

ELMA ELECTRONIC INC. WORKMANSHIP STANDARD

WS-102 REV. G

COSMETIC INSPECTION










Issue Date: 14 SEP. 1998
Revision: **G** 11 OCT. 2005
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Department: QUALITY MANAGEMENT

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2. FOREWORD

Elma Electronic Inc. strives to provide products superior in quality, reliability, performance, and consistently presents new, innovative designs to the market. Elma's product line encompasses well over 16,000 parts, including embedded computer platforms, enclosures, cabinets, high quality switches, LED arrays, knobs and much more. Elma also offers design/integration services backed by responsive and knowledgeable technical support.

Elma's leading quality level is reached through training of all employees and following of systematic procedures per ISO 9001 standards to which Elma has been certified.

2.1. QUALITY POLICY

Awareness, Commitment and Improvement through Process is Elma's practiced quality policy.

Customer satisfaction is our mission.

2.2. QUALITY DEFINITION

'Quality is the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.' (ISO Standard 8402)

- Stated needs: Specification, Standards, Law
- Implied needs: Sometimes unknown and unspoken or wrong interpreted customer needs. Every individual has a different point of quality and different acceptance criteria's.

3. PURPOSE

The purpose of this standard is to define and establish acceptance and rejection criteria for surface finish for incoming and outgoing inspections applicable at; Customer, approved Supplier or Subcontractor and Elma Electronic Inc.

Elma Electronic Inc. performs market analyses and Elma uses similar inspection criteria as today's technology and market leader.

Elma Electronic Inc. can meet any surface finish on request; our finishing standard is common industrial finish described in Surface Categories Section.

Each finishing class stands for special manufacturing and handling processes, which are proportional to the related costs. Every customer has to decide if a special cosmetic finish is a must or nice to have. Manufacturing processes of bare material (e.g. cold rolled steel, pre galvanized steel, extruded parts) as well from machining processes (e.g. punching, forming, welding) may leave visible marks at the finished products, which are not avoidable. Anodized material is more scratch resistant than Alodine material.

4. INSPECTION PURPOSE

The inspection purpose is to determine any conditions for which the part or system will be rejected.

The intent of inspection is

- To ship a part or system that meets of finish standard.
- It is NOT intent of inspection to find all imperfections on a part or system.

5. SCOPE

This standard applies to Surface Finishes such as Paint, Chemical Conversion Coating (Alodine, Anodize), Plating, Molding and silk-screening.

6. PREFERRED APPEARANCE QUALITY

6.1. PAINT

6.1.1. Preferred

Painted surfaces should be defect free and the texture and color should be uniform throughout the entire surface.

The finish on a continuous surface shall exhibit no gross imperfections such as gouges, large chips, runs, blisters, oil spots, flaking, or any defects that will affect the functional properties of the finish.

Paint touch-up is acceptable.

A touch-up is not acceptable if visible at the viewing distance for that class of surface.

6.2. SILK-SCREENING

6.2.1. Preferred

Silk-screened logos or symbols should be defect free, and should withstand cleaning with mild solvents and the tape pull test.

6.2.2. Tape Pull Test

The tape pull test is a non-destructive test of silk-screened parts.

Elma Electronic Inc. is using 3M Scotch Brand #600 for all silkscreen pull tests.

This tape is common used by the industry due it is close to matching the specifications callout in ASTM D3359-76: "Measuring Adhesion by Tape Test", 36 +/- 2.5 oz/in.

6.2.2.1. Tape pull test procedure

1. Smooth tape into place by finger
2. Within 90 sec +/-30 sec of applying the tape, remove by seizing the free end pulling it off rapidly back upon itself, as close to an angle of 180 degrees as possible.
3. Inspect the tape and the tested area for removal of paint

6.3. PLATING

6.3.1. Preferred

Visible outside surfaces should be defect free, and die and slug marks should not be visible.

6.4. CHEMICAL CONVERSION COATING (Alodine)

6.4.1. Preferred

The finish shall have uniform appearance; be semi-bright, smooth, and clear to slightly yellow or iridescent in color. Visual appearance will vary between different alloys and between machined, milled, cast, and grained surfaces.

Outside surface shall be free from scratches, dents, or gouges.

7. ACCEPTABLE DEFECTS MATRIX

7.1. Acceptable Defects For Class "A" Surfaces

<u>Viewing time</u>	<u>Viewing distance</u>
Ten (10) seconds per 200 square inches per part, Five (5) seconds per 50 square inches for front panels	24 Inch (610 mm)

DEFECT	ACCEPT	REJECT
<u>Bleed out</u>	Up to 5/16" away from seam. Touch up allowed.	Any greater than 5/16"
<u>Blister</u>	None	Any
<u>Blush</u>	Accept per approved engineering document.	
<u>Bubble</u>	None	Any
<u>Burns</u>	Accept per approved engineering document.	
<u>Burrs</u>	Less than 10% of material thickness	Any greater than 10%
<u>Cloudiness</u>	None	Any
<u>Contamination</u>	None	Any
<u>Corrosion / Rust / Oxidation</u>	None	Any
<u>Cracks</u>	None	Any
<u>Dent / Ding / Pitting</u>	None	Any
<u>Discoloration</u> color consistency	Accept per approved engineering document for 100% uniformity of surface.	Partial discoloration
<u>Dirt / Lint / Specks / Smudge</u>	Less than or equal to 0.02"	Any greater than 0.02"
<u>Flash</u>	Accept per approved engineering document.	
<u>Flow Marks</u>	None	Any
<u>Fingerprints</u>	None	Any
<u>Flaking / Chipping / Peeling</u>	None	Any
<u>Metal Fuzz</u>	None	Any
Paint <u>Non-Adhesion / Non-Uniformity / Inconsistency</u>	None	Any
<u>Paint runs</u>	None	Any
<u>Scratches / Gouges</u>	Qty. 3, less than or equal to 0.01" x 0.03"	More than qty. 3. Any bare metal or base metal on a painted surface
<u>Scuff Marks</u>	Accept per approved engineering document.	
<u>Short-Shots</u>	None	Any
<u>Sink</u>	Less than or equal to 0.003" deep	Any greater than 0.003"
<u>Smearing</u>	None	Any
<u>Spot weld, Welding Lines</u>	Accept per approved engineering document.	
<u>Texture / Gloss / Finish</u>	100% uniformity of surface, Accept per approved engineering document.	Partial variation
<u>Tooling marks / Die marks / Slug mark / Punch mark / Burnish marks</u>	Accept per approved engineering document.	
<u>Voids</u>	Less than or equal to 0.01"	Any greater than 0.01"
<u>Water Spots</u>	None	Any

7.2. Acceptable Defects For Class "B" Surfaces

<u>Viewing time</u>	<u>Viewing distance</u>
Seven (7) seconds per 200 square inches per part	30 Inch (760 mm)

DEFECT	ACCEPT	REJECT
Bleed out	Up to 3/8" away from seam. Touch up allowed.	Any greater than 3/8"
Blister	None	Any
Blush	Accept per approved engineering document.	
Bubble	None	Any
Burns	Accept per approved engineering document.	
Burr	Less than 10% of material thickness	Any greater than 10%
Cloudiness	None	Any
Contamination	Qty. 1, Less than or equal to 0.03"	More than qty. 1 per surface or any greater than 0.03"
Corrosion / Rust / Oxidation	None	Any
Cracks	None	Any
Dent / Ding / Pitting	None	Any
Discoloration color consistency Non-Uniformity	90% uniformity of surface.	More than 10% surface discoloration or consistency
Dirt / Lint / Specks / Smudge	Qty. 3, Less than or equal to 0.03"	More than qty. 3 per surface or any greater than 0.03"
Flash	Less than or equal to 0.005" in height	Any greater than 0.005" in height
Flow Marks	None	Any
Fingerprints	Surface 99% fingerprint free	More than 1% of the surface
Flaking / Chipping / Peeling	Less than or equal to 0.03"	Any bare metal greater than 0.03" or any exposed base metal
Metal Fuzz	None	Any
Paint Non-Adhesion /	None	Any
Paint runs	None	Any
Scratches / Gouges	Qty. 2; Less than or equal to 0.02" x 0.09"; Qty. 1; Less than or equal to 0.01" x 0.25";	More than limit qty. per surface. Any exposed base metal on painted surfaces
Scuff Marks	Accept per approved engineering document.	
Short-Shots	None	Any
Sink	Less than or equal to 0.005" deep	Any greater than 0.005" deep
Smearing	None	Any
Spot weld , Welding Lines	Less than or equal to 0.005" in height or depth	Any greater than 0.005" in height or depth
Texture / Gloss / Finish	Less than or equal to 0.02" x 0.25"	Any greater than 0.02" x 0.25"
Tooling marks / Die marks / Slug mark / Punch mark / Burnish marks	Accept per approved engineering document.	
Voids	Less than or equal to 0.03"	Any greater than 0.03"
Water Spots	None	Any

7.3. Acceptable Defects For Class "C" Surfaces

<u>Viewing time</u>	<u>Viewing distance</u>
Five (5) seconds per 200 square inches per part	36 Inch (460 mm)

DEFECT	ACCEPT	REJECT
<u>Bleed out</u>	Up to 3/8" away from seam. Touch up allowed.	Any greater than 3/8"
<u>Blister</u>	None	Any
<u>Blush</u>	Accept per approved engineering document.	
<u>Bubble</u>	None	Any
<u>Burns</u>	Accept per approved engineering document.	
<u>Burrs</u>	Less than 10% of material thickness	Any greater than 10%
<u>Cloudiness</u>	None	Any
<u>Contamination</u>	Qty. 3, Less than or equal to 0.03"	More than qty. 3 per surface or any greater than 0.03"
<u>Corrosion / Rust / Oxidation</u>	None	Any
<u>Cracks</u>	None	Any
<u>Dent / Ding / Pitting</u>	None	Any
<u>Discoloration</u> color consistency	80% uniformity of surface.	More than 20% surface discoloration or consistency
<u>Non-Uniformity</u>		
<u>Dirt / Lint / Specks / Smudge</u>	Qty. 3, Less than or equal to 0.06"	More than qty. 3 per surface or any greater than 0.06"
<u>Flash</u>	Less than or equal to 0.005" in height	Any greater than 0.005" in height
<u>Flow Marks</u>	None	Any
<u>Fingerprints</u>	Surface 95% fingerprint free	More than 5% of the surface
<u>Flaking / Chipping / Peeling</u>	Less than or equal to 0.09"	Any bare metal greater than 0.09" or any exposed base metal
<u>Metal Fuzz</u>	None	Any
Paint <u>Non-Adhesion</u>	Non-Adhesion None	Any
<u>Paint runs</u>	None	Any
<u>Scratches / Gouges</u>	Qty. 4; Less than or equal to 0.02" x 0.25"; Qty. 1; Less than or equal to 0.01" x 0.5";	More than limit qty. per surface. Any exposed base metal on painted surfaces
<u>Scuff Marks</u>	Accept per approved engineering document.	
<u>Short-Shots</u>	None	Any
<u>Sink</u>	Qty. 1, Less than or equal to 0.015" deep	Any greater than 0.015" deep
<u>Smearing</u>	None	Any
<u>Spot weld</u> , Welding Lines	Less than or equal to 0.005" in height or depth	Any greater than 0.005" in height or depth
<u>Texture / Gloss / Finish</u>	Less than or equal to 0.02" x 0.09"	Any greater than 0.02" x 0.09"
<u>Tooling marks / Die marks / Slug mark / Punch mark / Burnish marks</u>	Accept per approved engineering document.	
<u>Voids</u>	Less than or equal to 0.03"	Any greater than 0.03"
<u>Water Spots</u>	None	Any

7.4. Acceptable Defects For Class "D" Surfaces

<u>Viewing time</u>	<u>Viewing distance</u>
Five (3) seconds per 200 square inches per part	36 Inch (460 mm)

DEFECT	ACCEPT	REJECT
<u>Bleed out</u>	Up to 3/8" away from seam. Touch up allowed.	Any greater than 3/8"
<u>Blister</u>	None	Any
<u>Blush</u>	Accept per approved engineering document.	
<u>Bubble</u>	None	Any
<u>Burns</u>	Accept per approved engineering document.	
<u>Burrs</u>	Less than 10% of material thickness	Any greater than 10%
<u>Cloudiness</u>	None	Any
<u>Contamination</u>	Qty. 3, Less than or equal to 0.06"	More than qty. 3 per surface or any greater than 0.06"
<u>Corrosion / Rust / Oxidation</u>	None	Any
<u>Cracks</u>	None	Any
<u>Dent / Ding / Pitting</u>	Less than or equal to 0.09" in depth	Any greater than 0.09"
<u>Discoloration</u> color consistency <u>Non-Uniformity</u>	70% uniformity of surface.	More than 30% surface discoloration or consistency
<u>Dirt / Lint / Specks / Smudge</u>	Qty. 5, Less than or equal to 0.09"	More than qty. 5 per surface or any greater than 0.09"
<u>Flash</u>	Less than or equal to 0.02" in height	Any greater than 0.02" in height
<u>Flow Marks</u>	None	Any
<u>Fingerprints</u>	Surface 90% fingerprint free	More than 10% of the surface
<u>Flaking / Chipping / Peeling</u>	Less than or equal to 0.09"	Any bare metal greater than 0.09" or any exposed base metal
<u>Metal Fuzz</u>	None	Any
Paint <u>Non-Adhesion</u>	None	Any
<u>Paint runs</u>	Qty. 1, Less than or equal to 0.02" x 0.5"	More Than qty.1 or any greater than 0.02" x 0.5"
<u>Scratches / Gouges</u>	Less than or equal to 0.02" x 0.25"; Qty. 3; Less than or equal to 0.01" x 0.5";	More than limit qty. per surface. Any exposed base metal on painted surfaces
<u>Scuff Marks</u>	Accept per approved engineering document.	
<u>Short-Shots</u>	None	Any
<u>Sink</u>	Qty. 1, Less than or equal to 0.03" deep	Any greater than 0.03" deep
<u>Smearing</u>	None	Any
<u>Spot weld</u> , Welding Lines	Less than or equal to 0.005" in height or depth	Any greater than 0.005" in height or depth
<u>Texture / Gloss / Finish</u>	Less than or equal to 0.25" x 0.25"	Any greater than 0.25" x 0.25"
<u>Tooling marks / Die marks / Slug mark / Punch mark / Burnish marks</u>	Any	Any exposed base metal on painted surfaces
<u>Voids</u>	Less than or equal to 0.06"	Any greater than 0.06"
<u>Water Spots</u>	None	Any

7.5. Acceptable Defects For Class "E" Surfaces

<u>Viewing time</u>	<u>Viewing distance</u>
Unspecified	Unspecified

DEFECT	ACCEPT	REJECT
<u>Fingerprints</u>	Surface 50% fingerprint free	More than 50% of the surface
<u>Metal Fuzz</u>	None	Any
Cosmetic Flaws	All kinds of touchup allowed	Any flaw that impacts the functionality of the part. Any exposed <u>base metal</u> on painted surfaces. Defective corrosion protection.

8. INSPECTION REQUIREMENTS

8.1. Viewing Conditions



The inspector shall scan the surface in a continuous manner. All judgments shall be made from the specified lighting, viewing distance, angle and material classes as described below.

8.2. SURFACE CATEGORIES

8.2.1. Class A

Is a **critical** cosmetic surface usually front exterior surfaces which are most often closely viewed by the user / customer.

- Panels
- Instrument cases
- Desktop cases
- Customer specified

8.2.2. Class B

Is a semi-critical cosmetic surface usually exterior surface which are adjacent to Class A, not viewed as often but easily seen.

8.2.3. Class C

Is a non-critical cosmetic surface either exterior surfaces rarely viewed by the user / customer, such as back surface; or an internal surface that is visible but not normally viewed by the user / customer.

8.2.4. Class D

Is a non-critical cosmetic surface usually exterior surfaces normally not viewed by the user / customer, such as a bottom surface or a back of a panel.

8.2.5. Class E; Unclassified

Non-cosmetic surface usually never seen by a customer or if surface is customer classified as non-cosmetic surface.

- All parts that cannot be viewed in an assembled condition
- Parts that will be discarded at customers location (shipping protection)
- Customer specified



8.3. Light Source

8.3.1. Light Specification

White, cool artificial office lighting (e.g. fluorescent light)



Do not use direct sunlight.

8.3.2. Light Intensity

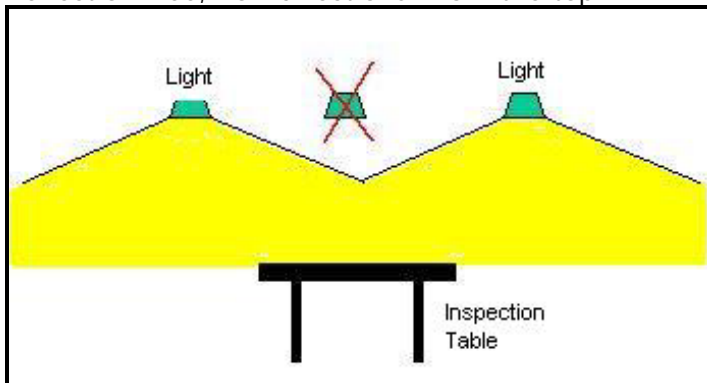
Uniform intensity between 70 and 120 foot-candles. (750 and 1250 Lux)



At levels of greater light intensity caution should be used to not over inspect the parts in order of accentuate surface flaws.

8.3.3. Light position

Reflection free, non-directional from the top.



No direct overhead light above inspection table.



8.4. Inspection Table Surface

The table surface should be made of a non-reflective dark color to avoid twilight conditions.

Preferred: Black rubber mat

Acceptable: Dark blue rubber mat

Unacceptable: Light color table surfaces e.g. white, gray, yellow, metallic etc.



Reflective light-colored surfaces eliminate or accentuate surface flaws.



8.5. Viewing Time

8.5.1. Class A

Systems: Ten (10) seconds per 200 square inches per part

Front Panels: Five (5) seconds per 50 square inches per part

8.5.2. Class B

Seven (7) seconds per 200 square inches per part

8.5.3. Class C

Five (5) seconds per 200 square inches per part

8.5.4. Class D

Three (3) seconds per 200 square inches per part

8.5.5. Class E

Unspecified



8.6. Viewing Orientation

During inspection, view objects in an orientation perpendicular to each surface.

During assembly, view objects in normal orientation of manufacturing process.

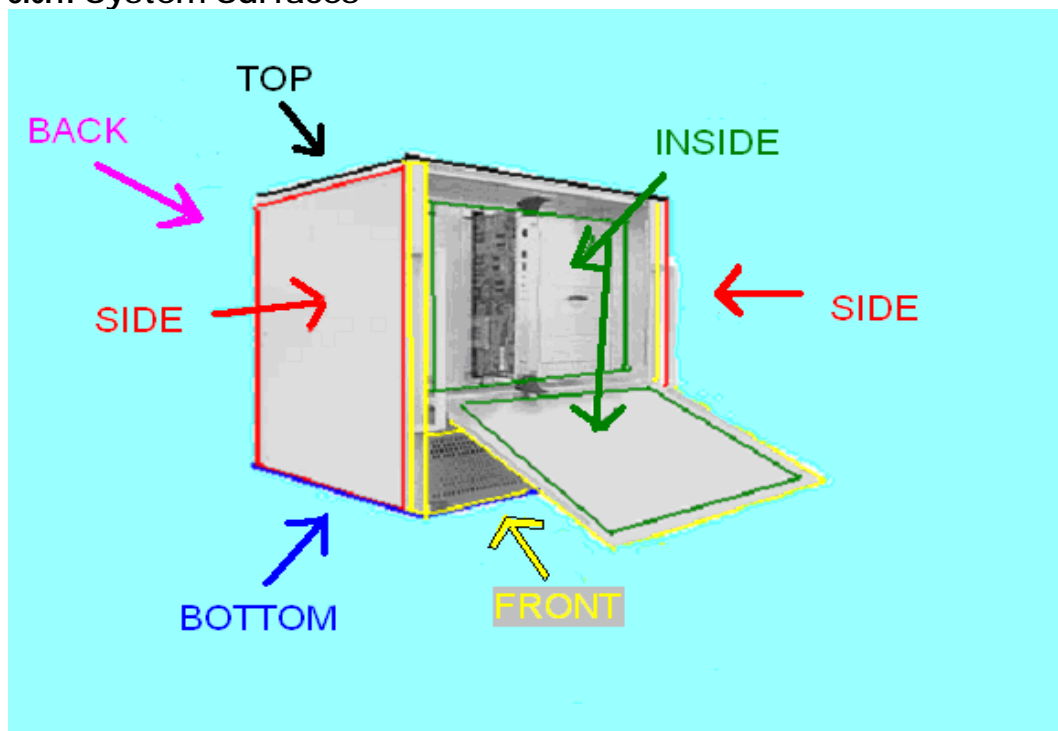
In some cases inspection should be held prior to assembly.

Any visible surface flaw has to be verified against the [acceptable defect matrix](#).

Use Elma's [CODETE](#), Cosmetic Defect Template.

CAUTION Parts shall not be manipulated to reflect a single light source in order to accentuate surface flaws.

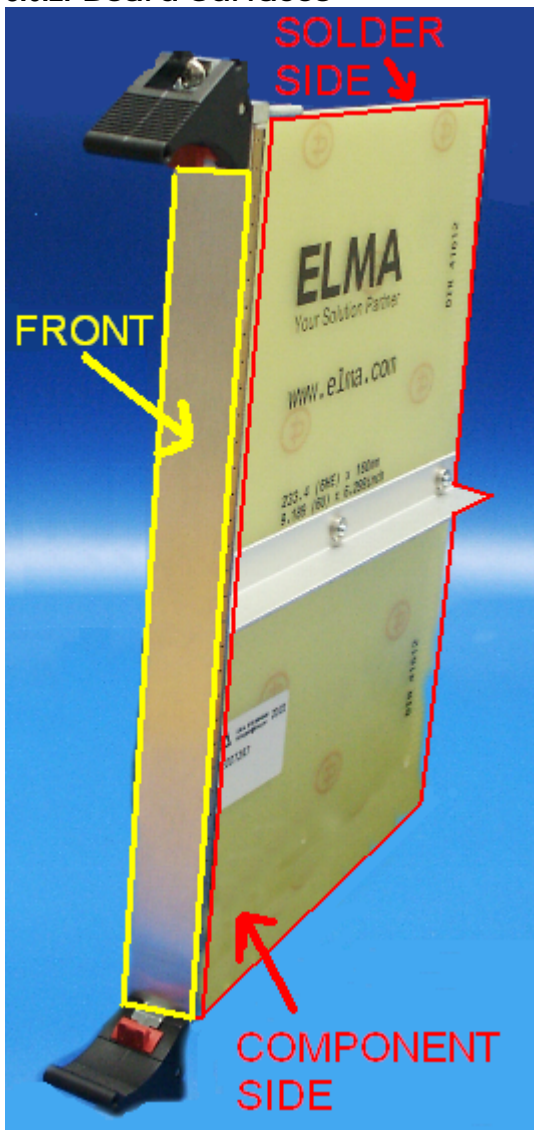
8.6.1. System Surfaces



8.6.1.1. Classification System Surfaces

Type/Style	Front	Top	Side	Back	Bottom	Inside
DESKTOP	A	B	B	C	D	Invisible E Visible C
SUBRACKS	B	C	C	C	D	Invisible E Visible C
CABINET	B	C	B	C	D	Invisible E Visible C
INSTRUMENT CASES	A	B	B	C	D	Invisible E Visible C
RACKMOUNT	B	C	C	C	D	Invisible E Visible C
EXTRUDED PARTS AND HANDLES	Anodize B Alodine C Painted B	Anodize C Alodine D Painted C	Anodize C Alodine D Painted C	Anodize C Alodine D Painted C	Anodize D Alodine E Painted D	Invisible E Visible D

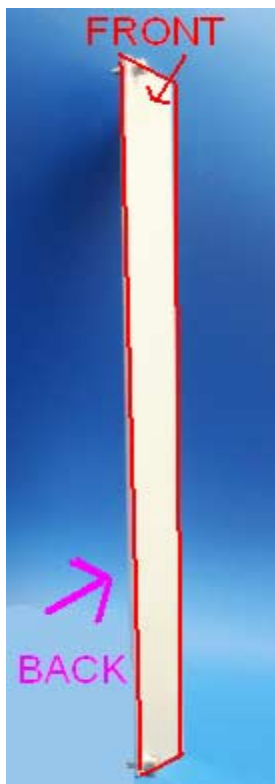
8.6.2. Board Surfaces



8.6.2.1. Classification Board Surfaces

Type/Style	Front	Top	Sides	Back	Bottom	Inside
FILLER PANEL	Anodize A Alodine B	N/A	C	E	N/A	N/A
DUMMY BOARD	Anodize A Alodine B	N/A	C	E	N/A	N/A
LOAD CARD	Anodize A Alodine B	N/A	B	E	N/A	N/A

8.6.3. Panel Surfaces



8.6.3.1. Classification Panel Surfaces

Type/Style	Front	Top	Side	Back	Bottom	Inside
FRONT PANEL	Anodize A Alodine B	N/A	N/A	E	N/A	N/A
BACK PANEL	Anodize A Alodine B	N/A	N/A	E	N/A	N/A
INSIDE FILLER PANEL	C	N/A	N/A	E	N/A	N/A
TEMPORARY PANEL (Protection purpose, customer will exchange or discard panel)	E	N/A	N/A	E	N/A	N/A

8.7. Viewing Tools



8.7.1. Cosmetic Defect Template (CODETE)

Use the Elma Electronic Inc. workmanship standard defect template to verify all cosmetic defect measurements or comparisons. The current version of CODETE is Rev. A.

8.7.2. Magnification Tools

Magnification tools may be used to find root causes for defects or to verify correctness of special areas.



Magnification is not to be used when inspecting for cosmetic defects.



8.8. Viewing Distance

Viewing Distances from the surface being inspected

8.8.1. Class A

24 Inch (610 mm)

8.8.2. Class B

30 Inch (760 mm)

8.8.3. Class C

36 Inch (910 mm)

8.8.4. Class D

36 Inch (910 mm)

8.8.5. Class E

Unspecified

9. Elma Electronic Inc. Internal Inferior Workmanship Escalation

9.1. Workmanship standard does not identify a defect

Every team member has to question inferior workmanship **ONLY** when you see a defect that is not clearly identified at this workmanship standard

9.2. Escalation Process

When questioning a system or part for inferior workmanship issues follow this escalation process:

- Locate suspected defect
- Check the WS-102 Workmanship standard, AWO, and any applicable engineering specs
- If no specs or special instructions are applicable contact following support team members
 - Line Inspector / Line Lead
 - Responsible applications engineer
 - Final QC Team member
 - Quality Manager
- Support team member must evaluate and make a decision on the suspected defect.

9.3. Order Of Precedence

In case of a conflict between this Workmanship standard, AWO, work instructions, engineering specification or other applicable specifications, following hierarchy will apply:

- Approved Deviation
- Engineering Specification
- Work Instruction
- Workmanship Standard



10. TERMS AND DEFECT DEFINITIONS

10.1. Accept per approved engineering drawing

- Some cosmetic imperfections are not avoidable in certain process and design circumstances. Approved engineering documents will point this out.

10.2. Abrasion

- Surface imperfection that doesn't remove or displace material appears as a scuff or changes to the surface finish.

10.3. Bare Metal

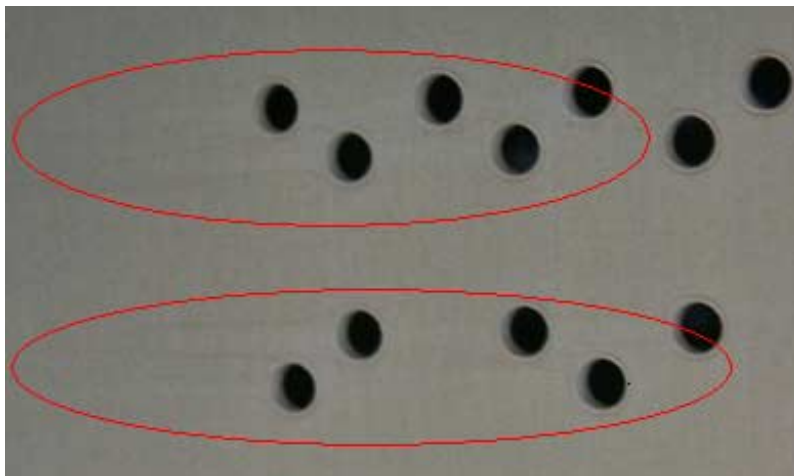
- A metal surface that has an intact protective coating but no cosmetic finish.

10.4. Base Metal

- A bare metal surface on which the protective coating has been compromised.

10.5. Bleed Out

- A Substance that runs out of seams. Color can vary from brown, dark brown to gray white at plating.



10.6. Bleeding

- Rough and not densely packed dull gray lines at plated material.

10.7. Blister

- A bubbling in the surface of the finish. Non-adhesion or lack of proper sticking of the coating to the surface caused by trapped air, gas or moisture.

10.8. Blush

- Discoloration or change in gloss.

10.9. Burns

- Brown marks or streaks on a surface of the part caused by trapped gases burning the surface of the plastic during molding operation.

10.10. Bubble

- A bubbling in the surface of the finish. Non-adhesion or lack of proper sticking of the coating to the surface caused by trapped air, gas or moisture.

10.11. Bump

- Protrusions caused by trapped air / gas or moisture usually seen in finished parts.

10.12. Burnish Marks

- Marks or lines that cannot be felt usually caused by tooling dies most common on flattened cold rolled material e.g. Steel or aluminum sheets.



10.13. Burrs

- Sharp edges around part features caused by manufacturing process like punching, shearing, milling or drilling.



CAUTION Sheet metal edges that are compliant to UL 1439 can still cut through protective gloves and/or human hands.

10.14. Chipping

- Areas in which the adhesion between the paint and the surface is poor, causing the paint to come off with light rubbing.

10.15. Cloudiness

- A haziness or lack of clarity in otherwise transparent part.

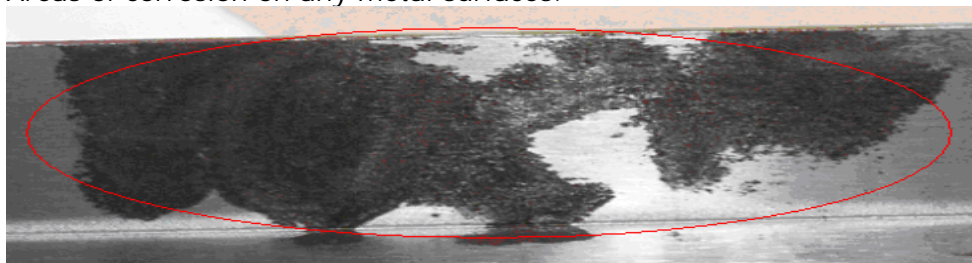
10.16. Contamination

- Rough and not densely packed dull gray lines at plated material. Colored specks of foreign material embedded in or on the surface part.



10.17. Corrosion

- Areas of corrosion on any metal surfaces.



CAUTION Small areas of rust are acceptable where plating is removed by a standard manufacturing or welding process, e.g. sheared (cut) edges.

10.18. Cracking

- Cracked appearance due to poor adhesion usually from surface contamination before plating.
- Hairline cracks of anodized material caused by bending, high temperature curing after silk screening of the aluminum or tool mark hair cracks on the opposite site of the aluminum. **Some cracks can't be avoided.**
- Fine damages which may extend in a pattern on or beneath the surface or through a layer of material.



10.19. Crazeing

- A fine mesh of minute cracks on the surface of some plastics due mainly to the effects of UV light.

10.20. Delaminating

- Separation, peeling of thin layer of material

10.21. Dent

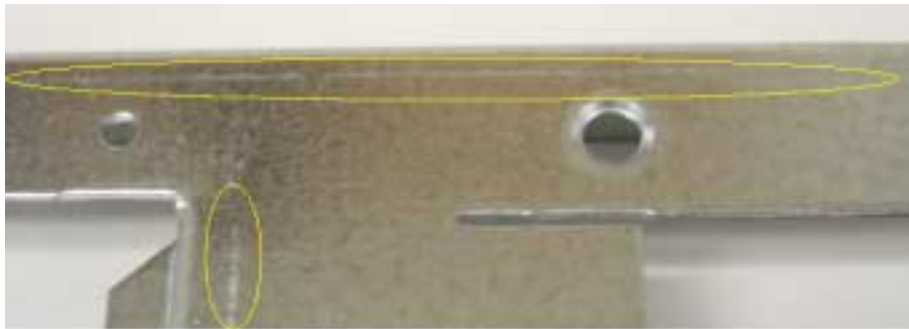
- A surface depression caused by an impact.



CAUTION Tooling marks are not dents.

10.22. Die marks

- Marks made on the metal's surface when it is formed, usually consist of long straight lines.



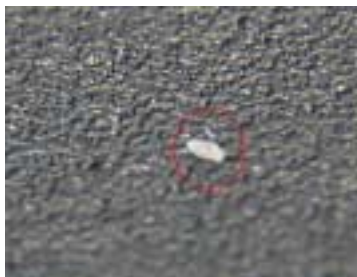
10.23. Ding

- Roughly funnel shaped dent caused by an impact.



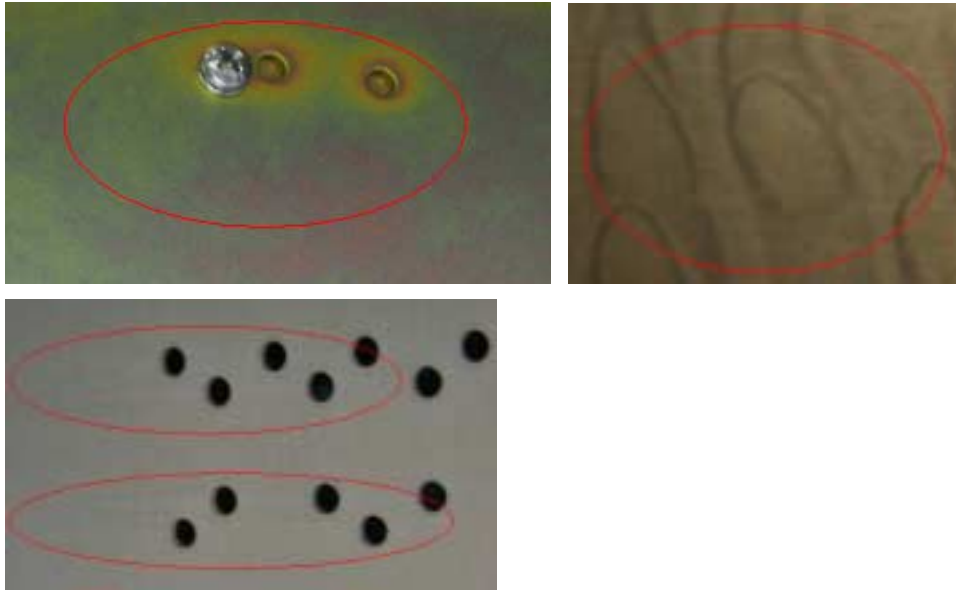
10.24. Dirt

- Any particle of foreign material.



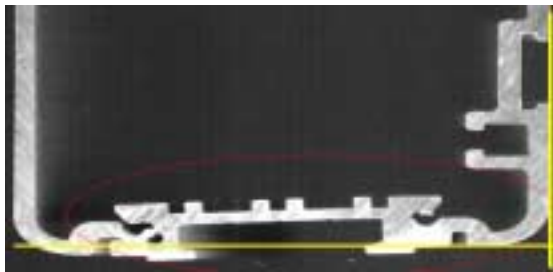
10.25. Discoloration

- Any change from the original color or shade in the finish.



10.26. Distortion

- A deformation of a die-casted part



10.27. Dust

- Small particles.



10.28. Fill In

- An excess of ink that alters the form of a screened feature not affecting legibility.

10.29. Fingerprints

- An impression left on the surface due to operator handling.



10.30. Finish

- An area of smoother finish of molded plastic parts.

10.31. Flaking

- Areas in which the adhesion between the paint and the surface is poor, causing the paint to come off with light rubbing.

10.32. Flash

- Thin, excess material usually around the area of the mold parting line or internal shutoff areas.

10.33. Flow Marks

- Waviness of edge or excess linear surface texture of silk-screened areas.

10.34. Fracture

- Material splitting usually on the outside bend radius.

10.35. Gates

- Point at which plastic is injected in cavity, usually on parting line.

10.36. Gloss

- A uniform appearance of a painted or molded area. E.g. Shiny, matt

10.37. Glossiness

- An area of either excessive or deficient gloss.

10.38. Gouge

- A groove or scratch that extends through the finish and into the metal caused by a sharp object. A depth is measurable.



10.39. Grease

- Any lubricant transferred to the part's surface, shiny or glossy patches on the surface of the part.



10.40. Haze

- Cloudiness on an otherwise transparent part.

10.41. Inconsistency

- Variation of gloss, thickness of line or surface texture.

10.42. Inclusions

- Small craters on surface caused by dust or dirt.

10.43. Lint

- Any unintended foreign substance in the coating or on the surface.

10.44. Marbling

- Colored streaks on a surface caused by improper mixing of molten plastic.

10.45. Marks

- Pits, sanding, or other marks on base material that remains visible after coating.

10.46. Matt Finish

- A less glossy finish of a surface area.

10.47. Metal Fuzz

- Fine grit metal shavings that are clumped together, may also be magnetic.

10.48. Nicks

- Like gouges but short of length caused by impact.



10.49. Non-adhesion

- Lack of proper sticking of the coating or a glued material to the surface.

10.50. Non-uniform Coverage

- Areas that have an insufficient or excessive coating.

10.51. Oils

- Oily material on the surface due to materials used in manufacturing processes. Oily looking spots caused by Loctite locking feature.



10.52. Orange Peel

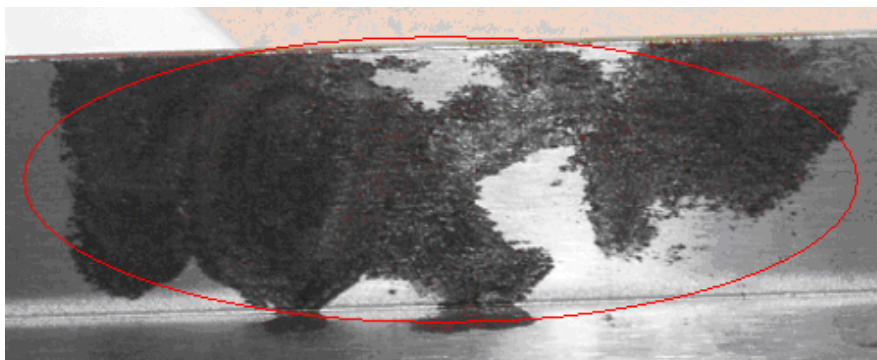
- Paint defect, rippled or mottled appearance viewable as concentric lines caused by under pressurizing not dried paint surfaces.

10.53. Orange Skin

- Paint defect, rippled or mottled appearance.

10.54. Oxidation

- Has a rough feel of appearance. Dull gray, dark gray, black, brown, dark cinnamon or possibly white colored substance.



10.55. Peeling

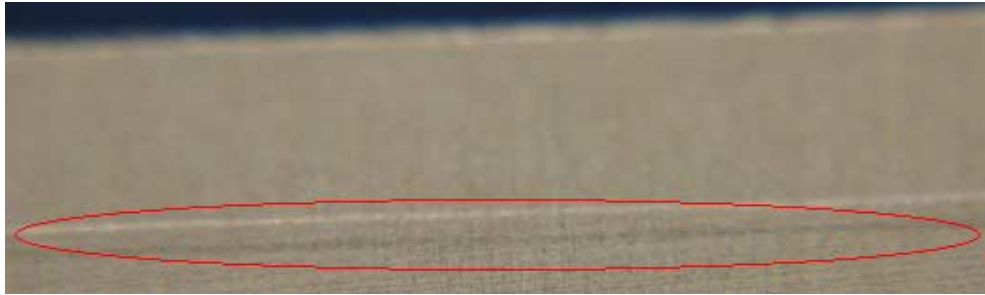
- Areas in which the adhesion between the paint and the surface is poor, causing the paint to come off with light rubbing.

10.56. Pitting

- Small craters on surface.

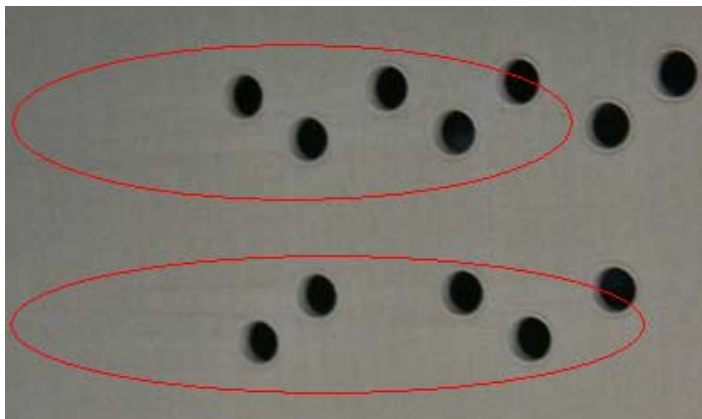
10.57. Punch mark

- Mark on the surface of a material due to punch process.



10.58. Runs

- Drips, bleeding, visible lines or raised areas of excessive paint or chemical coating similar to non-uniform coverage.



10.59. Rust

- Areas of corrosion on any metal surfaces.



CAUTION Small areas of rust are acceptable where plating is removed by a standard manufacturing or welding process, e.g. sheared (cut) edges.

10.60. Scratch

- A shallow groove that can be seen but not felt.



10.61. Scuff marks

- A series of very light, concentrated scratches that can be seen but not felt.

10.62. Short-Shot

- Incomplete molded feature.



10.63. Sink

- Depression or dimple caused by non-uniform material shrinkage.

10.64. Slug Mark

- A surface deformity caused by the punching process.



10.65. Smearing

- The presence of ink on areas not called out in the master artwork.



10.66. Smudge

- Any dirt particle of foreign material.



10.67. Specks

- Small particles.



10.68. Spot Weld Mark

- Dish shaped surface caused by spot welding process.
- Preferred workmanship is homogeneous spot weld marks.



CAUTION Spot weld marks are not avoidable. Black residue occurs during plating process.

10.69. Tooling Marks

- Very shallow lines that are parallel to bends in part.
- Unwanted impact of a tool during punch process.



CAUTION Some tooling marks are not avoidable in some process steps. E.g. punching, forming, bending.

10.70. Texture

- An area of rougher finish of plastic molded parts.
- A rougher but uniform finish of painted parts.

10.71. Visible Surface

- Surfaces those are visible when the enclosure or part is installed in a completed assembly.

10.72. Void

- The failure of ink to define a graphic feature.

10.73. Warpage

- Dimensional distortion in a part after molding, pressing or laminating. Twist or bows in the part.

10.74. Water Spots

- Rough and not densely packed dull gray lines at plated material.

10.75. Weld lines

- Line where molten plastic or metal joins form a part. A weld line usually appears as a noticeable line or gloss variation across the surface of the part.

11. References

- 11.1. **INTEL**
 - System Workmanship Standard #61957 Rev.17
- 11.2. **GNP Computers**
 - Finish Specification, EN50037 Rev. V
- 11.3. **IBM**
 - Workmanship Standard
- 11.4. **ZAFFIRE**
 - Workmanship Standard, #60021-000 Rev. 1
 - Cosmetic Standard Guideline, #600026-000 Rev. 1
- 11.5. **CIENA,**
 - Cosmetic and Workmanship Standards, #101745 Rev. A02
- 11.6. **DSM**
 - Cosmetic Inspection Standard
- 11.7. **Department of Defense**
 - DOD Preferred Methods Of Acceptance Of Products, MIL-STD-1916
 - Classification Of Visual And Mechanical Defects For Equipment, Electronic, Wired, And Other Devices, MIL-STD-252
 - Classifications Of Characteristics, DOD-STD-2101
- 11.8. **NASA**
 - Workmanship Standard For Staking And Coating Of Printed Wiring Boards And Electronic Assemblies, NASA-STD-8739.1
 - Workmanship Standard For Surface Mount Technology, NASA-STD-8739.2
- 11.9. **Raytheon, Electronic Systems**
 - Workmanship Standard Solder, Quality Notes, QN053
- 11.10. **IPC**
 - Acceptability Of Electronic Assemblies, IPC-A-610
- 11.11. **Overland Storage**
 - Workmanship Standards for Metal Fabricated Parts

12. Document History

12.1. Rev. A

- First Edition (14 Sep. 1998)

12.2. Rev. B

- Second Edition (12. Dec. 2001)
- Added terms and definitions
- Modified inspection requirements

12.3. Rev. C

- Third Edition (22. OCT. 2003)
- Added: More Terms and Definitions
- Added: Failure Pictures
- Modified: Inspection Requirements
- Added: Reference List

12.4. Rev. D

- Fourth Edition (02. JAN. 2004)
- Error Correction

12.5. Rev. E

- Fifth Edition (11. NOV. 2004)
- Added: Tape Pull Test Procedure (7.2.2)

12.6. Rev. F

- Sixth Edition (05. JAN. 2005)
- Added: Spot Welding criteria (6.68)

12.7. Rev. G

- Seventh Edition (11. OCT. 2005)
- Added: Error correction (9.8.3)
- Modified: Table of content and order of chapters, tables and inspection criteria moved to the front of this inspection standard.
- Modified: Changed to new Q-Logo