drawbars, excluding the frame components
<b>Class C</b>	<b>Non-Critical components-</b> whereby the surface finish is for corrosion protection purposes only. This Class also includes the following components: Motors, Engines, Units, Tanks, Axles, and the Inner & Outer Surfaces of the Frames

- 4.6.2 If the classification is still unclear based on the general criteria above, the classification (A, B, or C) shall be determined by the Production Design Engineer and/or Marketing.
- 4.6.3 Unless specified elsewhere, the criteria established in this document shall govern acceptance
- 4.6.4 Following is the order of precedence:
  - 4.6.5.1 Part drawing
  - 4.6.5.2 Customer standards
  - 4.6.5.3 This appearance standard
- 4.6.5 Unless otherwise specified, all screen printing is to be considered Class A

## 5.0 Procedure

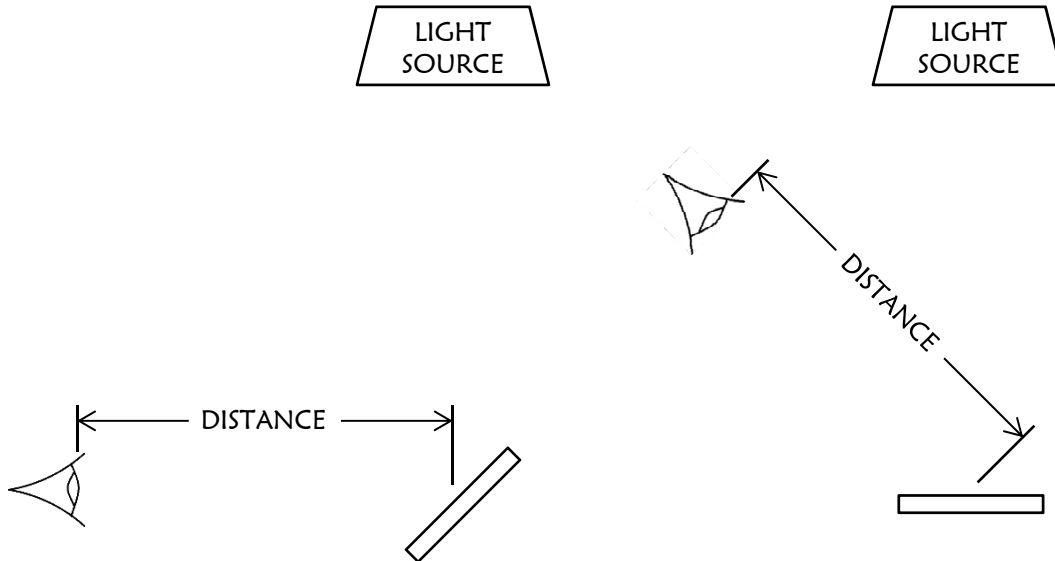
### 5.1 Viewing for Defect Inspection

- 5.1.1 Find a good light source. Unless specified, normal factory lighting should be sufficient.
- 5.1.2 Whenever possible the light shall be directly overhead, with the sample viewed at approximately 45 degrees. Sample may be moved from side to side or turned in the light as necessary during inspection. See **Figure 1** (on the next page) for general guidelines for viewing.
- 5.1.3 Evaluation of large parts shall be made with the part oriented in the position it will be used in the final product, if known.

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**Figure 1: Viewing Arrangements**




**5.2 Viewing Distance**

- 5.2.1 Acceptance of parts shall be based on visual inspection at the prescribed viewing distance for the designated class.
- 5.2.2 Where the area being inspected is recessed or not possible to view from the viewing distance specified below (See **Table 2**), the accept criteria shall be in accordance with **Table 3**.

5.2.3 The following viewing distances are from the center of the part surface to the eye

**Table 2: Viewing Distance**

CLASS	VIEWING DISTANCE
A	24 inches (61 cm)
B	24 inches (61 cm.)
C	48 inches (122 cm)

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### 5.3 The Accept / Reject Criteria

- 5.3.1 Accept — No finish defects readily visible or, in case of disputes, less than or equal to the maximum allowance per **Table 3** unless otherwise specified.
- 5.3.2 Reject — Defects visible or in case of disputes, in excess of maximum number allowable per **Table 3** unless otherwise specified.
- 5.3.3 An inspector who has not been informed as to location and/or type of defect shall recheck marginal or contested visual defects at viewing distances specified in **Table 2**. In cases of unresolved disputes the appropriate customer engineer shall act as a final arbitrator.
- 5.3.4 **Table 3** indicates the maximum number of imperfections allowable if captured by a 16 sq in (100cm sq) surface area, unless otherwise specified.

**Table 3. Defect Count in 16sq in (100cm sq) area**

	Class		
	A	B	C
Maximum Number of Defects	1	3	6


### 5.4 Appearance Defect Measurement

- 5.4.1 **Tables 4, 5, and 6** provide the generic criteria for acceptance of aesthetic parts.

**Table 4:** Measurement of Defects on Powder Coated / Painted Surfaces/Stainless Surfaces  
(Refer to Pages 6 & 7)

**Table 5:** Measurement of Defects on Plated Surfaces  
(Refer to Pages 7 & 8)


**Table 6:** Measurement of Defects on Base Metal (Uncoated) Surfaces  
(Refer to Pages 8 & 9)

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**Table 4. Measurement of Defects on Powder Coated / Painted Surfaces/Stainless Surfaces**

Defect	Class A (Critical) Accept Criteria	Class B Accept Criteria	Class C Accept Criteria
Screen Printing	Free of voids in lines or print; clear/ crisp lettering (not blurry); ink color matches standard; location and orientation match requirements	Print must be legible and located per customer specification	Print must be legible and located per customer specification
Blister	None	0.062 inch (1.59mm) max diameter	Allowable <b>up to 0.5"</b> diameter
Chips or Voids	None (except for all hanging marks no larger than 0.25" diameter and any defects 0.25" diameter using Sullair Paint Touch-up Procedure- <b>WQA096 Paint Quality Guidelines</b> )	Permissible, not objectionable at viewing distance using Sullair Paint Touch-up Procedure - <b>WQA096 Paint Quality Guidelines</b>	Allowable using Sullair Paint Touch-up Procedure- <b>WQA096 Paint Quality Guidelines</b>
Color	In accordance with print requirements, per Observational Standard	In accordance with print requirements, per Observational Standard	
Fisheye	Not visible at viewing distance	0.062 inch (1.59mm) max	Allowable up to 0.5" diameter
Foreign Material	0.031 inch (0.8mm) max	0.062 inch (1.59mm) max	0.125 inch (3.2mm) max
Gloss, Uneven	Appearance even in lighting stated in document, unless panel touched up using Sullair Procedure <b>WQA096 Paint Quality Guidelines</b>	Appearance even in lighting stated in document, unless panel touched up using Sullair Procedure <b>WQA096 Paint Quality Guidelines</b>	Allowable at viewing distance
Orange Peel	Not visible at viewing distance	Allowable at viewing distance	Allowable at viewing distance
Runs, Sags	Not visible at viewing distance	Not visible at viewing distance	Allowable at viewing distance
Painting Touch-Up	None (except for all hanging marks no larger than 0.25" diameter and any defects 0.25" diameter using Sullair Paint Touch-up Procedure- <b>WQA096 Paint Quality Guidelines</b> )	Permissible, not objectionable at viewing distance using Sullair Paint Touch-up Procedure - <b>WQA096 Paint Quality Guidelines</b>	Allowable using Sullair Paint Touch-up Procedure- <b>WQA096 Paint Quality Guidelines</b>
Peeling and Flaking	None	None	None
Scratches/Abra sion	0.003 inch (0.076mm) width max 0.250" in length touch up using Sullair Procedure <b>WQA096 Paint Quality Guidelines</b>	0.006 inch (0.15mm) width max. 0.250" in length touch using Sullair Procedure <b>WQA096 Paint Quality Guidelines</b>	Touch-up permissible providing using Sullair Procedure <b>WQA096 Paint Quality Guidelines</b>
Texture, Non Uniform	Appearance even in lighting stated in document, unless panel touched up using Sullair Procedure <b>WQA096 Paint Quality Guidelines</b> , without detriment to corrosion protection intent	Appearance even in lighting stated in document, unless panel touched up using Sullair Procedure <b>WQA096 Paint Quality Guidelines</b> without detriment to corrosion protection intent	Allowable at viewing distance

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Grind Marks	Not visible at viewing distance	Not visible at viewing distance	Allowable if 120 grit minimum is used
Spot Welds	No protrusions visible at viewing distance (Except for Stainless Steel surfaces unless clear burn through evident)	Protrusions not to exceed .003	Protrusions not to exceed .007
Tool Marks	Not visible at viewing distance	Allowable at viewing distance	Allowable at viewing distance
Weld Porosity	Not visible at viewing distance and allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on Page 9</b>	Allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on Page 9</b>	Allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on Page 9</b>
Weld Spatter	Not visible at viewing distance	Acceptable when adhering in non-visible, recessed, hard to reach areas.	Acceptable when tightly adhering
Burrs and Sharp Edges	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)
Pem Nuts	Installed per pem manufacturer's requirements. Threads protected and functional at point of use.	Installed per pem manufacturer's requirements. Threads protected and functional at point of use.	Installed per pem manufacturer's requirements. Threads protected and functional at point of use.

**Notes:**

- 1) All defects below 0.003 inch (0.076mm) diameter are considered not visible.
- 2) Any defect exposing base metal is a reject, or unless meets the requirements of Sullair Procedure **WQA096 Paint Quality Guidelines**.
- 3) For Class A, Observational Standard to be placed directly adjacent to surface, and for Class B separated by 1 inch (25.4mm) from surface.
- 4) Hook marks must be touched up on outside of hole; inside of hold and countersink area does not need to be touched up.
- 5) The number of allowable defects cannot exceed the maximum number of defects per **Table 3** unless specified otherwise

**Table 5. Measurement of Defects on Plated Surfaces**

Defect	Class A (Critical) Accept Criteria	Class B Accept Criteria	Class C Accept Criteria
Blister	None	None	Not visible at viewing distance
Burned Deposits	Not visible at viewing distance	Not visible at viewing distance	Not visible at viewing distance
Chemical Bleed-Out	None	0.062 inch (1.57mm) max from seam	0.125 inch (3.175mm) max from seam
Insufficient Plating	Thickness per Applicable specification/standard	Thickness per Applicable specification/standard	Thickness per Applicable specification/standard
Plating Touch-Up	None	None	None
Poor Conversion Coat	Not visible at viewing distance	Not visible at viewing distance	Not visible at viewing distance

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Peeling and Flaking	None	None	None
Scratches / Abrasions	No bare metal	No bare metal	No bare metal
Stain Spots	None	20% of surface	50% of surface
Grind Marks	Not visible at viewing distance	Not visible at viewing distance	Allowable if 120 grit minimum is used
Spot Welds	No protrusions visible at viewing distance.	Protrusions not to exceed .003	Protrusions not to exceed .007
Tool Marks	Not visible at viewing distance	Allowable at viewing distance	Allowable at viewing distance
Weld Porosity	Not visible at viewing distance and allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on Page 9</b>	Allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on Page 9</b>	Allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on Page 9</b>
Weld Splatter	Not visible at viewing distance	Acceptable when adhering in non-visible, recessed, hard to reach areas.	Acceptable when tightly adhering
Burrs and Sharp Edges	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)
<b>Notes:</b> 1) All defects below 0.010 inch (0.25mm) diameter are considered not visible. 2) Any defect exposing base metal is a reject. 3) The number of Allowable defects cannot exceed the Maximum number of defects per <b>Table 3</b> unless specified otherwise.			

**Table 6: Measurement of Defects on Base Metal (Uncoated) Surfaces**

Defect	Class A (Critical) Accept Criteria	Class B Accept Criteria	Class C Accept Criteria
Flatness	Per drawing	Per drawing	Per drawing
Grind Marks	Not visible at viewing distance	.030 inch max to a depth of 5% material thickness for sheet metal. For heavy fabrication allowable	Allowable if 120 grit is used
Spot Welds	No protrusions visible at viewing distance No depressions greater than 0.025.inch (0.64mm)	Protrusions not to exceed .003	Protrusions not to exceed .007
Tool Marks	Not visible at viewing distance	.030 inch max to a depth of 5% material thickness for sheet metal. For heavy fabrication allowable	.060 inch max to a depth of 10% material thickness for sheet metal. Heavy fabrication allowable
Weld Porosity	Not visible at viewing distance and allowable, without detriment to integrity of the weld per the <b>AWS</b>	Allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on Page 9</b>	Allowable, without detriment to integrity of the weld per the <b>AWS D1.1 Criteria on</b>



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	D1.1 Criteria on Page 9		Page 9
Weld Spatter	Not visible at viewing distance	Acceptable when adhering in non-visible, recessed, hard to reach areas	Acceptable when tightly adhering
Burrs and Sharp Edges	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)	Does not snag or abrade a standard 100% Cotton Material (e.g. T-Shirt)
Pem Nuts	Installed per pem manufactures requirements. Threads protected and functional at point of use.	Installed per pem manufactures requirements. Threads protected and functional at point of use.	Installed per pem manufactures requirements. Threads protected and functional at point of use.
<b>Notes:</b> 1) All defects below 0.010 inch (0.25mm) diameter are considered not visible. 2) The number of Allowable defects cannot exceed the Maximum number of defects per <b>Table 3</b> unless specified otherwise.			

## 6.0 Records & Forms

Record	Responsibility	Location	Retention	Disposition
n/a	n/a	n/a	n/a	n/a

## 7.0 References: Sullair Paint Touch-up Procedure- WQA096 Paint Quality Guidelines

*and*

### AWS (American Weld Standard) D1.1 Criteria


Sum of visible piping porosity is as follows:

1/32" diameter and larger porosity, should not exceed a total sum of 3/8" in one linear inch of weld, Also the sum should not exceed 3/4" in 12" of linear weld.

Inspection process:

*Step 1:* With a scale or calipers, measure all porosity diameters within the densest area of porosity in a given inch. Add all porosity dimensions, however discarding the dimensions of the porosity that measures less than 1/32". The weld is acceptable if the sum of the porosity dimensions is equal to or less than 3/8".

*Step 2:* With a scale or calipers, measure all porosity diameters within the densest area of porosity in a given 12". Add all porosity dimensions, however discarding the dimensions of the porosity that measures less than 1/32". The weld is acceptable if the sum of the porosity dimensions is equal to or less than 3/4".

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**Approval Signatures On File**

Date: 04/18/13	Date: 04/18/13
Approved By: E. Greenwood	Author/Initiator: D. Roden

*ISO Revision Log*

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