1 Purpose

The purpose of this document is to establish cosmetic acceptance and rejection criteria for the paint, silk screen marking, chem film, brazing, machined metal and honeycomb filters. It is meant to be used in conjunction with customer specific workmanship standards.

2 Guidelines

Inspect the parts using the unaided eye (no magnification) at a ~18 inches for 7 seconds. View the parts in normal glare-free fluorescent shop lighting with illumination of ~100-foot candles to detect any cosmetic defects. Inspect up to a 45 degree angle of how the product would normally be viewed normally by the customer. Inspect all finished surfaces.

Magnification should only be used to adjudicate the presence of a nonconformance which was previously identified.

2.1 Paint Nonconformances

This section applies to the painted surfaces.

2.1.1 Blisters

Areas of local air entrapment or non-adhesion. Frequently seen (intact or popped) around brazed seams or rivets (see images below).

Figure 1 - Popped Blister

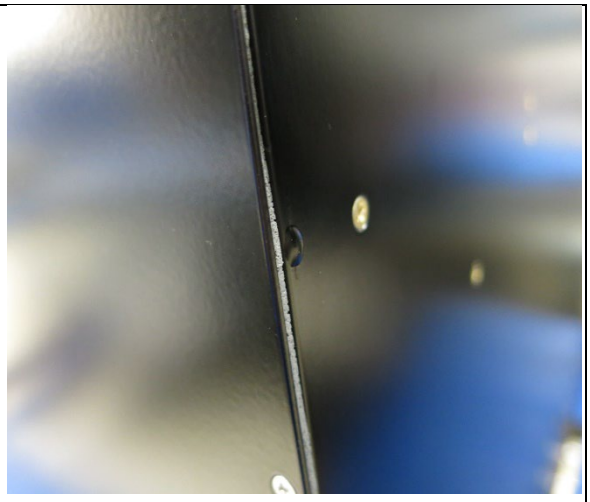

Figure 2 - Intact Blister

No blistering is acceptable. Return the part to Vendor for refinishing.

2.1.2 Peeling, Flaking, Chipping Paint

Paint peeling away at edge of unit exposing the primer or base metal. Nonconformance may be exasperated when tape or protective plastic is removed (see images below).

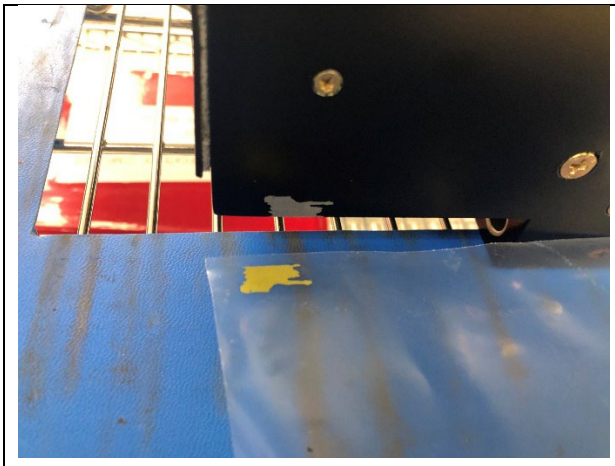

Figure 3 - Paint peeling when protective plastic is removed

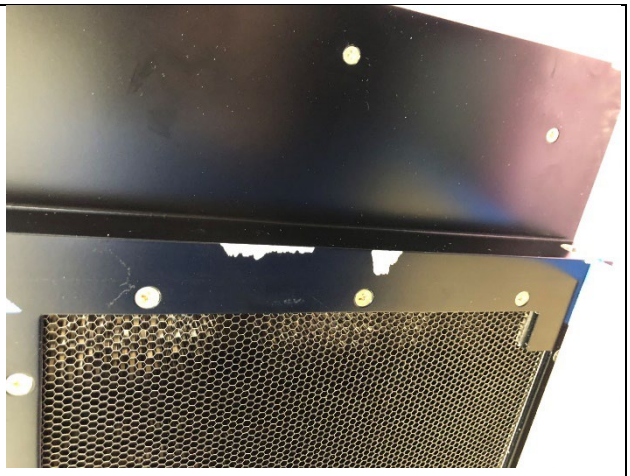

Figure 4 - Paint peeling when tape is removed

No Peeling is acceptable. Return the part to Vendor for refinishing.

2.1.3 Pin Holes

Pits or holes in the paint which expose base metal or primer (see images below).

Figure 5 - Pin holes in PCP

Figure 6 - Pin holds on edges

Touching-up paint is acceptable under conditions described in (Section 2.1.15).

If that is not possible, return the unit to Vendor for refinishing.

2.1.4 Embedded FOD

Small particles or fibers trapped under paint surface (see images below).

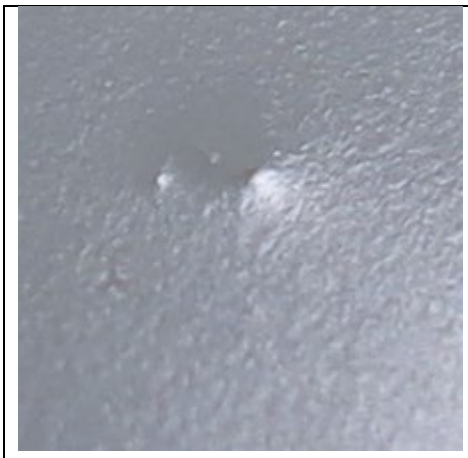

Figure 7 - 2 Pieces of Embedded FOD

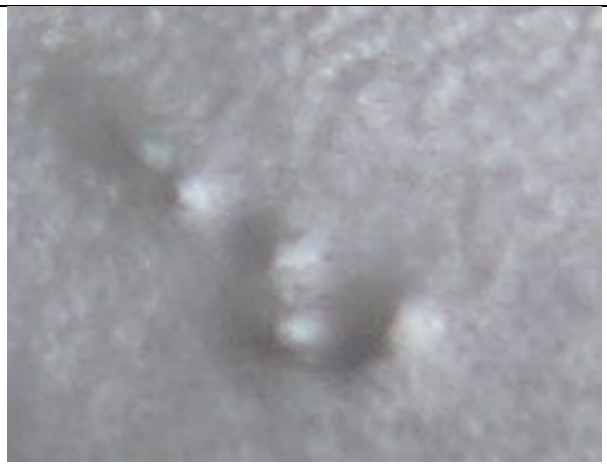

Figure 8 - 5 Pieces of Embedded FOD

Figure 9 - Embedded Fiber

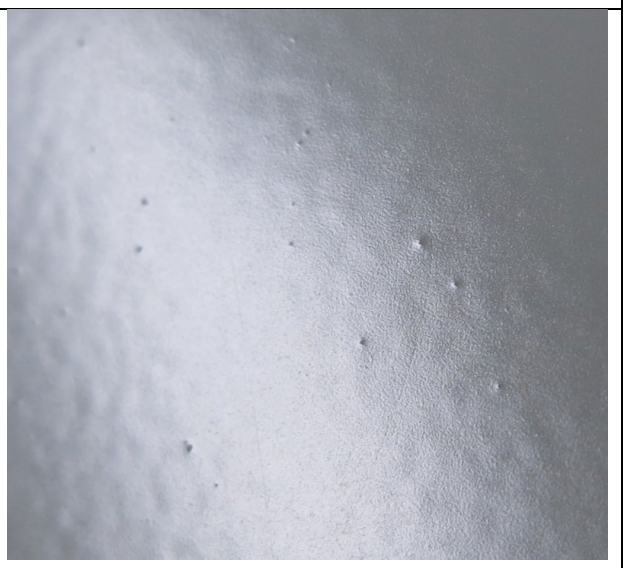

Figure 10 - Greater than 5% of the total surface

Embedded FOD is acceptable under the following conditions:

a) No more than 5% of the surface area is covered with embedded FOD.
b) Embedded FOD should have no nonconformances such as un-attached bubbles, or delamination that may later separate from the product causing potential foreign object damage.
c) No more than 10 pieces of embedded FOD are allowable in a 1 square inch localized area. Size restrictions for embedded FOD are as follows:
   c.1. Only 1 piece of embedded FOD: <≈ 0.05” diameter
   c.2. 2-10 pieces of embedded FOD: <≈ 0.030” diameter.
d) No more than 1 piece of embedded fiber (see Figure 9) is allowable in a 1 square inch localized area, and it must measure:

d.1.1. Large Chassis: < 1" long and thinner than 0.010"
d.1.2. Small items: < .25" long and thinner than 0.010"

If any the above criteria are exceeded, the unit should be returned to the Vendor for refinishing.

If you notice a trend in embedded FOD across multiple parts, please notify the Quality Manager. This may be a leading indicator that the paint booth and/or drying area are not properly protected from dust and debris.

2.1.5 Scratches

Marks on the surface exposing primer or base metal (see images below). Thin scratches that do not expose primer or base metal are acceptable, but they should be buffed out to reduce visual impact.

Figure 11 – Reject – base metal exposed

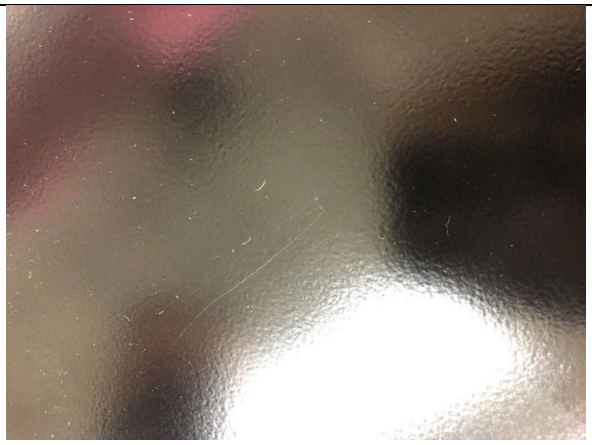

Figure 12 - Acceptable

A thin scratch which is <u>not</u> through the paint to the base metal or primer is acceptable. Buff the part to reduce visual impact.

If the scratch is through the paint exposing the primer or base metal, it should be returned to Vendor for refinishing.

If you are noticing a trend in thin scratches across multiple parts, please notify the Quality Manager. This maybe a leading indicator that parts are not being properly protected from damage during shipping, storing or WIP.

2.1.6 Scuffs

Dull patches in the paint that do not go through to the primer or base metal (see image below).

Figure 13- Scuffs in Paint

No scuffing is acceptable on the front of the unit that would face the end user after installation. Some small scuffing is acceptable on the back, sides, top and bottom of the Chassis if not through paint. Buff out to reduce visual impact.

If you are noticing a trend in scuffs across multiple parts, please notify the Quality Manager. This maybe a leading indicator that parts are not being properly protected from damage during shipping, storing or WIP.

2.1.7 Screw Pops

Paint missing around screw holes (see images below).

Figure 14 - Paint missing around screw hole

Figure 15 - Unacceptable Paint Touch-Up Around Screw Hole

Touching-up paint is allowed, but the paint must be allowed to dry completely before applying plastic wrap for shipment (please refer to Figure 15 for unacceptable paint touch-up).

2.1.8 Orange Peel

An irregularity textured in the surface of a paint film. Orange peel occurs as an uneven or grainy surface to the eye, but usually feels smooth to the touch; appearance resembles the skin on an orange (see image below).

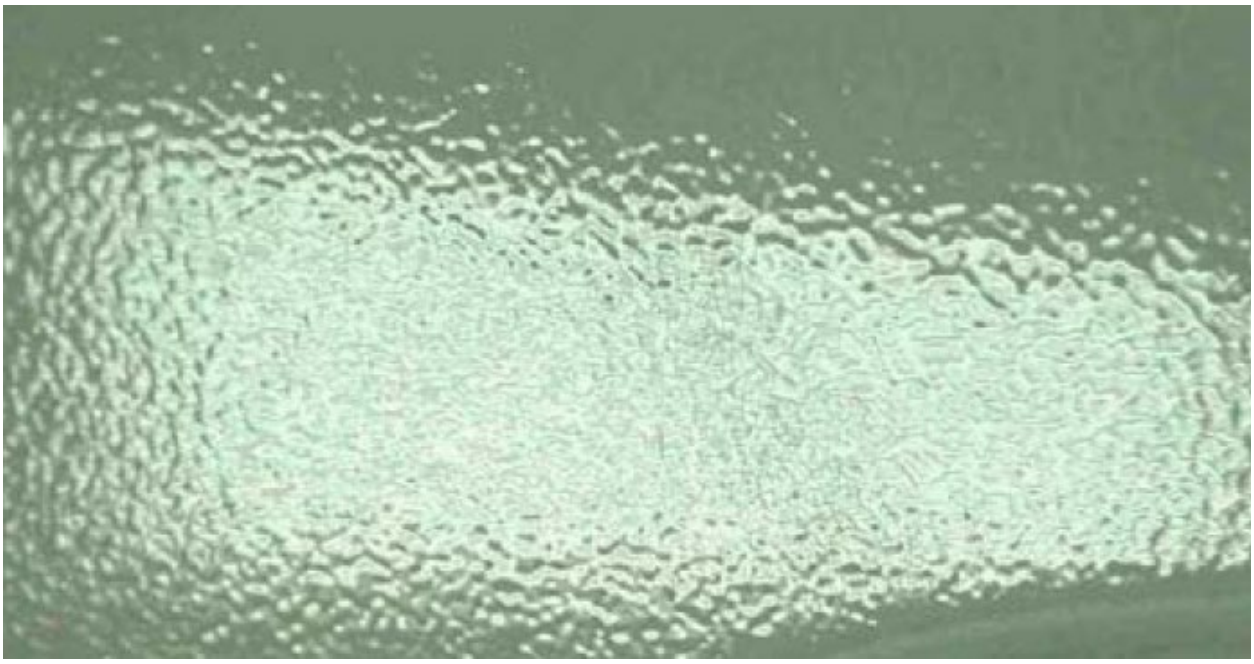

Figure 16 - Orange Peel

Orange peeling is not acceptable. Part should be returned to Vendor for refinishing.

2.1.9 Crazing, Cracking and Checking

Surface imperfection that appears as lines that may be straight or crooked, long or short, interconnected or may be completely separate. Crazing is a surface defect while cracks penetrate through the paint (see images below).

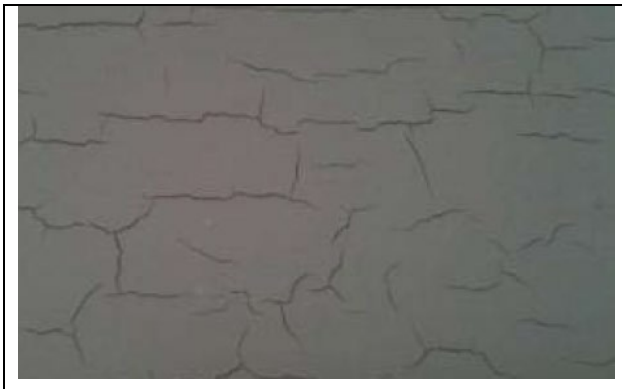

Figure 17 - Cracking or Crazing

Figure 18 - Checking

Neither condition is allowable. Return part to Vendor for refinishing.

2.1.10 Paint Runs or Sags

Excessive paint in a local area not drying uniformly (see images below).

Figure 19 - Paint Runs

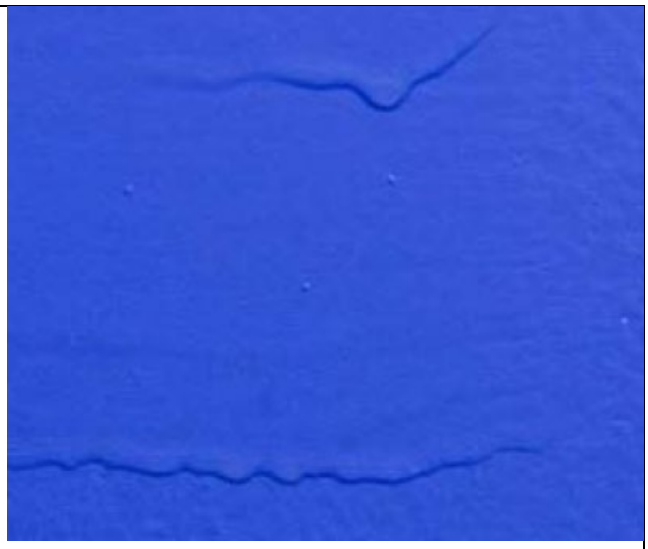

Figure 20 - Paint Sags

Not acceptable. Return part to Vendor for refinishing.

2.1.11 Gouges

Material removed or displaced in a local area resulting in the exposure of primer or base metal.

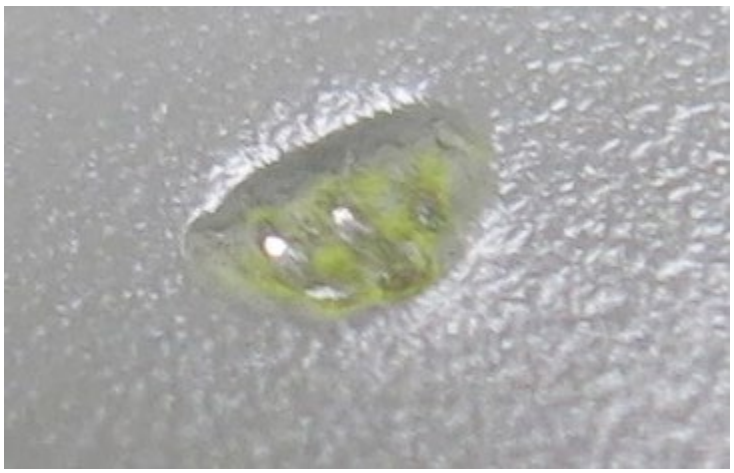

Figure 21 - Paint Gouge

Not acceptable. Return part to Vendor for refinishing.

2.1.12 Paint Discoloration

Paint should be uniform in color.

2.1.13 Over-Spray

Paint that has crept up or been deposited on the screws.

Figure 22 – Paint over-sprayed onto the screw.

Not acceptable. Return part to Vendor for refinishing.

2.1.14 Tab Indentations

Areas on the front of the unit where the brazing or filler material has not filled the tabs and leaves a small, indented area.

Tab and rivet indentations are allowable on the top, side, back and bottom of the unit provided there is no expose primer or base metal.

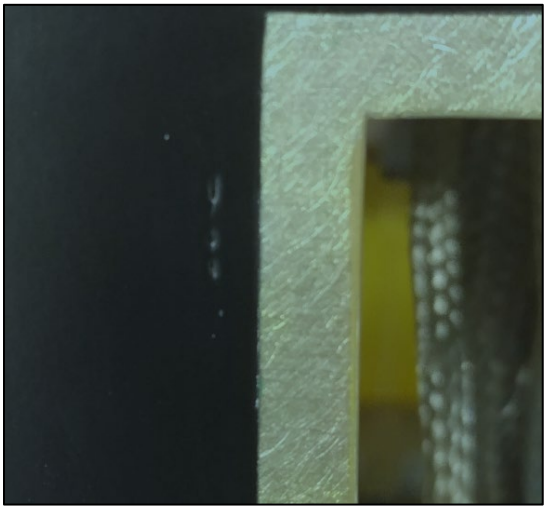

Figure 23 - Unallowable tab indentation

Not acceptable. Return part to Vendor for refinishing.

2.1.15 Concealed Areas

Painted areas may be concealed by hardware, mating panels, or other components at the final assembly level. Paint defects in these areas are acceptable provided they are not visible when assembled and do not expose unfinished base metal. Flaking paint should be removed to prevent a FOD and to prevent spreading. Base metal should be touched up if it does not affect the fit of mating of components.

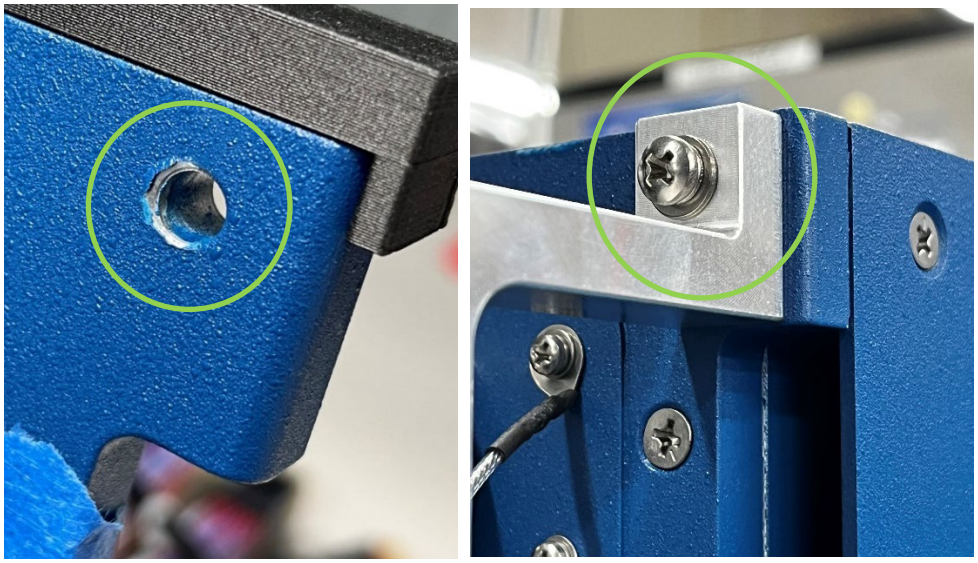

Figure 244 – Painted Concealed by Hardware

Some areas may be partially visible or have limited visibility. Light scuffing and touch up is acceptable in these areas provided they are not visible at arm's length in the final assembly.

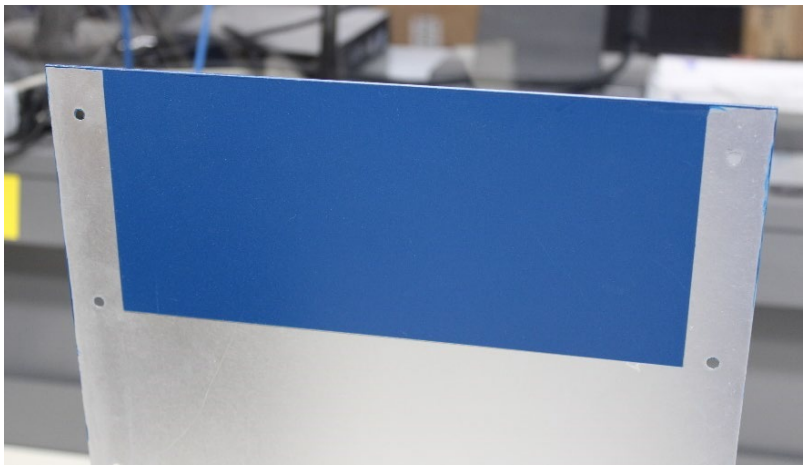

Figure 255 – Air Flow Path with Limited Visibility

2.1.16 Paint Touch-Ups

Paint touch-ups are allowed when they are virtually indistinguishable when viewed from approximately 2 feet (see images below).

Figure 266 - Screw Pop Touch-Up – Acceptable

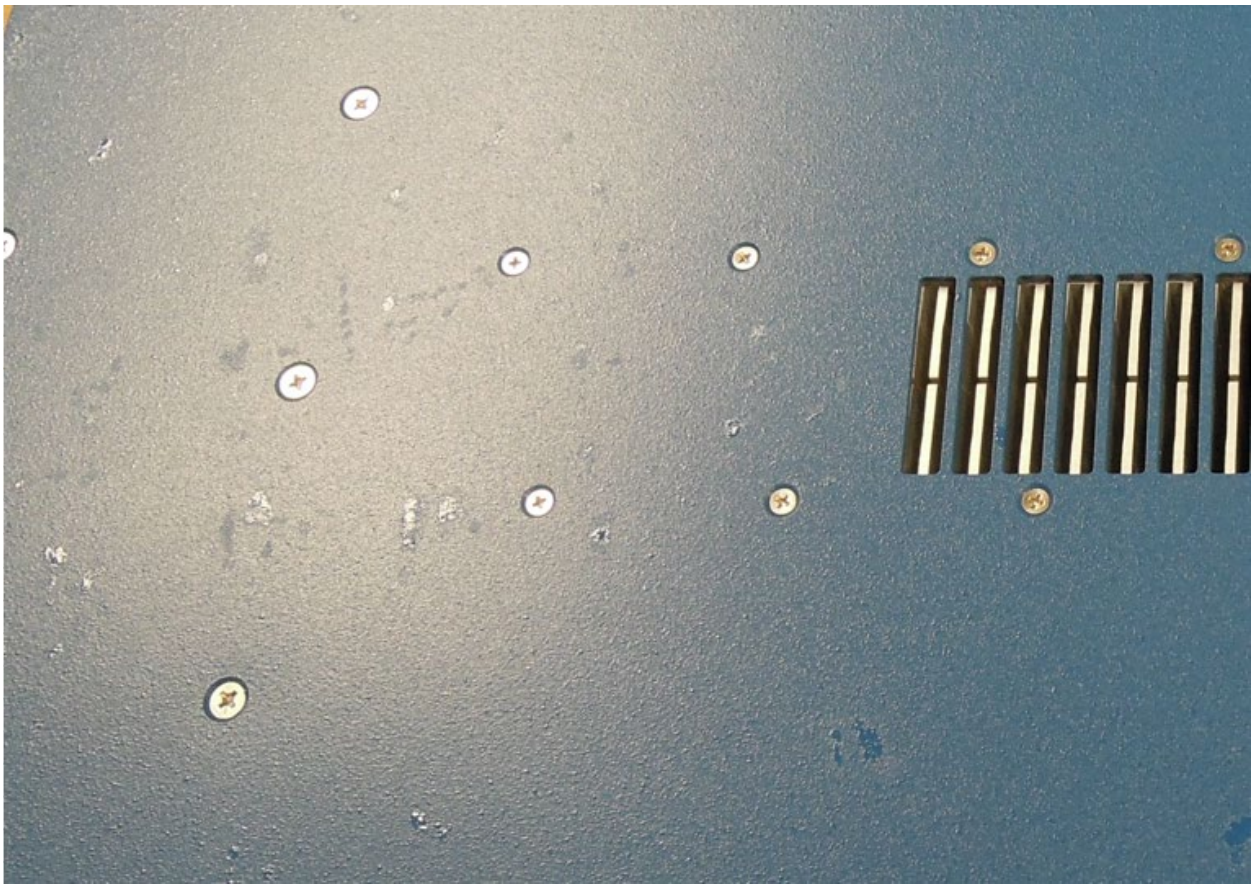

Figure 277 - Unacceptable Touch Up

Paint touch-ups are frequently performed for pin holes or screw pops. Touch-up paint should be allowed to thoroughly dry before wrapping for shipping or it will stick to the plastic and look like a popped blister or paint peel (also see Figure 15).

Figure 288 - Unacceptable Touch-Up

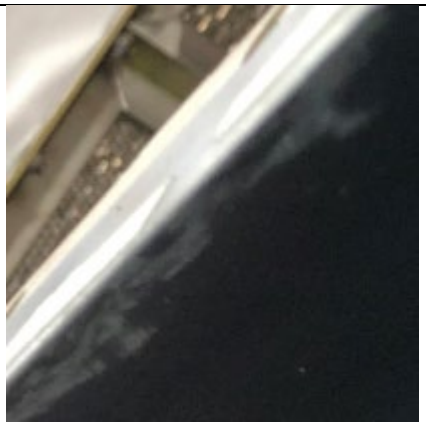

Figure 29 - Unacceptable Edge Touch-Up

2.2 Silk Screen Marking

Marking should be sharp, well defined and easily readable (see images below).

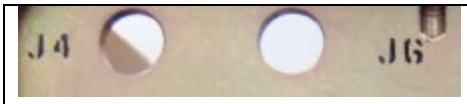

Figure 30 - Preferred: Clear sharp lines

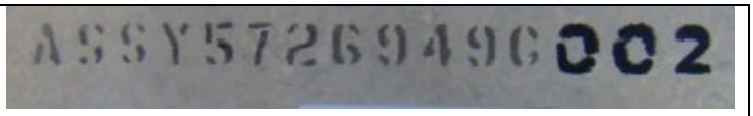

Figure 31 - Acceptable: Characters are light, but not smeared and contain all elements.

Blurring, smearing, or other imperfections that impair the legibility are unacceptable.

Unacceptable marking would include:

- Characters half-filled in
- Too light to read
- Half the number missing
- Blurred or smeared
- Poor contrasting color
- Scratch through marking surface
- Mark over marking surface

Nonconforming units should be reworked in house or returned to Vendor for re-marking.

2.3 Chem Film Nonconformances

2.3.1 Chem Film Discoloration

Color levels may range from clear to iridescent yellow or brown. Variation in color, hue, or tint of the Chem Film on a single part due to differences in surface finish are acceptable if the finish meets the requirements of the drawing. It must be evident that all required Chem Film surfaces are covered.

2.3.2 Chem Film Coverage

No bare metal or gaps in the Chem Film coverage are allowed. Touch-up small areas with a Chem Film Pen in accordance with governing specification. If that is not practical, return part to Vendor for refinishing.

2.4 Brazing Quality

Surface porosity, voids or brazing metal skips are allowed provided they do not exceed 3.1 mm (0.120 in.) with a total accumulated length less than 50% of length. See AWS C3.7M/C3.7 current revision. Section 6.5.1.1 Class C.

2.4.1 Voids

Example of acceptable void. The void is small and does not go all the way through the brazed joint.

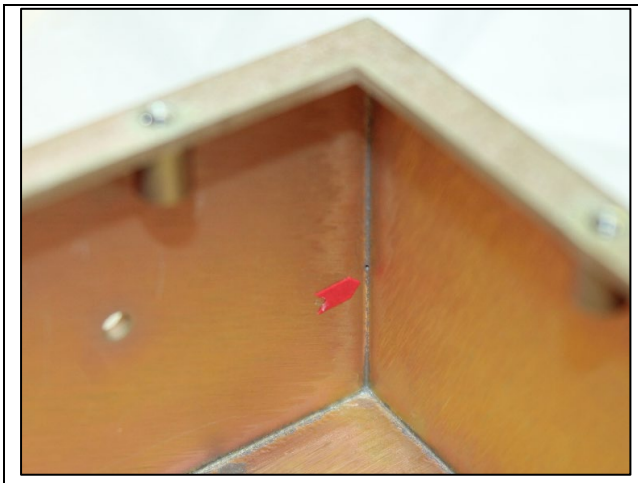

Figure 32 - Small Void

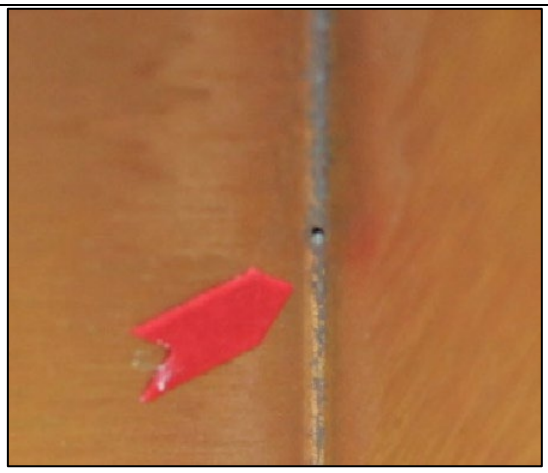

Figure 33 - Same Void Magnified

2.5 Machined Metal Surface Finish

This section establishes visual inspection criteria for the surface finish on a machined metal part.

Inspection should be performed without magnification under normal lighting conditions. Inspections should be conducted from approximately an arm's length distance from the part.

Please note there are different acceptance criteria for the outside surface (visible by the end user after installation) and the inside surface (not visible to the end user after installation).

2.5.1 Homogenous Finish

2.5.1.1 Outside Surface

The outside surface should have a homogenous finish either orbital sanded finish (see Figure 32) or time saver finish (see Figure 33). Time saver finish is preferred.

Figure 34 - Orbital Sanding Finish

Figure 35 - Time Saver Finish

2.5.1.2 Inside Surface

Interior surfaces may have a mix of orbital sanded finish and time saver finish.

2.5.2 Machining Marks

Light scratches left on the metal by machine tools prior to any finish (chem film, paint, anodize). Please note this section does not apply to damage done to the part after the finish is applied.

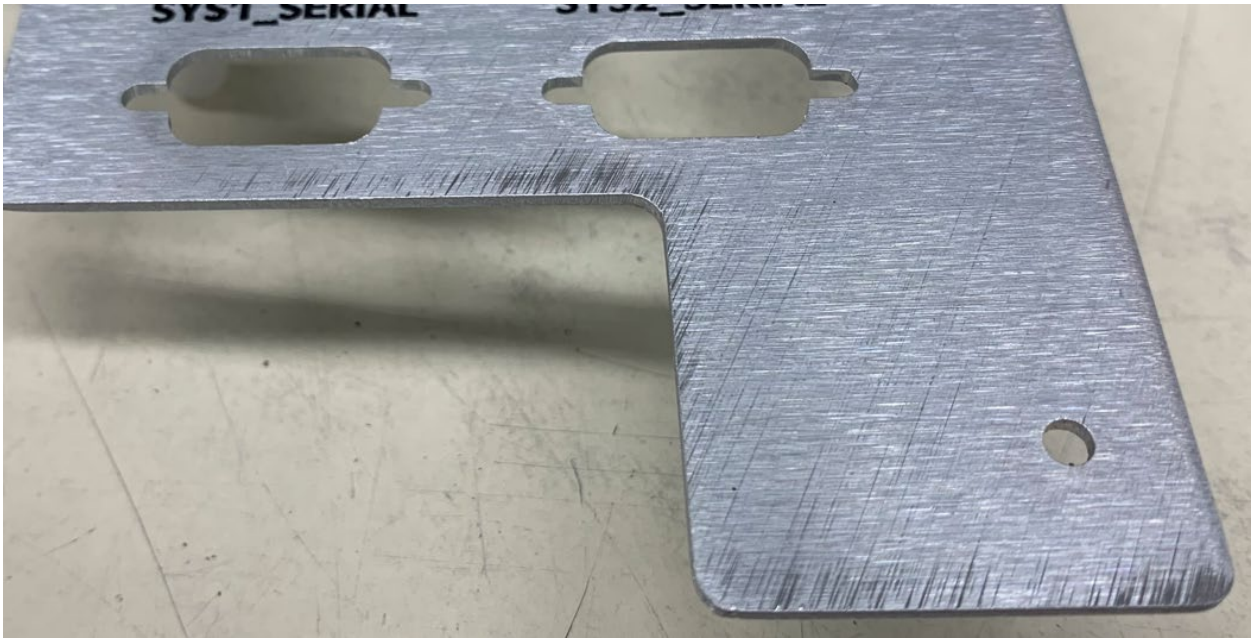

Figure 36 - Scratches from deburring

Figure 297 - Scratch from tooling

2.5.2.1 Outside Surface

Minimum tooling marks are permissible provided they:

- Do not feel rough to the touch
- Are sealed with whatever finish is defined for the part
- Do not cover more than 5% of the part surface

Light tooling marks similar to Figure 35 would be permissible. Tooling marks as seen in Figure 34 would not be permissible.

2.5.2.2 Inside Surface

Tooling marks are permissible on the inside surface provided they:

- Are not burred
- Are sealed with whatever finish is defined for the part

Tooling marks seen in Figure 34 and those seen in Figure 35 are both permissible.

2.5.3 Burred Metal

All surface whether inside or out, must be deburred.

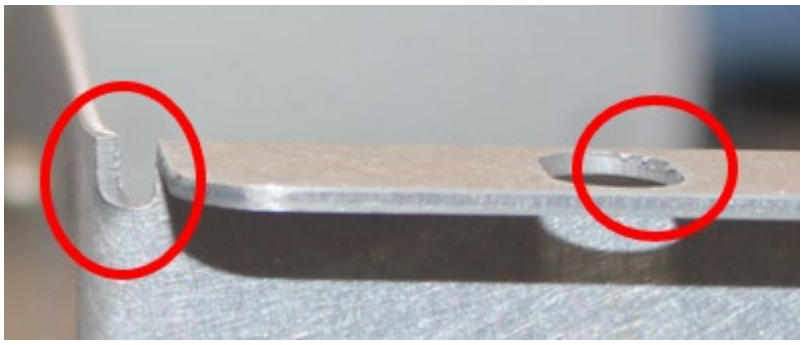

Figure 308 - Burred Metal

2.5.4 Damage to Finished Parts

Any damage (scratches, gouges) to finished parts needs to be reworked back to the criteria listed in this document including reapplying the finish to the reworked areas. Please see the appropriate section of this document for finish touchup criteria.

2.6 Honeycomb Filters

This section establishes visual inspection criteria for honeycomb filters.

Filters should be inspected without magnification under normal lighting conditions. Parts should be inspected at approximately 12in.

Please note there are different acceptance criteria for in the inside surface (not visible by the customer after installation) and outside surface of the filter.

2.6.1 Chemical Conversion Coating

Chemical conversion coatings can be clear/colorless, iridescent yellow, brown, gray, or blue. Coatings shall be smooth, continuous in appearance, and free of voids, flaking, or scratches. There shall be no spots of discoloration that indicate a lack of finish.

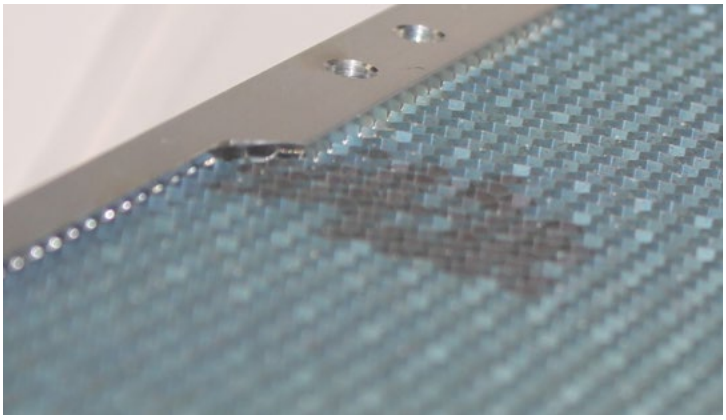

Figure 39 – Chem Film Defect

2.6.2 Nickel Plating

Nickel plating shall be smooth, continuous in appearance, and free from visible blisters, pits, nodules, porosity, cracks, and flaking. These shall be no spots of discoloration that indicate a lack of finish.

Figure 40 – Nickel Plating Defect

2.6.3 Water Stains

Small white areas of discoloration caused by rinsing process (dried droplets of water).

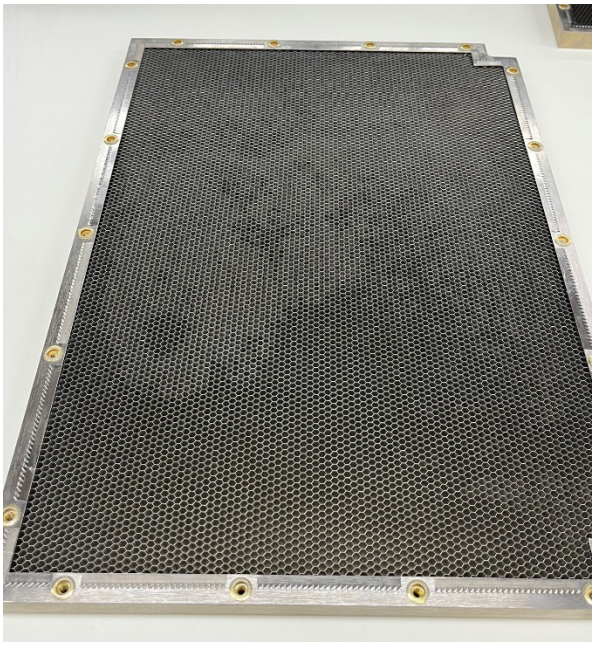

Figure 41 - Water Stains

2.6.3.1 Outside Surface

Up to 50% of the part surface

2.6.3.2 Inside Surface

Allowed.

2.6.4 Crease

Fold or wrinkle in the material.

Figure 42 - Crease

2.6.4.1 Outside Surface

Not allowed.

2.6.4.2 Inside Surface

Not allowed.

2.6.5 Dented or Crushed Hexagonal Cells

Area of bent or dented cells from damage

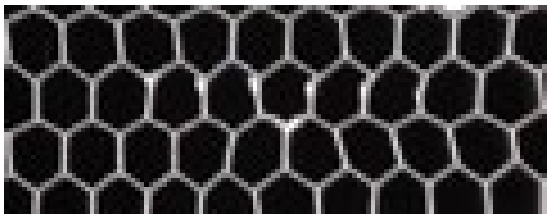

Figure 313 - Dented or Crushed Cells

2.6.5.1 Outside Surface

Not allowed.

2.6.5.2 Inside Surface

Up to 10% of the part surface providing the following conditions are met:

- No bucked or split cells
- Not a FOD hazard
- Not visible from outside surface
- Does not restrict air flow or impact performance

2.6.6 Cracks, Fractures, and Splits

Crevice/break in material whether or not the material has separated.

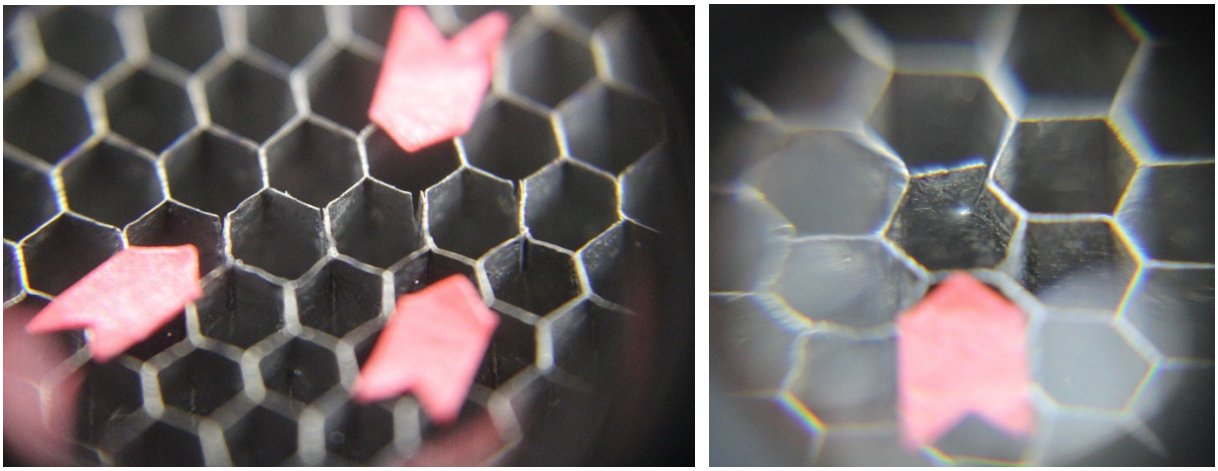

Figure 324 – Split Cells

2.6.6.1 Outside Surface

Not allowed.

2.6.6.2 Inside Surface

Not allowed.

2.6.7 Burred Edges

A thin ridge or area of roughness produced in cutting or shaping metal.

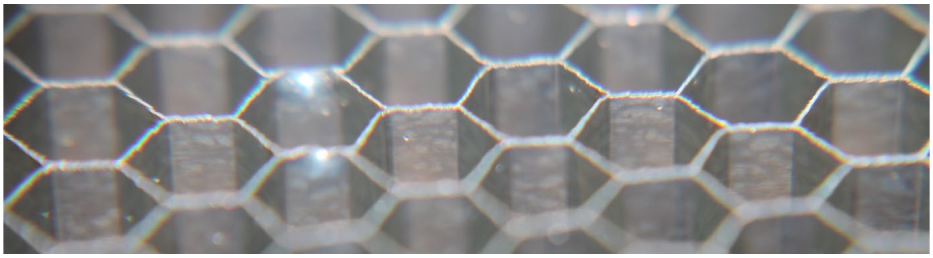

Figure 335 - Burred Edges

2.6.7.1 Outside Surface

Not allowed.

2.6.7.2 Inside Surface

Not allowed.

2.6.8 Voids

Absence of plating material or coating, exposing underplated or base metal

2.6.8.1 Outside Surface

Not allowed.

2.6.8.2 Inside Surface

Not allowed.

2.6.9 FOD Hazzard

Any peeling, blistering, or tearing of the material that could come loose and become FOD.

2.6.9.1 Outside Surface

Not allowed.

2.6.9.2 Inside Surface

Not allowed.

2.6.10 Weld Marks

Surface imperfections caused by the welding process.

2.6.10.1 Outside Surface

May not protrude above the surface.

2.6.10.2 Inside Surface

Must not impair part function.

3 Reference

3.1 Terms and Abbreviations

Term	Definition
FOD	Foreign Object Debris or Damage

3.2 Reference Documents

Document Number	Document Title
AWS C3.7M/C3.7	American Welding Society Standard for Aluminum Brazing

4 Authorization

Title	Name	Signature	Date
Quality Manager	Molly Levy	On File	11/15/22

5 Revision History

Revision	Reason for Change	Change	By Whom
4/13/16		Original Issue	J. McCarte
5/27/16		Added card cell specs and correct LCR header.	J. McCarte

8/3/16		Added requirements for all MMA chassis.	J. McCarte
12/8/17	Consistency with other procedure formats.	Format change only. No changes to requirements.	J. Lentz
5/8/17	Add an additional defect. Streamline language.	Simplified the inspection instruction formatting. Added tab indentations and photos.	J. Lentz
10/9/18	Clarify requirements.	Updated procedure to match BAE document RF01447. Added photos.	J. Lentz
09/02/2020	Clarify requirements	Reworded for clarification and added images. Reduced allowable size of embedded fibers on the PCP. Added notes about nonconformance leading indicators.	M. Levy
2/18/22	Modified so that this inspection standard can be used across different product lines	Removed all references to specific customer's or products.	M. Levy
5/13/22	CA383 – Splotchy paint touchup	Added image 25 as an example of splotchy paint touchup on Weeping Angel.	M. Levy
5/20/22	CA381 – Damage to Honeycomb filter	Added section 2.5 to establish cosmetic acceptance rejection criteria for honeycomb filters.	M. Levy
7/20/22	Response to Supplier Request for clarification	Established criteria for Machined Metal Surface Finish.	M. Levy

9/13/22	Feedback from suppliers	Updated acceptance criteria for honeycomb filters.	D. Saporito
11/11/22	No prior guidance concealed areas.	Added section for concealed areas.	D. Saporito