

Cosmetic Inspection Guidelines for Mechanical Components

Table of Contents

1.0 Purpose/Scope/Timing	2
1.1 Responsible Roles	2
1.2 Communication.....	2
1.3 Compliance Date.....	2
2.0 Procedure/Quality Record Requirements	3
2.1 Global Appearance Guidelines.....	3
2.2 Inspection Procedure Requirements.....	4
2.3 Cosmetic Reference Standard Table and Instructions	5
2.4 Control of Non-Conforming Material.....	21
3.0 Definitions, Acronyms and References	21
4.0 Supporting Documents	24
5.0 Document Revisions and Approvals	25
6.0 Appendix	26



Cosmetic Inspection Guidelines for Mechanical Components

1.0 Purpose/Scope/Timing

This document provides cosmetic appearance guidelines for both GE Grid Automation, GE Industrial Communications, and its suppliers. It establishes quality requirements for the cosmetic inspection of purchased mechanical parts. The purpose of this document is to clarify the acceptance and rejection criteria. This document entails products such as chassis, covers, faceplates, cast enclosures, heat sinks, cabinets, plastic cases, pulls, handles, brackets, and bezels. This inspection document may be used to assist in making an accept or reject decision.

1.1 Responsible Roles

- Supplier
 - Provide all parts and services as outlined in Purchase Order (PO), drawings, and/or specifications
Note: Unless otherwise specified, refers to the corporation, company, partnership, sole proprietorship or individual with whom EC places a Purchase Order (PO).
- Supplier Quality Engineer (SQE)
 - Communicates qualification and production quality requirements to supplier
 - Serves as the key interface with the supplier
 - Communicates qualification acceptance to the supplier
 - Coordinates process improvements, non-conforming material dispositions, corrective actions, and surveillance auditing
Note: The roles and responsibilities of the SQE apply to the Product Quality Engineer (PQE), Quality Process Engineer (QPE) or other business equivalent Global Supply Chain (GSC) representative.
- Sourcing Representative
 - Negotiates price, delivery, terms and conditions
 - Places the PO for qualification and production
Note: The roles and responsibilities of the sourcing representative apply to a site commodity leader (SCL), global commodity leader (GCL), buyer, or other business equivalent sourcing delegate.
- Responsible Engineer
 - Technology Engineering, in conjunction with SQE and Quality, will be responsible for establishing the appropriate cosmetic specifications for products that fall under the scope of this document.
 - Communication with the Responsible Engineer must be done with the knowledge of the SQE
Note: For the purposes of this document the Responsible Engineer applies to the Design Engineer, Materials Engineer, Welding Engineer, Repair Engineer, or other equivalent Engineering representative.

1.2 Communication

All communication with suppliers, including questions or requests for additional information, should be submitted to the appropriate Supplier Quality representative.

1.3 Compliance Date

Full compliance from all organizations within scope is expected at the time of issuance of this document. Any specification exceptions to references in this document by the supplier must be submitted by the supplier utilizing eSDR (Clear Orbit) and approved by the appropriate GE representative and documented accordingly.



Cosmetic Inspection Guidelines for Mechanical Components

2.0 Procedure/Quality Record Requirements

2.1 Global Appearance Guidelines

- Products must meet requirements specified in the drawing.
- **Note:** When a discrepancy exists between this document and the drawing, the drawing takes priority. Reference EM-SRC-0002 Supplier Quality Requirements section 2.2.1 for the full order of precedence of guiding documents.
- Acceptable defects shall not affect the fit or function of the product.

2.1.1 Cleanliness of Workspace

- Work space should be suitable for inspection purposes and be free of clutter.
- Proper PPE garments such as cotton or latex gloves should be worn.

2.1.2 Cleanliness of Part being Inspected

- GE expects products to be free of dirt, grease, oils, contaminants, and any removable foreign material.
- At supplier location, clean parts with appropriate methods as needed.
- At GE location, GE may clean or reject material for unacceptable cleanliness.

2.1.3 Staining and Discoloration

- For painted or coated parts, staining and discoloration is not allowed.
- For uncoated parts, staining is not allowed. Standard mill finish applies unless more stringent criteria are defined on the drawing.

-

2.1.4 Silk-Screening

- Should have no defects on the lettering or surface

2.1.5 Insufficient/ Excessive Paint and/or coating

- Follow the GE drawing for keep-out areas and allowable overspray.
- Coverage in painted/coated areas is expected to be complete without exposing base material.
- It is not acceptable for Paint and Coatings on surfaces to cause dimensions to exceed the dimensions on the drawing. The dimensions on drawing apply to the finished part after painting and coating.

2.1.6 Chemical Conversion Coating

- For any chromate conversion, use of hexavalent chromium is forbidden unless stated in drawings or direct approval from GE.



Cosmetic Inspection Guidelines for Mechanical Components

2.2 Inspection Procedure Requirements

2.2.1 Viewing Position

All surfaces should be viewed as close to “normal viewing position” as practical. That is, look at the part as you would see it as a complete unit installed in the customer site. It is not necessary to rotate the part to allow light to reflect at all possible angles of the product. Lighting should be sufficient enough to inspect the hardware.

2.2.2 Viewing Distance

Table 1 Viewing Distance and Time

	A zone	B zone	C zone	D zone
Viewing Distance	18 in	24 in	30 in	36 in
Viewing Time	10 seconds	8 seconds	6 seconds	4 seconds

2.2.3 Viewing Time

Any one surface should not be inspected for more than 10 seconds. This “once over” glance is sufficient to notice any imperfections that are readily apparent. Imperfections that take over 10 seconds to notice are not generally the type that would result in customer dissatisfaction.

2.2.4 Viewing Tools

The use of tools such as Vernier caliper, magnification and defection templates may be used to find the root causes for defects in the product. This will help verify the problem and find the correct action to fix the situation. Magnifying devices are not permitted for initial visual inspection. They are to be used to determine the size of the defect.

2.2.5 Viewing Zones

The following zones have been established and proven effective and are listed here only to maintain continuity. This is classified from A to D, most importance to least importance.

“A” zone	All areas that include the primary appearance and interface area, as the customer views or interacts with the product part. Refer to the following photographs, which identify this area. This is the area that is most visible to the customer.
“B” zone	Areas adjacent to “A” zone, but not readily visible in normal open and close positions.
“C” zone	Areas that are visible only when special effort must be made to see a sizable defect.
“D” zone	All areas that are not exposed once the unit is populated.



Cosmetic Inspection Guidelines for Mechanical Components

2.3 Cosmetic Reference Standard Table and Instructions

Process for using the Cosmetic Reference Standard Table:

1. Determine the type of defect.
2. Determine the number and size of the defects.
3. Determine the zone(s) the defects are located in.
4. Determine the surface area size of the part. If less than 400 in² use the left-hand side of the table, if greater than 400 in² use the right-hand side of the table.
5. Use the information in steps 1 through 4 in the Cosmetic Reference Standard Table to determine acceptability.

Supplier can request or submit an eSDR to seek approval for any products that do not meet these specifications. Follow EM-SRC-0002 section 2.3.4 for eSDR requirements.



Cosmetic Inspection Guidelines for Mechanical Components

Cosmetic Reference Standard Table

Defect	Zone	Part's entire Area Less than 400 in ² per side		Part's entire Area Greater than 400 in ² per side	
		Max Defect Size Allowed	Max Number Allowed per 100 in ²	Max Size Allowed	Max Number Allowed per 300 in ²
Applicable to all Parts					
Fracture, Split, Crack	N/A	Defect not Allowed			
Incomplete Fill/ Cold Shot in Cast Metals	N/A	Defect not Allowed			
Corrosion, Oxidation, Rust	N/A	Defect not Allowed			
Short Shot injection molded plastic	N/A	Defect not Allowed			
Burrs and Sharp Edges	N/A	Defect not Allowed			
Scuff, Abrasion, Mark (light)	A	None	0	1" long	1
	B	0.25"	2	1.5" long	2
	C	0.5"	2	1.5" long	4
	D	1.0"	8	Acceptable	8
Note: Must not catch fingernail					
Scratch (catches fingernail)	A	None	0	0.25" Long	1
	B	0.125"	1	0.5" Long	2
	C	0.25"	2	1.0" Long	4
	D	0.5"	8	Acceptable	8
Note: No exposed metal ; 0.015" width max					
Pits	A	None	0	0.03"	3
	B	0.04" dia x 0.04" deep	2	0.03"	6
	C	0.06" dia x 0.04" deep	4	0.045"	6
	D	0.10" dia x 0.04" deep	8	Acceptable	Any
Gouge	A	None	0	None	0
	B	None	0	0.03"x0.06"	2
	C	0.075"x0.25"	2	0.075"x0.25"	2
	D	0.125"x0.5"	8	Acceptable	Any
Note: Maximum depth of gouge is 0.04"					
Dent, Ding, Nick	A	None	0	None	0
	B	0.100" dia	1	0.25" dia	1
	C	0.125" dia	3	0.50" dia	1
	D	0.250" dia	5	1.00" dia	Any
Note: No exposed metal ; 0.040" depth max					



Cosmetic Inspection Guidelines for Mechanical Components



Cosmetic Inspection Guidelines for Mechanical Components

Base Material Defect, Composition	A	None	0	None	0
	B	0.06" diameter	2	0.06" diameter	4
	C	0.06" diameter	4	0.06" diameter	8
	D	0.06" diameter	8	0.06" diameter	16
Punch & Die Mark	A	0.06" distance from hardware	Any	0.25" distance from hardware	Any
	B	0.15" distance from hardware	Any	0.5" distance from hardware	Any
	C	0.25" distance from hardware	Any	0.75" distance from hardware	Any
Note: Adjacent to any inserted hardware	D	Acceptable	Any	Acceptable	Any
Porosity, Voids & Sink Marks	A	None	0	None	0
	B	0.005"	2	0.01"	4
	C	0.01"	4	0.02"	8
	D	0.01"	6	0.02"	12
Protrusions	A	None	0	None	0
	B	0.06" Dia. x .010" H	2	0.12" Dia x 0.02"H	4
	C	0.06" Dia. x .010" H	4	0.12" Dia x 0.02"H	8
	D	0.01" Dia. x .010" H	6	0.02"Dia x 0.02" H	12
Removable Particulate Foreign Material	A	0.01"	2	0.01"	4
	B	0.03"	4	0.03"	8
	C	0.1"	6	0.1"	12
Note: Material can be cleaned at GE facility under GE's discretion	D	0.15"	10	0.15"	20
Ejector Pin Mark	A	None	0	None	0
	B	0.03"	2	0.03"	2
	C	0.06"	2	0.06"	2
	D	Acceptable	Any	Acceptable	Any



Cosmetic Inspection Guidelines for Mechanical Components

Plated, Painted and Coated Parts (Also includes specifications from section "Applicable to All Parts")					
Runs	A	None	0	None	0
	B	0.06"	2	0.12"	4
	C	0.1"	4	0.2"	8
	D	0.25"	6	0.5"	12
Blistering, Peeling, Flaking, Chipping	A	None	0	None	0
	B	0.1"	2	0.1"	2
	C	0.15"	3	0.15"	3
Note: Should not expose base metal; paint touch-up allowed	D	0.2"	4	0.2"	4
Fisheye	A	None	0	None	0
	B	0.06"	2	0.06"	4
	C	0.1"	4	0.1"	8
	D	0.125"	6	0.125"	12
Orange Peel/Orange Skin	A	None	0	None	0
	B	0.25"	2	0.25"	4
	C	0.5"	4	0.5"	8
Note: Must be fully cured	D	Acceptable	Any	Acceptable	Any
Delamination	A	None	0	None	0
	B	None	0	None	0
	C	None	0	None	0
Note: Only allowed over stainless steel or Aluminum in D zone	D	0.5"	4	0.5"	4
Bleed Out	A	None	0	None	0
	B	0.25"	2	0.25"	4
	C	0.375"	4	0.375"	8
	D	0.5"	8	0.5"	16
Slug Mark	A	None	0	None	0
	B	0.06"x 0.12"	1	0.06"x0.12"	1
	C	0.06"x 0.12"	3	0.06"x0.12"	3
Note: Cannot exceed drawing tolerances	D	Acceptable	Any	Acceptable	Any
Flow Marks & Ripples	A	None	0	None	0
	B	less than 0.5 in ²	2	less than 0.5 in ²	4
	C	less than 1in ²	4	less than 1in ²	8
	D	Acceptable	Any	Acceptable	Any



Cosmetic Inspection Guidelines for Mechanical Components

Non-painted and Non coated Areas (Also includes specifications from section "Applicable to All Parts")					
Rainbow Effect	A	None	0	None	0
	B	less than 0.5 in ²	2	less than 0.5 in ²	4
	C	less than 1 in ²	4	less than 1 in ²	8
	D	Acceptable	Any	Acceptable	Any
Burnish Marks	A	None	0	None	0
	B	None	0	None	0
	C	0.25"	2	0.5"	4
Note: Attempt to polish out except on Aluminum	D	Acceptable	Any	Acceptable	Any
Bend Line (Edge Area)	A	None	0	None	0
	B	0.25" from edge allowed entire length	Any	1.0" from edge allowed entire length	Any
	C	0.5" from edge allowed entire length	Any	Acceptable	Any
	D	Acceptable	Any	Acceptable	Any
Welded Area (showing burn or black)	A	None	0	None	0
	B	None	0	None	0
	C	Within 0.25" of Weld	Any	Within 0.25" of Weld	Any
	D	Acceptable	Any	Acceptable	Any



Cosmetic Inspection Guidelines for Mechanical Components

Plastic Parts (Also includes specifications from section "Applicable to All Parts")					
Gates	A	None	0	None	0
	B	Acceptable	1	Acceptable	1
	C	Acceptable	1	Acceptable	1
Note: Cannot exceed drawing tolerances	D	Acceptable	1	Acceptable	1
Parting Line	A	None	0	None	0
	B	0.005"	N/A	0.01"	N/A
	C	0.01"	N/A	0.02"	N/A
Note: Does not increase tolerance on the drawing	D	0.015"	N/A	0.03"	N/A
Flash	A	None	0	None	0
	B	0.005" protrusion	Any	0.005" protrusion	Any
	C	0.01" protrusion	Any	0.01" protrusion	Any
Note: Cannot exceed drawing tolerances	D	Acceptable	Any	Acceptable	Any
Weld (Knit) Line	A	None	0	None	0
	B	0.002" Wide	2	0.002" Wide	2
	C	0.002" Wide	4	0.002" Wide	4
	D	0.002" Wide	8	0.002" Wide	8
Sink (for Plastic Parts)	A	None	0	None	0
	B	0.003"	2	0.003"	2
	C	0.010"	4	0.010"	4
	D	0.015"	6	0.015"	6
Specks and Bubbles (for Plastic Parts)	A	0.025"	1	0.025"	1
	B	0.025"	2	0.025"	2
	C	0.030"	4	0.030"	4
	D	0.035"	6	0.035"	6
Scratches (for Plastic Parts)	A	0.100"	1	0.100"	1
	B	0.150"	1	0.150"	1
	C	0.300"	2	0.300"	2
	D	0.5"	4	0.5"	4
Discoloration	A	None	0	None	0
	B	Per drawing	Per drawing	Per drawing	Per drawing
	C	Per drawing	Per drawing	Per drawing	Per drawing
	D	Acceptable	Any	Acceptable	Any

The following defects are not allowed on plastic parts in A and B zones. Consult drawing for criteria in C and D zones:

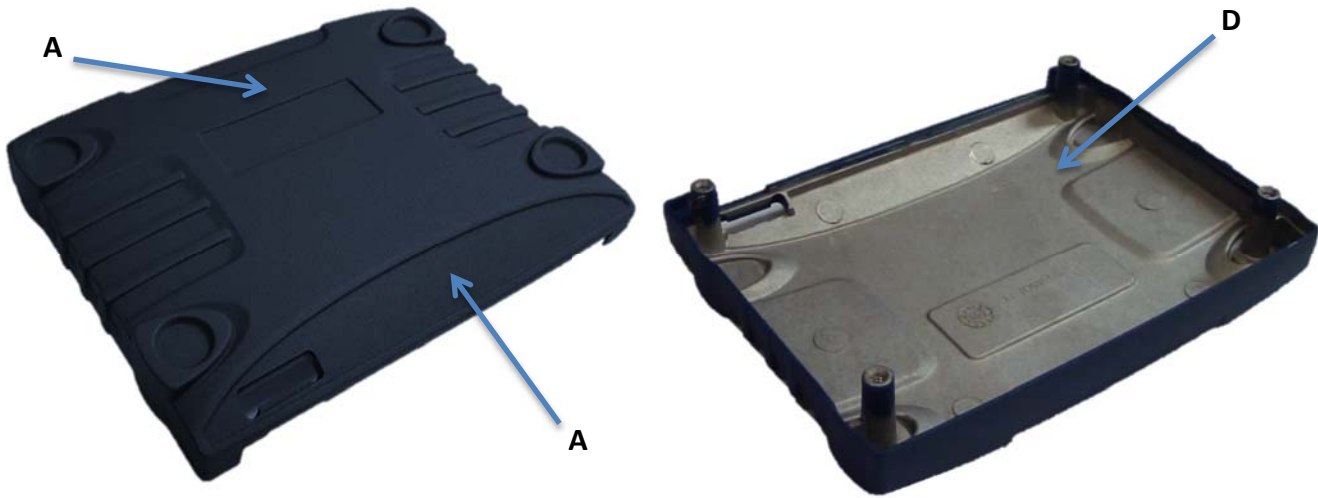
Splits, Burns, Gas Marks, Marbling, Orange Peel, Non-Uniform Texture, Pitting, Cracking, Delamination, and Cold Slugs



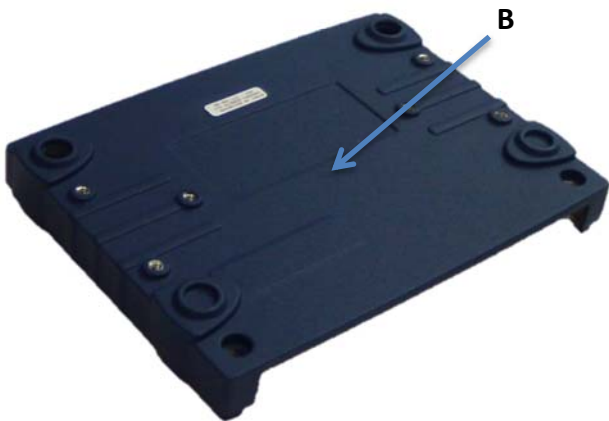
Cosmetic Inspection Guidelines for Mechanical Components

Note: For cosmetic defects not referenced in the above table, please refer to the latest revision of **AQ-103 Cosmetic Specification for Injection Molded Parts**.

Painted Cast Enclosures

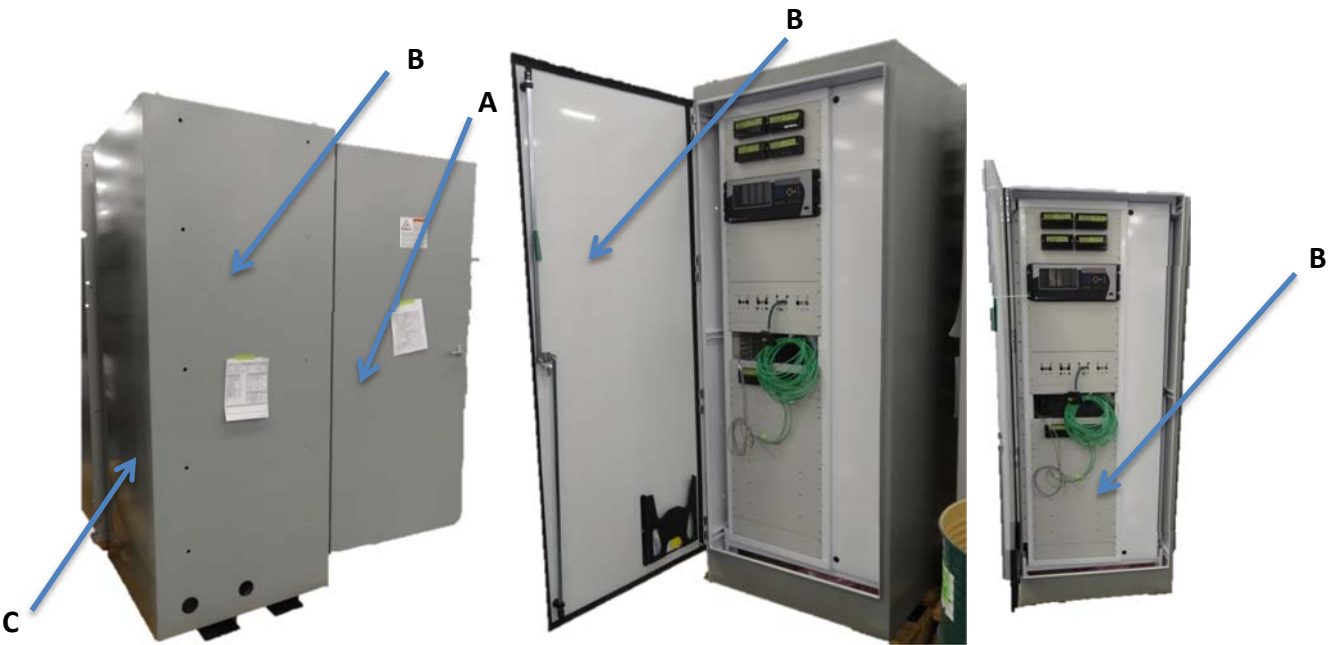


*Note: No paint on threaded holes, heat sinks, and mounting (grounding) areas. Heat sink areas must also be free of burrs and protrusions.

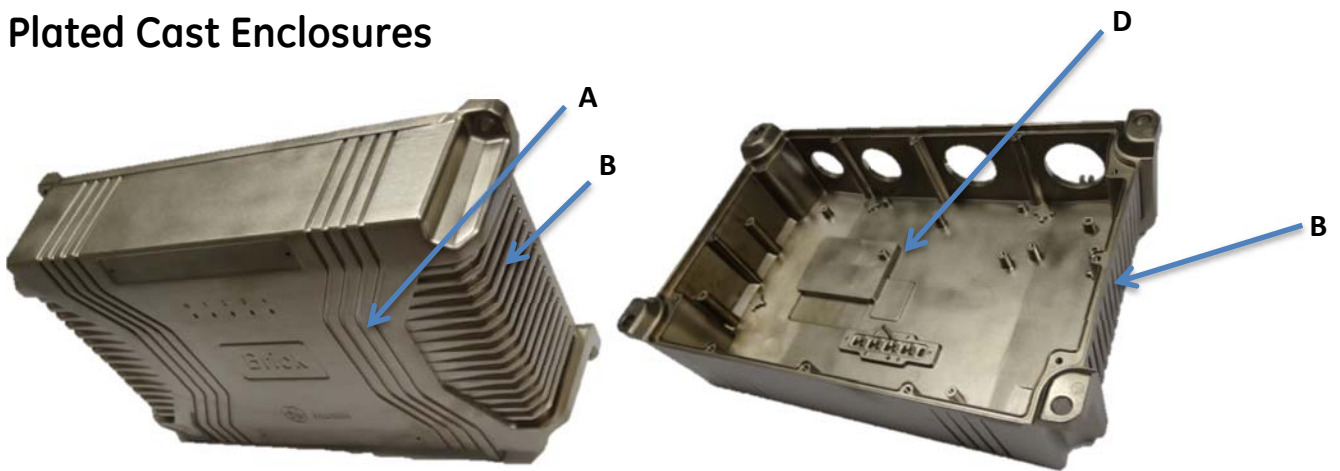


Cosmetic Inspection Guidelines for Mechanical Components

Painted Cabinets

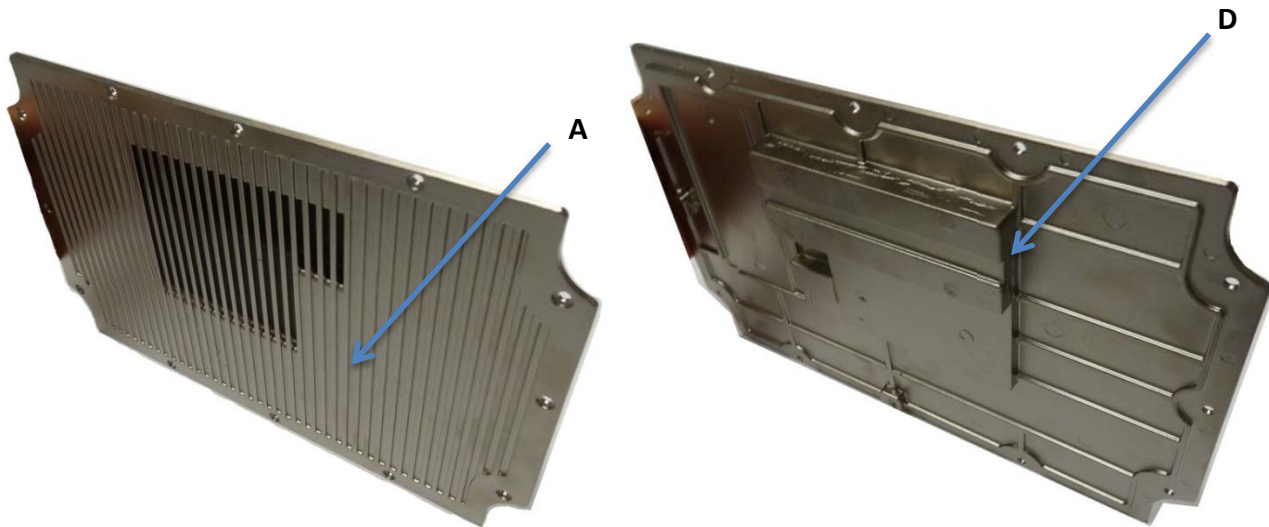


Plated Cast Enclosures



Cosmetic Inspection Guidelines for Mechanical Components

Plated Cover



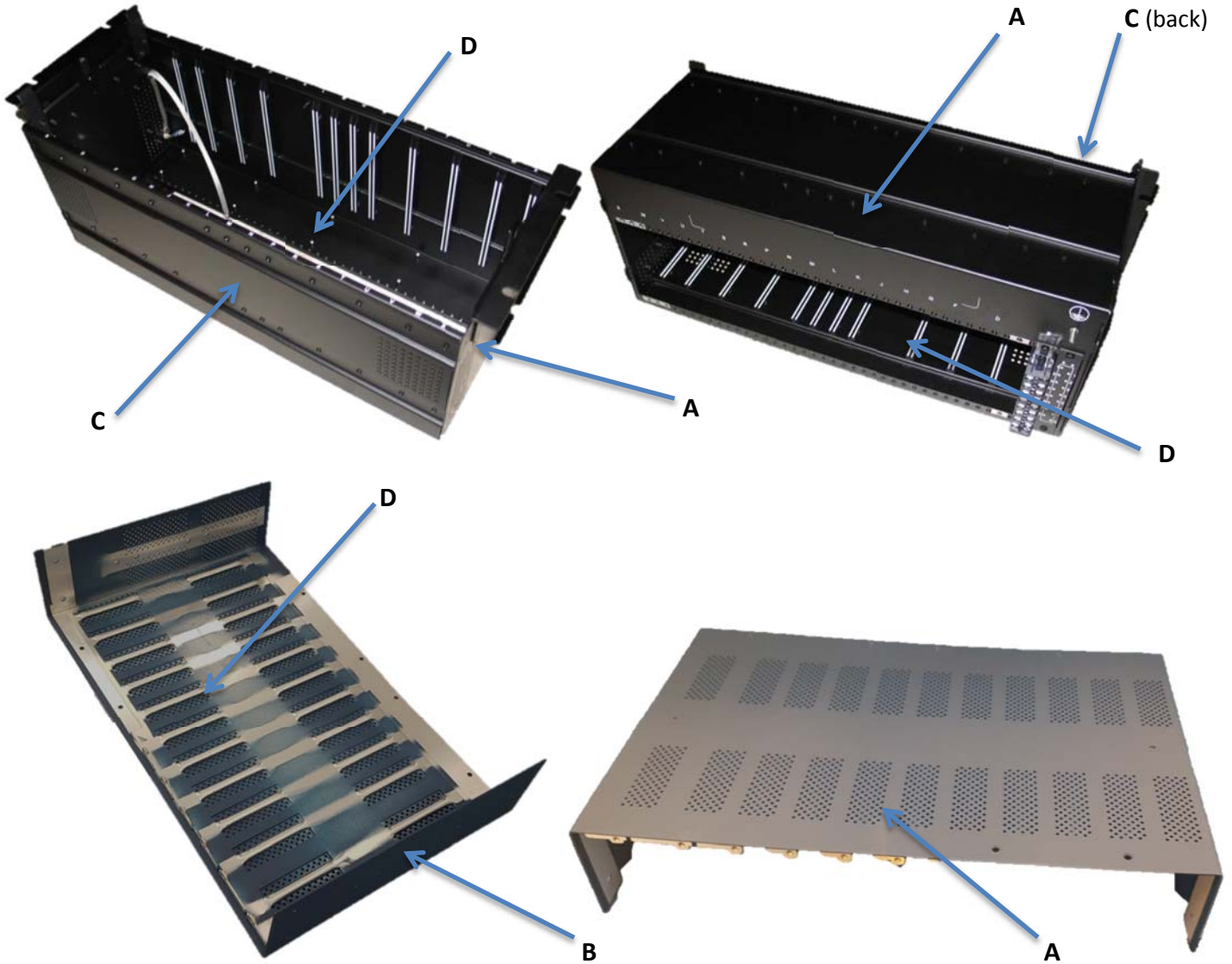
Die Cast criteria

Acceptable defects in zones A-D should not affect the fit/function of the product. In the Tolerance Table, 50 sq inch area is the limit for the # of defects found acceptable within the surface. Clustering of more than 2 defects is not acceptable



Cosmetic Inspection Guidelines for Mechanical Components

Painted Chassis



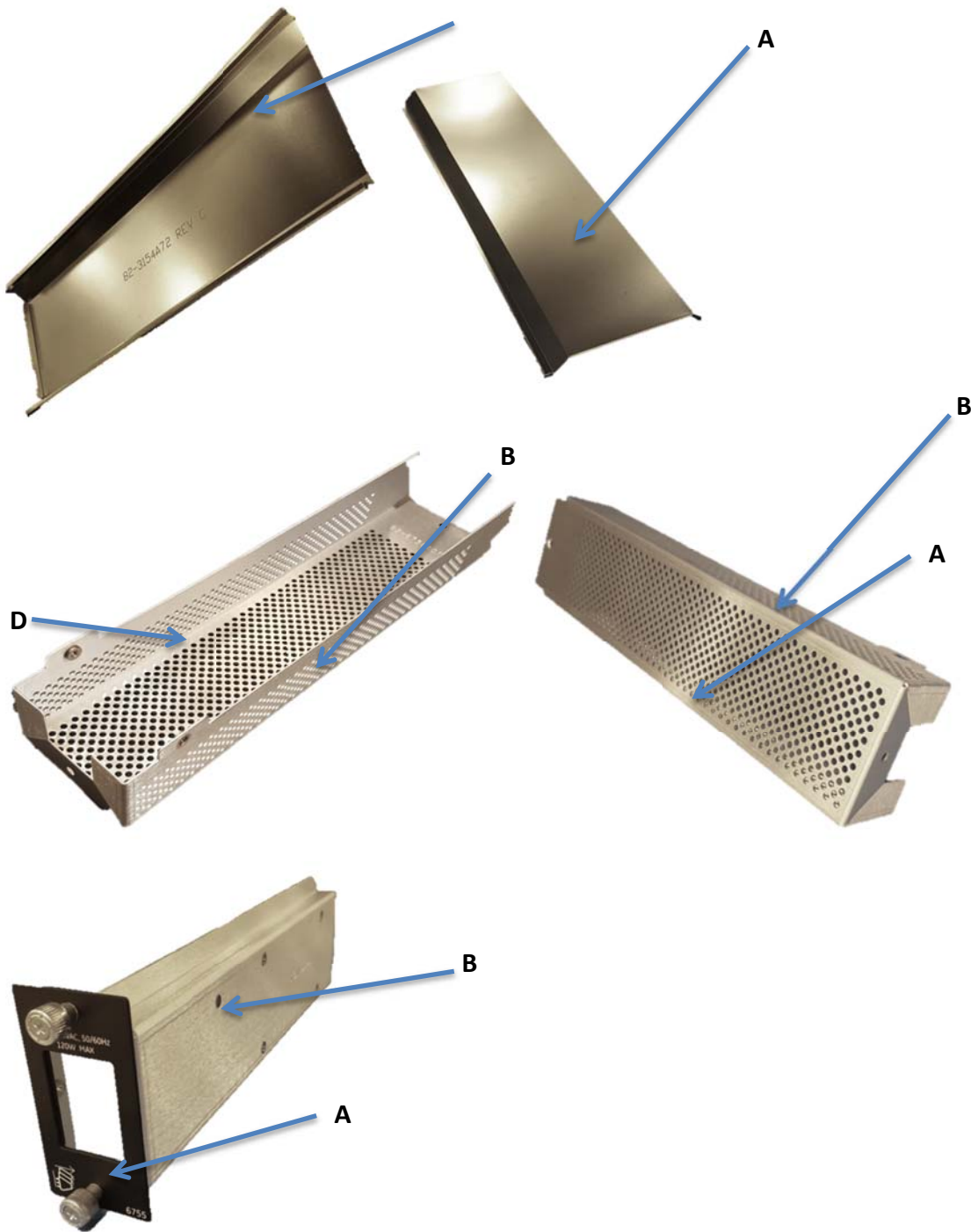
Cosmetic Inspection Guidelines for Mechanical Components

Stamped/Formed Covers

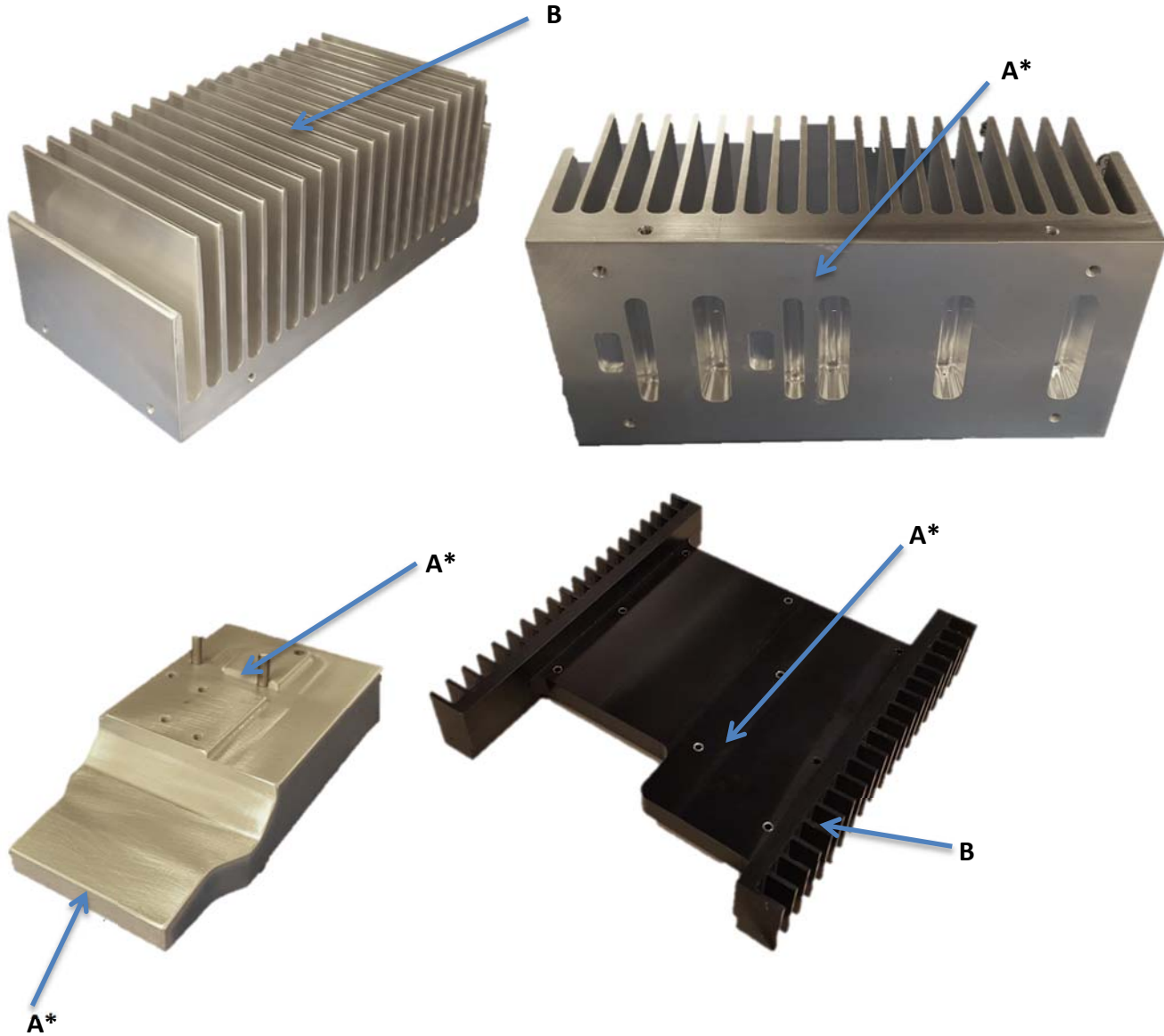
D



Cosmetic Inspection Guidelines for Mechanical Components



Cosmetic Inspection Guidelines for Mechanical Components Heat Sinks

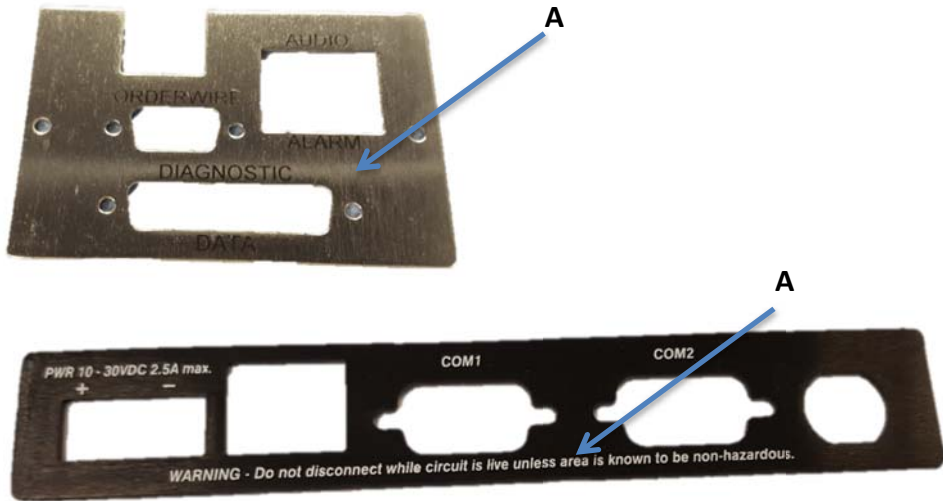


*For Heat sink thermal mating surfaces, the following A zone defect criteria apply:
Scratches, dings, dents, protrusions, gouges, any foreign particulate, or any anomaly above the surface



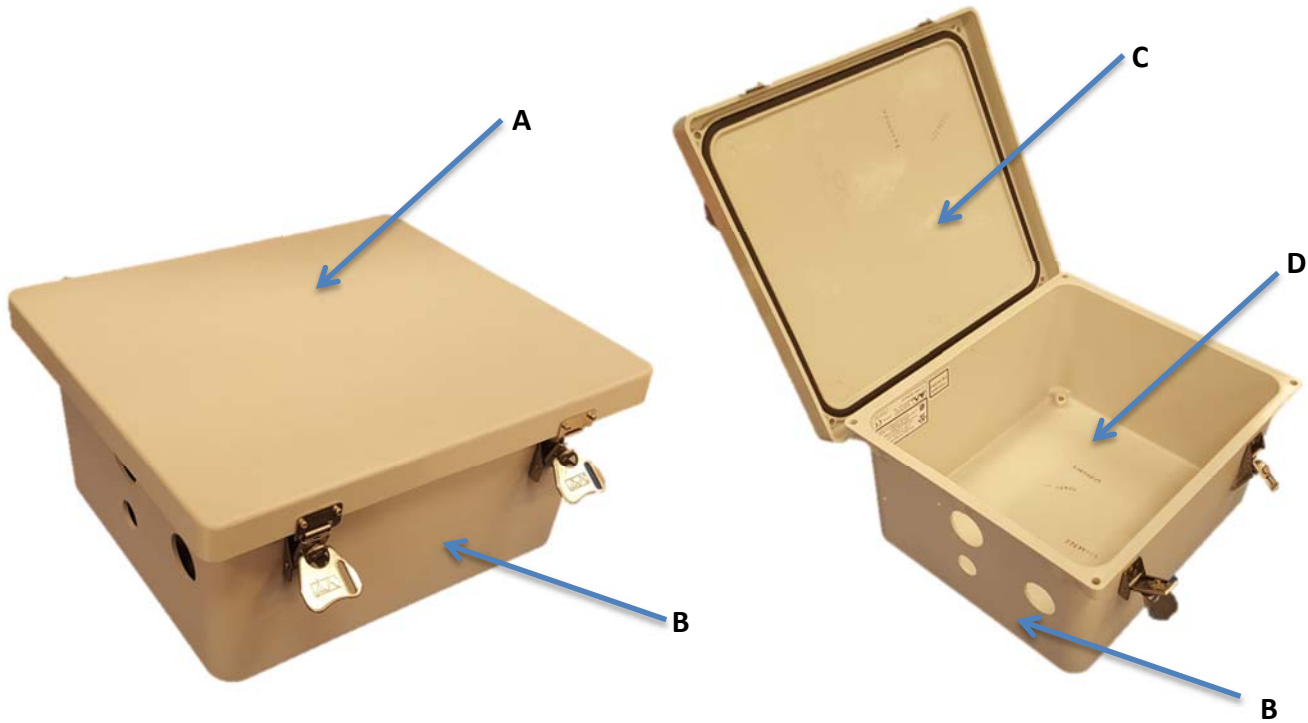
Cosmetic Inspection Guidelines for Mechanical Components

Faceplates



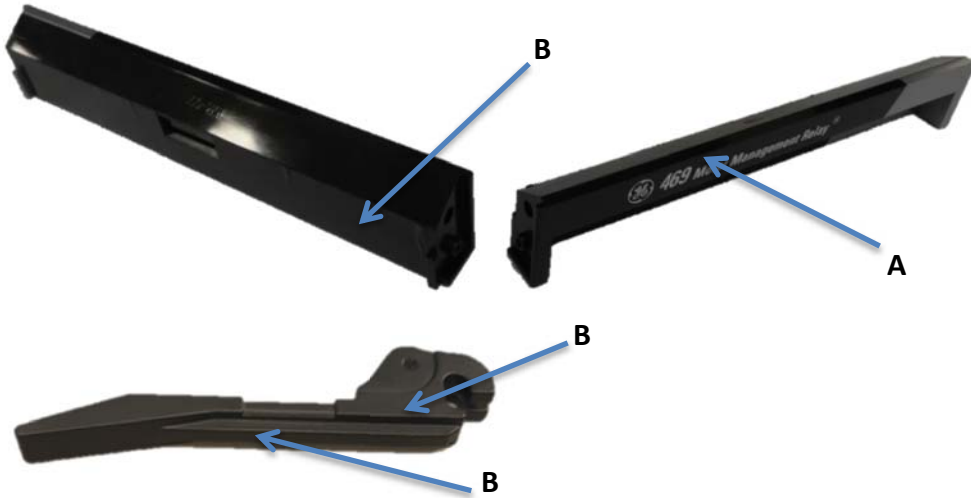
*Note: Backside of faceplates is D zone

Plastic Cases

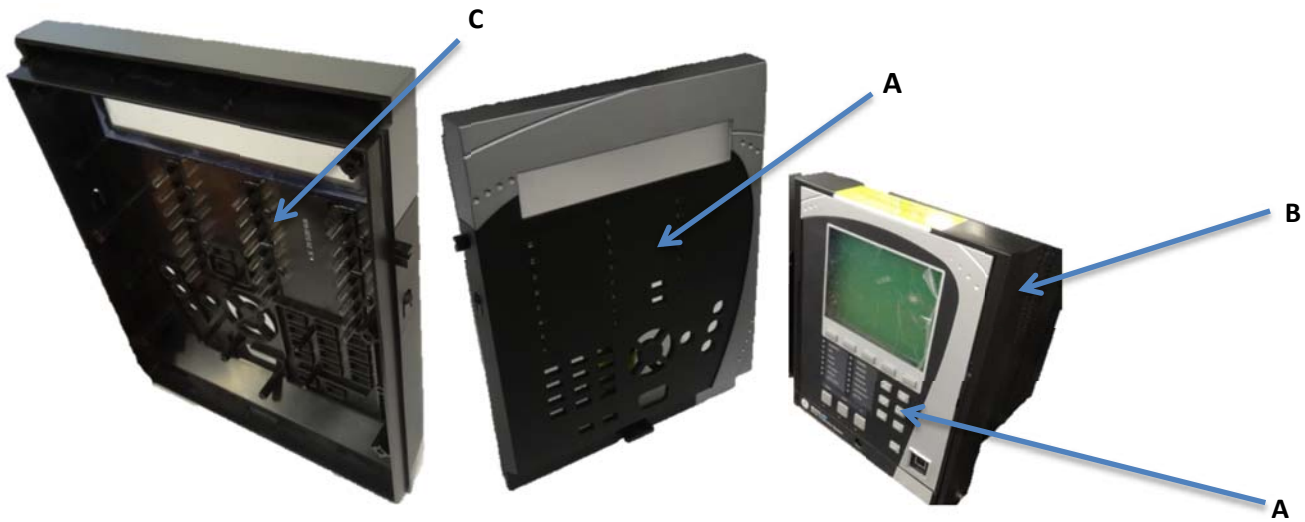


Cosmetic Inspection Guidelines for Mechanical Components

Pulls/Handles



Bezel /Front Panel



Label Decals



Cosmetic Inspection Guidelines for Mechanical Components



*Note: Front face of decals is all A zone

2.4 Control of Non-Conforming Material

If the product does not meet the above stated criteria, the team member should follow the site procedure for disposition and review of non-conforming material. Follow EM-SRC-0002 section 2.3.5 for root cause, corrective action, and preventative action requirements.

3.0 Definitions, Acronyms and References

4.0 Definitions, Acronyms and References

Abrasion: area damaged by scraping or wearing away that does not remove or displace material

Base Metal: bare metal used to fabricate the part

Bend Line: a mark created parallel to an edge bend (created by press brake tooling)

Bleed Out: a discolored substance that runs out of seams or holes leaving a stain

Blistering: area of air, gas or moisture entrapment that causes non-adhesion or a bubbling surface finish

Burnish Marks: marks or lines caused by friction at the surface

Burns: black or brown marks on the surface of a part caused by overheating

Burrs: a rough or sharp edge caused by manufacturing processes such as punching, shearing, milling or drilling

Chipping: area where paint or coating has been mechanically displaced from the surface

Composition: foreign particulate that has been added to the base material

Corrosion: oxidation reaction of a metal when exposed to air or contaminant

Crack: a narrow break or split in the material

Delamination: separation or peeling of a thin layer of material

Dent: a noticeable depression on a surface caused by a force or impact

Die Marks: a mark made by insertion tooling around the perimeter of inserted hardware

Ding: surface damage similar to a dent or nick

Discoloration: unintended contrasting shade on the surface or in the material



Cosmetic Inspection Guidelines for Mechanical Components

Ejector Pin Mark: a mark created by pins used to eject work piece from a tool, die or mold

Fisheye: a surface defect having the form of a spot or bubble

Flaking: area in which adhesion between the paint and surface is poor causing the paint to come off

Flash: excess material located around the mold parting line or internal shutoff areas

Flash: plastic in unintended areas, often at the parting line

Flow Marks: excess wavy or streaked appearance visible at the surface

Fracture: a break, fissure, or split

Gates: a point where plastic is injected in cavity

Gates: area where the sprue intersects the molded part, often leaving a small protrusion on the part

Gouge: a groove or depression caused by a sharp object that may dig into the base metal

Grease: a thick oily material that is often used as a lubricant causing shiny or glossy patches on the surface

Incomplete Fill/Cold Shot: areas of incomplete fill in the casting process

Insufficient/Excess Coverage: too much or too little paint or coating

Mark: a visible impression of something such as a line, cut, dent stain, or bruise that remains visible even after coating

Nick: a small notch, groove, or chip that is cut into a part or dented into a material

Oil Spots: a hydrocarbon residue remnant

Orange Peel/ Orange Skin: a paint defect caused by improper painting or drying which leaves a rippled or mottled appearance on the surface similar to the appearance of the surface of an orange

Overspray: excess paint or other coating that spreads beyond the designated area

Oxidation: a coating of rust that leaves a discolored area on the surface

Parting Line: a raised line formed at the seam of two halves of the mold

Parting Line: area where the two halves of the mold come together, leaving a seam

Peeling: area where adhesion between paint and surface is poor causing paint to strip or rip off.

Pits: small craters on the surface

Porosity: a collection of multiple small voids or air bubbles in a material that shows on the surface as one or more voids or bubbles

Protrusions: a section of material that extends beyond or above a surface

Punch Mark: mark on the surface caused by the punch process

Punch Mark: mark on the surface caused by the punch process



Cosmetic Inspection Guidelines for Mechanical Components

Rainbow Effect: discoloration causing a colored appearance

Removable Particulate Foreign Material: air fibers, metal flakes, dirt, lint, specks, and other particles

Ripples: small undulations, ruffles or folds on a surface

Runs: area of excess paint that is noticeably thicker and flowed downward before drying

Rust: an area of corrosion or oxidation on a metal surface

Scratch: a long, narrow (less than 0.015" wide) mark on the surface deep enough to catch the fingernail

Scuff: a light mark caused by scraping or wear that can be seen but not felt

SDR (Supplier Deviation Request): a request initiated by the supplier to deviate from purchase order technical requirements (drawings, specifications, engineering instructions, etc.) or the approved qualification package.

Short-Shot: molded part that is incomplete because of insufficient material injected into mold

Sink Marks: a depression or dimple caused by non-uniform material shrinkage

Slug Mark: surface deformity caused by the punch process (Similar to punch mark)

Split: a cleaved area in a section of material

Stains: a discoloration produced by foreign material having reacted with the surface or base material

Standard Mill Finish: ASTM- B209 defines Standard Mill Finish as, "Sheet having a non-uniform finish which may vary from sheet to sheet and within a sheet, and may not be entirely free from stains or oil." Federal Specification QQ-A-250/8 defines Mill Finish Workmanship as follows: "The plate and sheet should be uniform in quality and condition; clean, sound, smooth, commercially flat, and free from buckles, blisters, and other injurious defects within the limits consistent with the best commercial practice. Discoloration due to thermal treatment should not be cause for rejection.

Tooling Marks: impact from a tool during the fabrication process

VOIDS: an empty space, gap or opening in a material

Water spots: residue or discoloration remaining after water on the surface dries

Weld Line: area where molten plastic flows come together during injection molding without knitting together leaving a mechanically weaker area

Welded Area showing burn: black area where welding process had excess heat or soot on the surface



Cosmetic Inspection Guidelines for Mechanical Components

5.0 Supporting Documents

- AQ-103 Cosmetic Specification for Injection Molded Parts
- EM-SRC-0002 Supplier Quality Requirements
http://www.geenergyconnections.com/sites/geem/files/EM-SRC-0002-Supplier_Quality_Requirements%20Rev%202.3.pdf



Cosmetic Inspection Guidelines for Mechanical Components

6.0 Document Revisions and Approvals

The following chart lists the revisions made to this document tracked by version. Use this to describe the changes and additions each time this document is re-published. The description should include as many details of the changes as possible.

Records of Reviewers and Approvers may be found within the DMS (Document Management System).

Version	Section Modified and Revision Description	Date	Author
1.0	New Issue	30-Sep-16	Timothy Milliman, Bianca Espinoza and Bas Maulkhan

Title: Cosmetic Inspection Guidelines for Mechanical Components
 Reference: GA-SRC-0002
 Revision: 1.0
 Application Date: 9/30/2016 3:40:01 PM
 Expiration Date: 9/30/2019 12:00:00 AM



Cosmetic Inspection Guidelines for Mechanical Components

7.0 Appendix

Conversion Table	
1 Inch ²	6.4516 cm ²
1 Inch	2.54 cm
1 Inch	25.4 mm
0.060 Inch	1.5 mm
0.100 Inch	2.54 mm
0.125 Inch	3.175 mm

