

Document Scope:	Global Operating Procedure	Doc #	GDC OP 018	Rev:	08/09/17
Approved: 08/09/17	Jim Sweney Author/Document Owner		Jan Peels Document Sponsor		

1.0 PURPOSE

To provide criteria for the visual inspection and evaluation of raw and finished components

2.0 SCOPE

This is a Global Policy and applies to Allegion products, whether manufactured by Allegion or their Suppliers. This document addresses visual aesthetic characteristics based on the component's intended use. This document does not address performance or durability characteristics; those are covered under the appropriate Metal Finish Control (MFC).

3.0 REFERENCED DOCUMENTS

Allegion Supplier Requirements Manual SDC QM 001

4.0 DEFINITIONS

4.1 General

PLATING – Metallic deposition to a substrate.

SUBSTRATE - Base material like Brass, Bronze, Steel, Zinc, Stainless Steel, Aluminum and Plastic.

SUB-LAYER – An intermediate deposition between the substrate and final coating.

HIGHLIGHT RELIEVING – The intended removal of the coating on certain defined edges and surfaces to reveal the sub-layer underneath. The specific highlight pattern shall be described in the appropriate MFC and/or sample boards.

4.2 Visual Surface Classes

"A" SURFACE – Areas most prominent to the observer or most likely to be noticed at first glance which may include a top surface adjacent to a front surface.

"B" SURFACE -- Areas not visible except by special effort by the observer under normal conditions.

"C" SURFACE – Areas normally not seen by observer or those not seen except by disassembly.

Surface Classification is based on final assembly. The inspector shall consider a part's use in its final assembly when determining what surface classification is used.

4.3 Defect Definitions

1. **Agglomeration / Lump**-- This defect is characterized by a spotted, blotched, or patchy appearance as if the constituents of the coating material separated and coagulated before setting.
2. **Beading** – when paint, lacquer or powder coat builds up along the edge, creating a heavy bead. Some beading is unavoidable, excessive beading is very noticeable.
3. **Belting Lines / Polishing Lines** -- This defect appears as small circular/linear scratches in the finished material resulting from some sort of polishing operation.
4. **Bleed Out / Bleeding**-- This defect is the discoloration created by the diffusion of coloring material through an applied coating from the substrate to the surface or under the surface of the top (clear) coating.

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5. **Blend Lines** – occurs in areas where buffing or polishing surfaces in different directions merge. Sometimes unavoidable due to part configuration, in these cases, should be made as invisible as possible.
6. **Blister, Casting** -- Although may be very similar in appearance to plating blisters the appearance is also circular, dome-shaped, gas filled projections of differing diameters created from inclusions of gaseous materials and normally will not create a loss of adhesion of the coating films.
7. **Blister, Plating / Bubble**-- Blisters appear as circular, dome-shaped, and liquid or gas filled projections of differing diameters resulting from localized loss of adhesion and lifting of the film from a previously applied coating of the substrate.
8. **Burrs & Flash** --Hanging material left over from the manufacturing process (Casting, Machining, Forging, Stamping)
9. **Chip** --This defect is defined as the loss of adhesion and the removal, usually in small fragments, of the surface coating resulting from impact by hard objects.
10. **Chrome Burn** -- This defect manifests itself as areas that are dull, lusterless, and cast-iron gray in color. Chrome burn is usually found on corners or outer radii of plated surfaces.
11. **Chrome Stain** -- Appears as rust colored stain that usually can be wiped off soon after the Chrome plating process.
12. **Cloudy Chrome / Dull Finish / Whitewash** -- This defect appears as areas where the shine or luster of the coating material is less than the rest of the part under inspection. .
13. **Cold Shut** -- Surface lapping of solidified metal, occurring in die castings.
14. **Contamination / Dirt** -- This defect often appears in the form of irregularly distributed dust particles, usually appearing burnt and black. These particles generally have no common shape or size and may appear long in shape, much like tiny hairs.
15. **Corrosion** --The visible manifestation of corrosion attacking the base metal is seen in the formation of oxidation that is a reddish-brown color for iron alloys, a white color for zinc alloys and a green color on copper alloys
16. **Cracks / Checking** --
 - Irregular type-crack in which the breaks do not appear in any definite pattern, usually occurring only in the exposure of enamels.
 - Line type-crack in which the breaks are generally arranged in parallel lines in the surface coating, often following the lines of brush marks.
 - Crow's foot type-crack where the breaks form definite three-pronged patterns with the breaks starting from a center forming an angle of about 120 degrees between the three prongs.
17. **Cut Through / Excessive Relieving** -- The unintentional removal of the secondary plating or color layer to reveal the substrate (i.e. the removal of the copper layer in order to reveal Brass or Zinc substrate on Aged Bronze 716)
18. **Dent / Nicks / Dings** -- This defect is characterized by impressions or depressions in the metal beneath the finishing material caused by impact with some object. Dents have no characteristic size or shape. Can be located on either the raw or finished components.
19. **Die Marks / Tool Marks / Gate Marks** --This type of defect is an indentation, depression, or line that occurs in the same location of every part due to a damaged die, mold, tool, or ejector pin.
20. **Dimensional Variation** – areas of the part that have been dimensionally changed due to aggressive polishing or belting. Usually occurs on contours and may be flat spots or changing radii. May also be due to excessive build-up of plating or powder coating.
21. **Discoloration** -- Change in color or loss of luster over entire surface. Change from original color.
22. **Finger Prints** --This defect is characterized by shallow grooves in a coated surface, which appear after applying finishing material.

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23. **Fracture** --This defect is characterized by a tear, separation or pulling apart of material. A clean fracture is generally found at corners or wherever sharp radii are located.
24. **Irregular Color** --Larger spots or areas of a surface in which the color characteristics are different than those of the surrounding area.
25. **Irregular Surface** --Dimensional or cosmetic change due to process, for example buffing polishing.
26. **Light Paint** – Characterized by base metal (substrate) showing through. May also cause the surface to appear rough or orange peeled.
27. **Nickel Showing/ Light Chrome**-- This defect appears as a dull yellow-brown or beige spot on plated surfaces and cannot be wiped or polished from the surface.
28. **Orange Peel**-- This defect is a rippling of the cured finishing material and appears rough and uneven, much like the skin of an orange or the exterior of basketball.
29. **Peeling** --Lifting of the coating from the substrate; poor adhesion.
30. **Pinhole/ Pitting** --Pinholes are sharp, round, holes randomly distributed over a surface coating or base metal and may range in size from those barely visible to those the size of a pinhead.
31. **Polishing / Buffing Compound** --Organic / non-organic substance (Rouge, Tripoli, or Silicon) or residue left on the part as a result of poor cleaning after the polishing process. Shows as black spots on buffed brass and cloudiness on chrome plated parts.
32. **Porosity** -- This is a hole or cluster of holes, less than 1/16 of an inch in diameter, occurring in cast substrates. Porosity may cause blisters or bubbles in subsequent coating and may not be visible until coated.
33. **Roughness** -- A finished area(s) exhibiting a course surface texture or embedded dirt, dust, etc. and which appear rough to the touch or can be felt.
34. **Run / Sagging** -- A run is generally a long, narrow, linear band of discoloration on a finished surface. In many instances where the drop ceases to follow across the surface, it will dry in place, often forming, a bump, or drop-like defect, on the surface, the size of which depends on the amount of finishing material carried.
35. **Shifting / Die Mismatch** -- This defect occurs with the two sides, the drag and cope are off center. This is occurs with forging/casting processes.
36. **Scratches** -- A very light to heavy grooving of the surface finish caused by contact with other objects during manufacture, handling, or packing. Scratches can usually be detected with a fingernail
37. **Scuffs / Mar** -- Marks caused by contact with objects during manufacture, handling, or packing. Scuffs cannot be detected with a fingernail.
38. **Sharp Edges** – An edge when pulled across the palm of hand with a moderate pressure may cut the skin.
39. **Stop Marks** – Obvious marks where buffing or polishing has stopped and started. Usually occurs on larger pieces where buffing operator doesn't buff entire part in one stroke.
40. **Waviness / Wrinkles** – areas of part that exhibit changing elevations. May be in base material due to poor polishing, may be coating also. Wrinkles are an excessive form of Waviness that occurs in stamped parts due to improper draw. See also **Irregular Surface**.

5.0 POLICY

The subjective nature of visual blemishes and defects mandates the use of visual inspection criteria and guidelines for the acceptance of components and assemblies by Allegion and its suppliers. The criterion in this document does not replace or modify Allegion drawings or material specifications. If there is an apparent conflict, the Allegion drawings and material specifications take precedence.

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6.0 PROCEDURE

6.1 Visual Inspection Method

Viewing distance is “arm’s length” or about 24-28 inches (60 – 70 cm), “waist high” or about 26-30 inches (66 – 76 cm) from the floor. The viewing area should be well lite, and when judging colors, the use of a Light Booth is recommended. Illumination should be cool white fluorescent illumination, without shadow at 115 ± 15 foot-candles (1235 ± 160 lux). View the part for a **total inspection time of three (3) seconds for “A” surfaces** and an additional two (2) seconds for the remainder of the part, **using** a clean white background. Parts shall be held with a white cotton glove and **only a brief glance** should be given to any area.

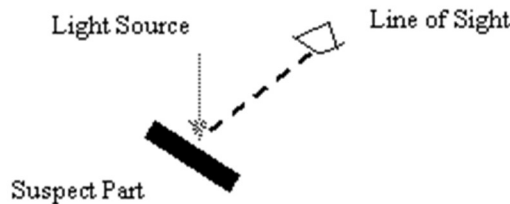


Figure 1. Proper Finish Inspection Orientation

Once a potential defect has been detected, closer examination is allowed to appropriately classify the type and degree of severity per Table1, 2 and 3. Only then can the potential defect in question be considered a defect. If a defect is identified, then the final, installed orientation should be considered in determining pass / fail.

As a standard repeatable method, the Allegion Visual Inspection Light Booth provides the environment for visual inspection and is used for final verification and determination, in the event that further review is needed or in the case of First Article inspection.

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6.2 Surface Defect Limitations

The Inspector shall use the following tables for determination of what defects should be looked for on each surface area. Table 1 shall be used for Raw Material; Table 2 shall be used for Polished or Buff parts and Table 3 shall be used for Finished Components.

6.2.1 Use the Defect Template to quantify defects found.

During Inspector certifications Inspectors will be provided this template by the assigned trainer.

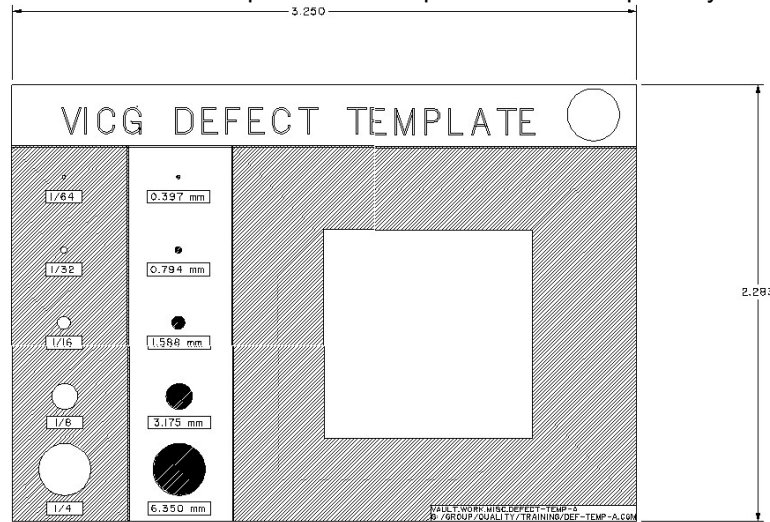


TABLE 1: Raw Components – Ready To Paint (Reference Section 4.0 for Definitions)

Defect	“A” Surface	“B” Surface	“C” Surface	Notes
Flash, Mismatch, Gate Marks	No Defect Allowed	No Defect larger than 0.005” (0.13mm)	No Defect Larger than 0.010” (0.25 mm)	All flashing, gate, vent and ejector pin marks to be polished smooth. Maximum die mismatch may be called out on prints.
Dents, Nicks, Die Marks, Depressions	No Defect Allowed	Allowed only if not visible after coating	Allowed	Many dents or depressions are difficult to see in raw casting, therefore may not show up until after coating.
Cracks, Fractures, Rust or Corrosion, Sharp Edges, Cold Shut	No Defect Allowed	No Defect Allowed	Only minor surface blemish allowed.	Cracks and fractures are not allowed on any surface. Others only if removed by supplier and are invisible after finishing.
Blisters, Pinholes, Porosity, Pits	No Defect Allowed	0 > 0.030” (0.75 mm) 4 < 0.030” in 1 Sq. In (4 < 0.75 mm in 6.5 sq. cm)	Allowed	

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Defect	"A" Surface	"B" Surface	"C" Surface	Notes
Roughness, Waviness, Irregular Surface / Dimensional Variation	No Defect Allowed	Allowed only if polished smooth	Allowed	Defects which are removed by the supplier and are invisible after finishing, may be accepted.
Dirt, Scratches, Scuffs	Allowed only if not visible after normal cleaning and painting	0 > 0.50" long or 0.10" wide (12.7 mm L X 2.5mm W) 2 < 0.50" long or 0.10" wide in 1 Sq. In (2< 12.7mm L x 2.5mm W in 6.5 sq. cm)	Allowed	Defects which are removed by the supplier and are invisible after finishing, may be accepted.

TABLE 2: Raw Components Pre-Polished or Pre-Buffered (Reference Section 4.0 for Definitions)

Defect / Attribute	"A" Surface	"B" Surface	"C" Surface	Notes
Surface Finish	Satin = 40 – 80 micro Inches Ra (10 – 20 microns) Buff = 15 Micro Inch Ra Max (4 microns)	Satin = 40 – 80 micro Inches Ra (10 – 20 microns) Buff = 15 Micro Inch Ra Max (4 microns)	No Requirements	Satin shall be finished with 220 grit abrasive with lines in the direction indicated on print. Buff shall be a mirror finish.
Surface Defects	See Table 1	See Table 1	See Table 1	
Stop Marks, Blend Lines	Not allowed. (See Note)	Allowed only in complex transitions and where not obvious.	Allowed	Some designs preclude the elimination of blend lines. Physical limit samples shall be created for those components.
Contamination	Not Allowed	Not Allowed	Not Allowed	Parts shall be cleaned and rinsed thoroughly before polishing. Abrasive and buffing materials may not cross-contaminate substrates, especially stainless steel. The use of chromate sealers are not allowed.
Dimensional Variation / Waviness / Wrinkles	Not Allowed	Not Allowed	Not Allowed	Polishing steps shall not remove excess material such that the part no longer conforms to the dimensional specifications on drawing.
Polishing / Buffing Compound	Not Allowed	Not Allowed	Minimal	Only a minimal amount of buffing compound is allowed on C surfaces. Care should be taken to prevent compound from collecting in "C" areas.



Finish Specification for Aesthetic Components

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Finish Specification for Aesthetic Components

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TABLE 3: Finished Components and Assemblies (Reference Section 4.0 for Definitions)

Defect / Attribute	"A" Surface	"B" Surface	"C" Surface	Notes
Agglomeration, Beading, Sagging, Heavy Coverage	Not Allowed	Only 1 < 0.06" (1.6mm) per surface.	Allowed	Must not interfere with assembly or functionality on any surface.
Belting Lines, Stop Marks, Incomplete Polish	Not Allowed	Not Allowed	Allowed	
Bleed Out, Stain, Chrome Stain	Not Allowed	Only 1 < 0.06" (1.6mm) per surface	Allowed	
Blisters	Not Allowed	Not Allowed	Allowed	Blisters must not interfere with assembly or functionality.
Burrs, Flash, Sharp Edges	Not Allowed	Not Allowed	Not Allowed	
Chip	Not Allowed	Not Allowed	Allowed	
Chrome Burn, Cloudy Chrome, Whitewash	Not Allowed	Not Allowed	Allowed	May be accepted if removed
Cold Shut, Cracks, Fractures, Tears	Not Allowed	Only 1 < 0.06" (1.6mm) per surface No more than 3 < 0.03" per Sq. In. (3 < 0.8mm per 6.5 sq. cm)	Allowed	Fractures and Tears refer to minimal cracks in the coated surface. No structural defects are allowed on any surface.
Contamination	Only 1 < 0.03" per surface.	Only 1 < 0.06" per surface. No more than 3 < 0.03" per Sq. In (3 < 0.8mm per 6.5 sq. cm).	Allowed	Visibility should be considered. Very obvious defects are not allowed of any size.
Corrosion	Not Allowed	Not Allowed	Not Allowed	
Cut Through / Excessive Relieving	Not Allowed	Not Allowed	Allowed	
Dents / Die Marks / Nicks	Not Allowed.	Only 1 < 0.06" (1.6 mm) per surface.	Allowed	
Discoloration, Irregular Color, Streaking, Gloss Variation	Not Allowed	Minimal	Allowed	Antique and living finishes are expected to have some changes in color. Limit samples or Review Panel judgment must be used to determine acceptance.
Irregular Surface / Waviness / Dimensional Variation	Not Allowed	Not Allowed	Allowed	
Nickel Showing, Poor chrome coverage	Not Allowed	Not Allowed	Allowed	Defect allowed if covered by screw heads or not visible when assembled.
Orange Peel	Minimum of 7 on PCI Smoothness Standard, or match limit sample	Minimum of 5 on PCI Smoothness Standard, or match limit sample	Allowed	Note: PCI = Powder Coating Institute. They manufacture a "Smoothness Standard" by which to grade Orange Peel.

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Defect / Attribute	"A" Surface	"B" Surface	"C" Surface	Notes
Peeling	Not Allowed	Not Allowed	Not Allowed	Peeling coating not allowed on any surface due to possibility of interference with mechanism
Pinhole/ Pitting	Not Allowed	Not Allowed	Allowed	Pinholes or pits through the coating are not allowed due to corrosion protection requirements
Polishing / Buffing Compound	Not Allowed	Not Allowed	Minimal	Only a minimal amount of buffing compound is allowed on C surfaces. Care should be taken to prevent compound from collecting in "C" areas.
Porosity	0 > 0.03" per surface. No more than 3 < 0.03" per Sq. In. (0>0.8mm and 3<0.8mm per 6.5 sq. cm)	0 > 0.03" per surface. No more than 3 < 0.03" per Sq. In. (0>0.8mm and 3<0.8mm per 6.5 sq. cm)	Allowed	
Roughness	See Note	See Note	Allowed	Must not catch cotton inspection glove under moderate pressure.
Shifting, Parting Lines, Incomplete Polish	Not Allowed	Not Allowed	Allowed	Allowed in "C" area as long as doesn't interfere with assembly or function.
Scratches / Scuffs	0 > 0.30" long, no more than 2 marks in 1 Sq. In. (0>7.5 mm long, no more than 2 per 6.5 sq. cm)	0 > 0.50" long, no more than 2 marks in 1 Sq. In. (0>13 mm long, no more than 2 per 6.5 sq. cm)	Allowed	Scratches shall not be wider than 0.005"
Sharp Edges	Not Allowed	Not Allowed	Not Allowed	Not Allowed

6.5 Statements of Consideration for Marginal Defects

- Only a brief glance should be given to any area, as described in Section 6.1. This is a common violation, especially with those unfamiliar with the intent of this guideline.
- The function of the component in the final product must always be considered during review of defects.
- Sound practical judgment and consideration of the customer's perception should be used in evaluation of all defects.
- Defects may be larger than specified if there is little or no contrast with the surrounding finish making the blemish less noticeable.
- Defects may be closer together than specified if they are in an area broken by holes or other surface features. Generally, the probability that at least one defect will be detected rapidly increases with the number of defects present.
- Acceptable marks will not catch a cleaning cloth or white inspection glove.
- Any area of thin coverage should look no worse than a shadow, must be uniform in appearance, and should not be noticeable at arm's length.

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- No open blisters, obvious orange peel, or obvious drain lines are to be accepted without an appropriate MRB documented in an NMR or Deviation.

If the normal visual inspection sampling results in a single defect which is considered marginal by standard processing, an additional sample may be taken to make final qualification of acceptability.

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6.6 Appendix

6.6.1 Figures illustrate parts and part families defining surfaces A, B, & C; scratch patterns characteristics, etc., specific to many part types. Note: Scratch patterns specified on the drawing will take precedent. Scratch patterns apply to all Satin Finishes

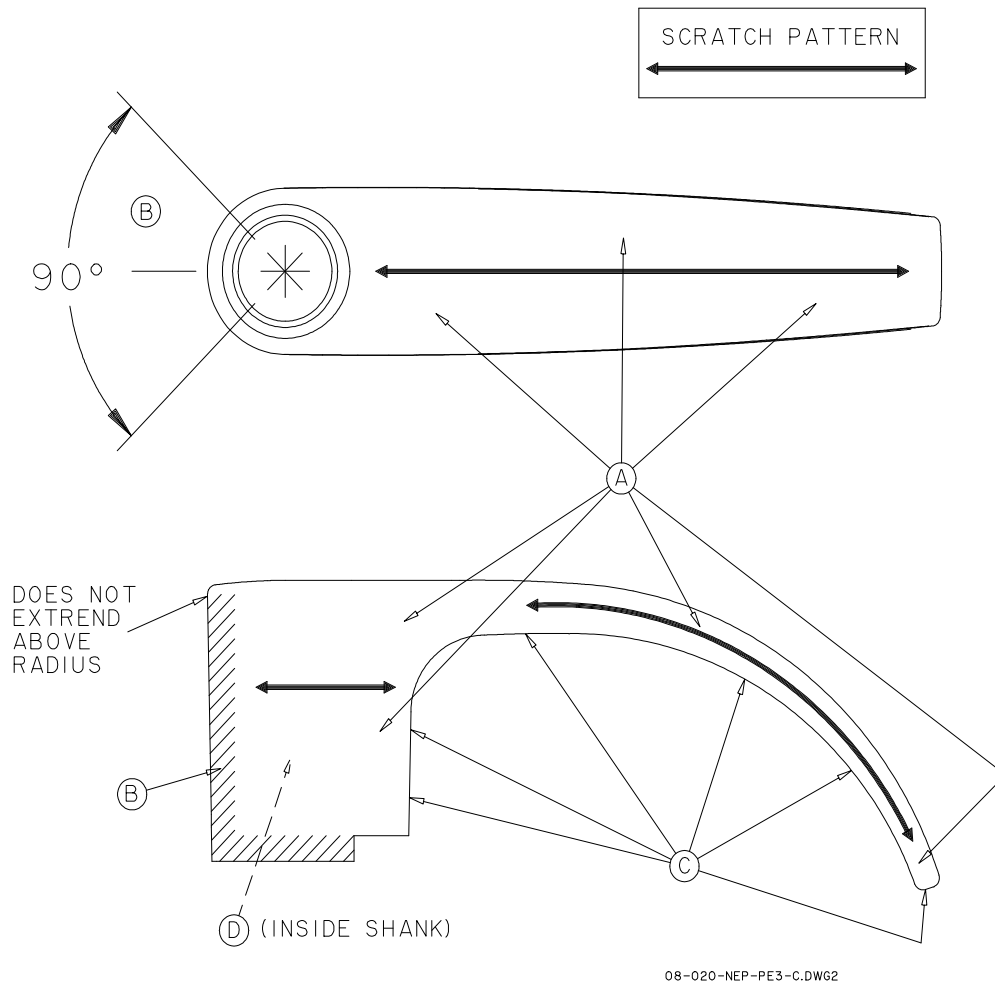
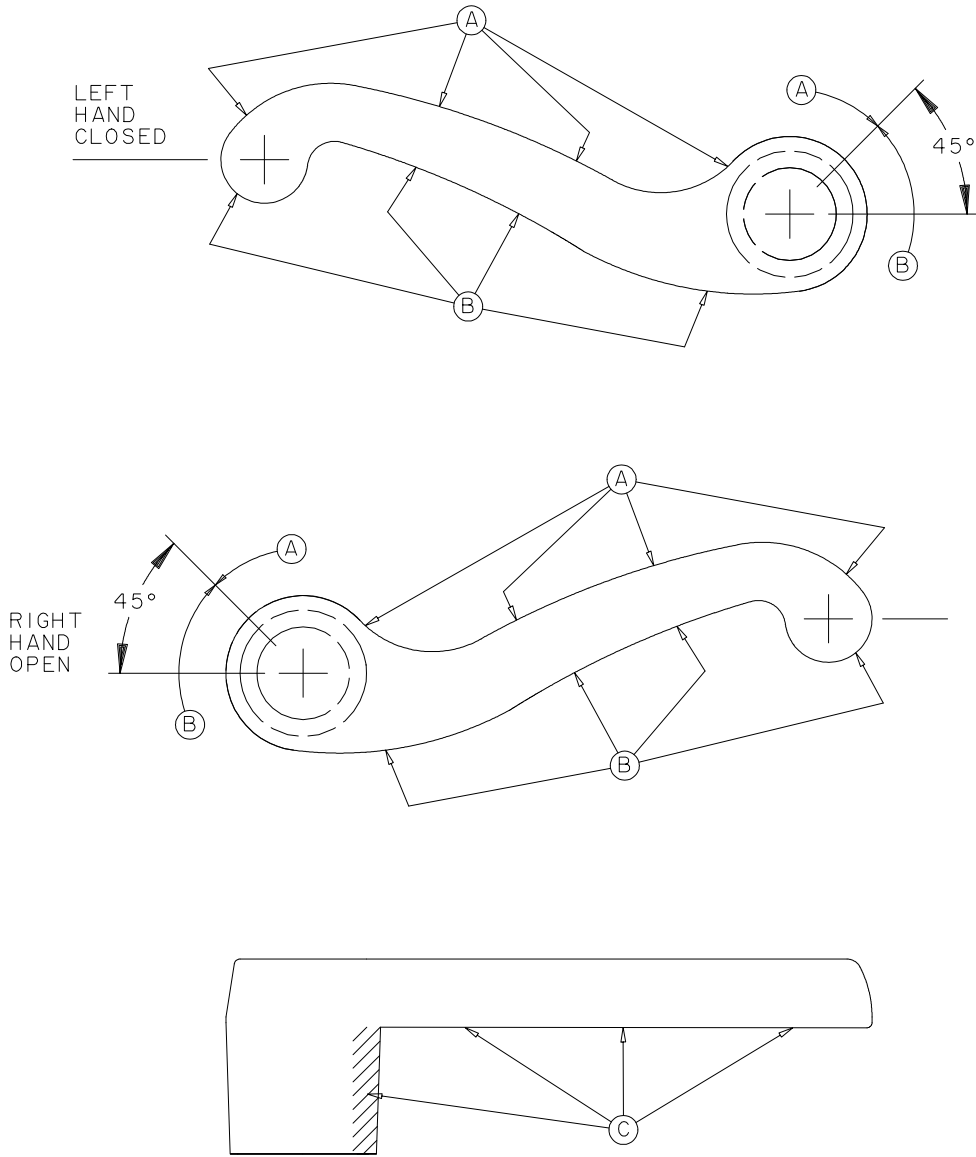


Figure 1 All **General Levers** either open or closed

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Figure 2 All **Handed type Levers** either open or closed

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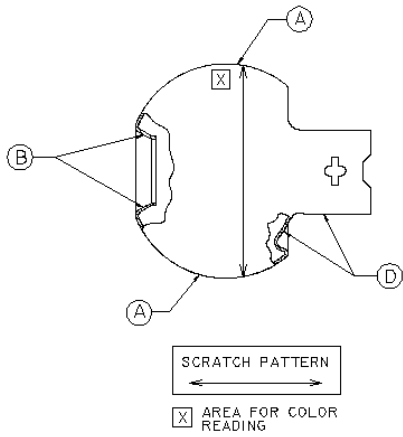


Figure 3A

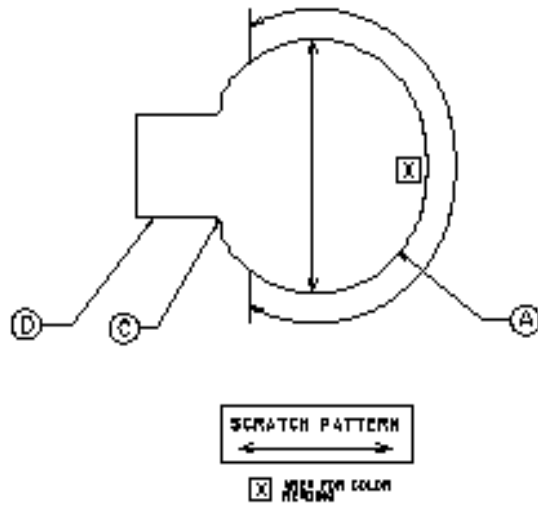
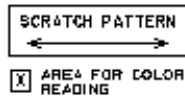
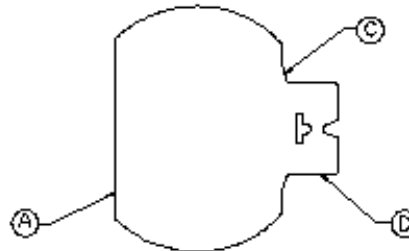
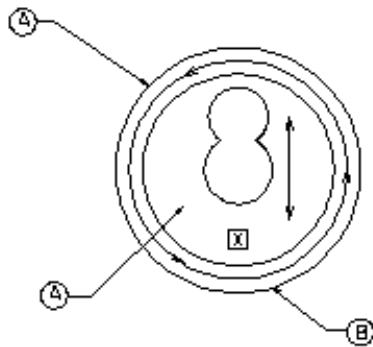


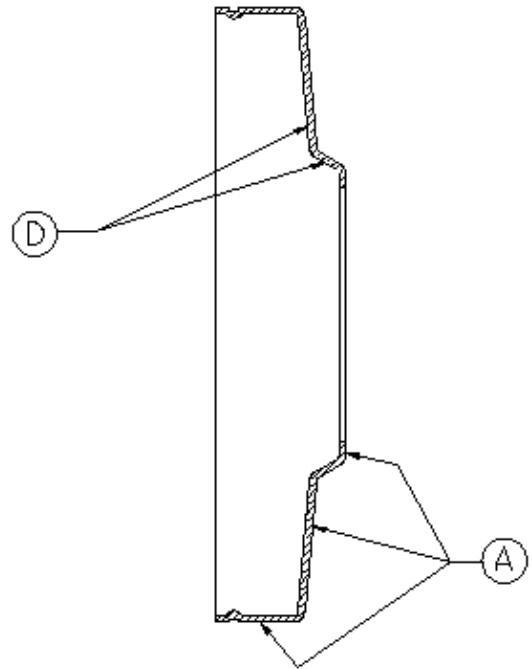
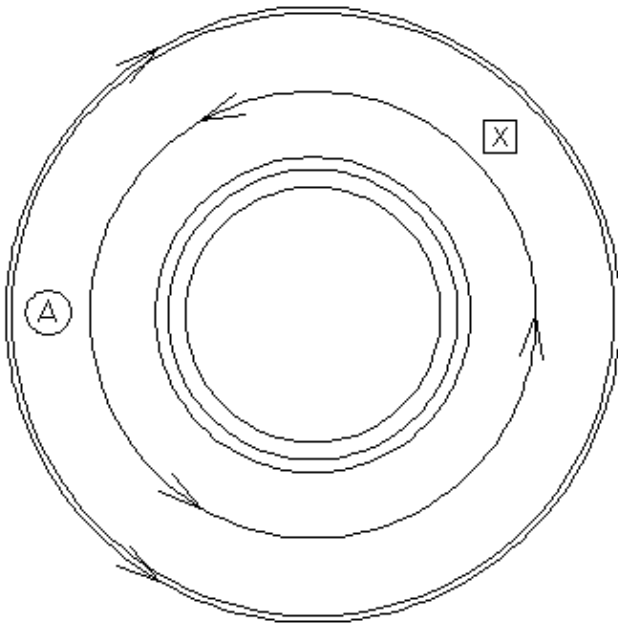
Figure 3B



Figures 3C

Figure 3A, 3B, 3C All **Knobs** either open or closed

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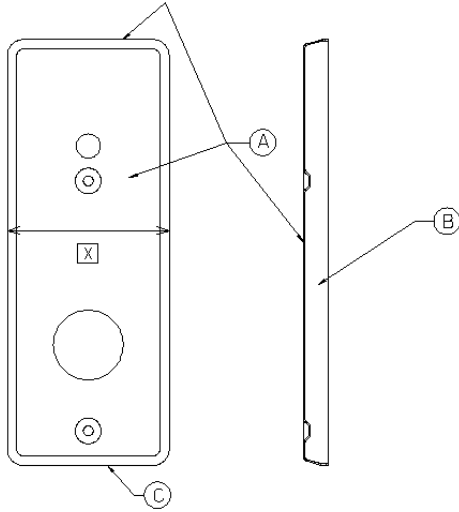


SCRATCH PATTERN


 AREA FOR COLOR READING

Figure 4 **Roses**

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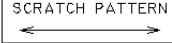
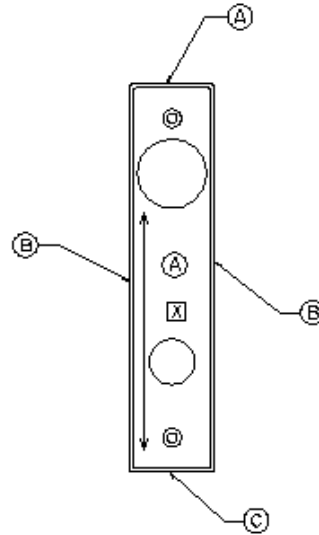
SCRATCH PATTERN

 AREA FOR COLOR READING

Figure 5 Flat Escutcheons



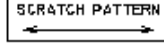
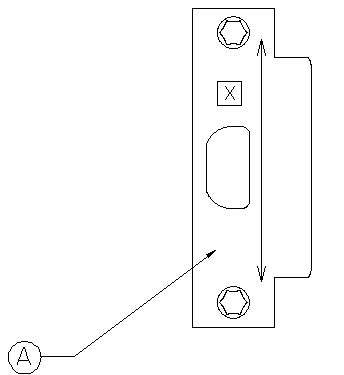
SCRATCH PATTERN

 AREA FOR COLOR READING

Figure 6 Mortise Escutcheons



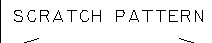
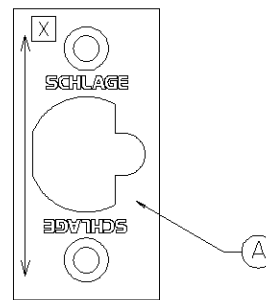
SCRATCH PATTERN

 AREA FOR COLOR READING

Figure 7A




SCRATCH PATTERN

 AREA FOR COLOR READING

Figure 7B

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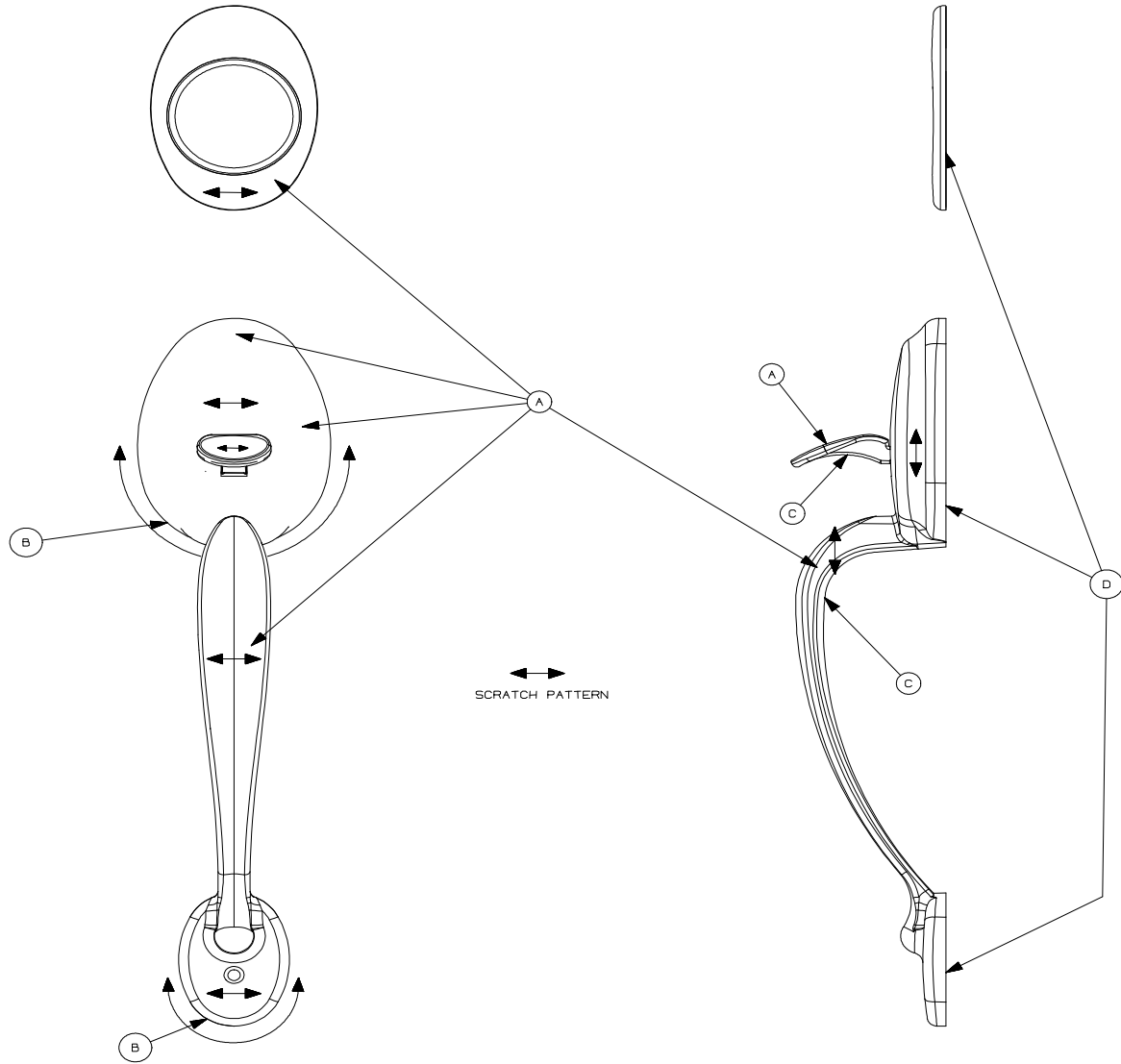
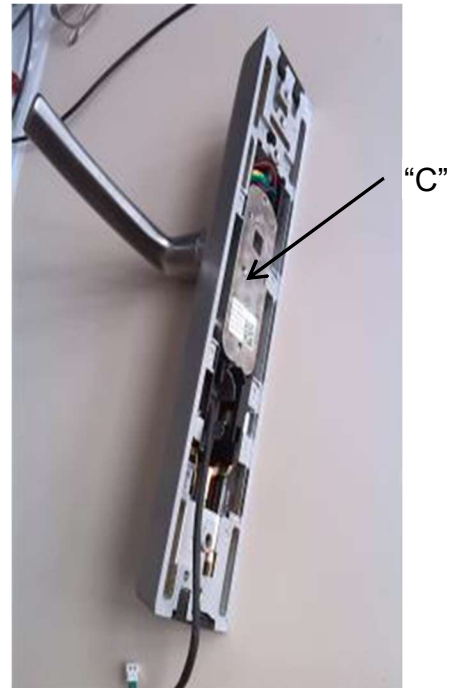
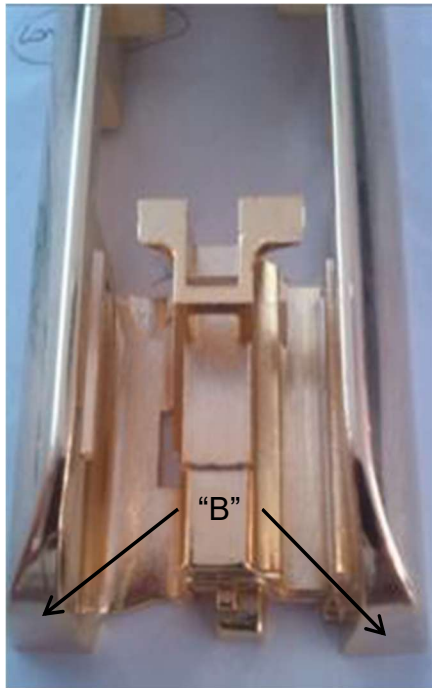
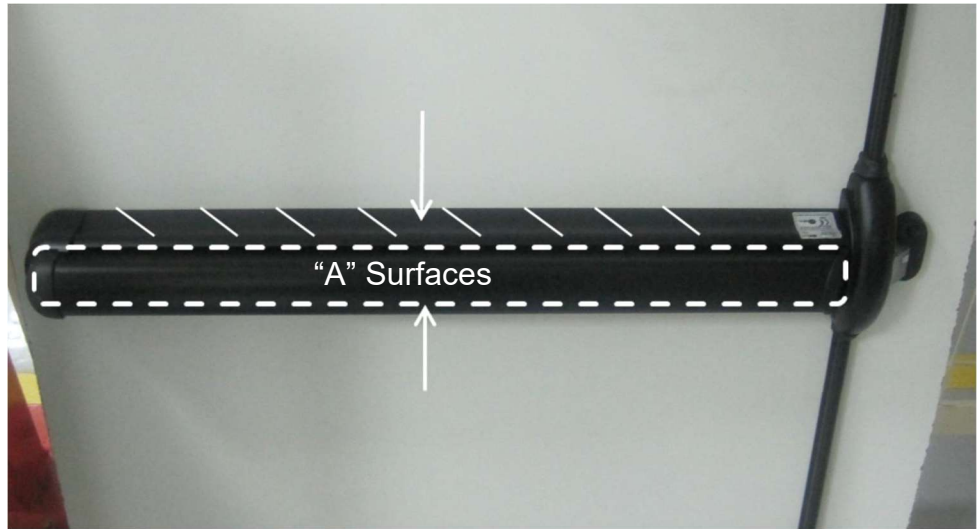
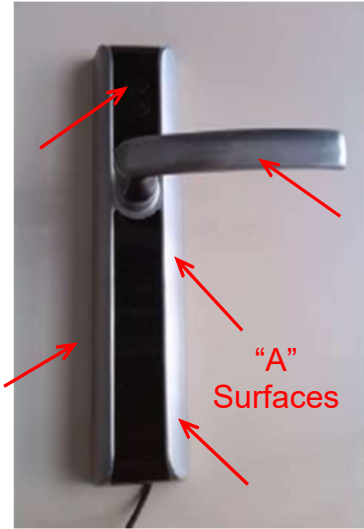
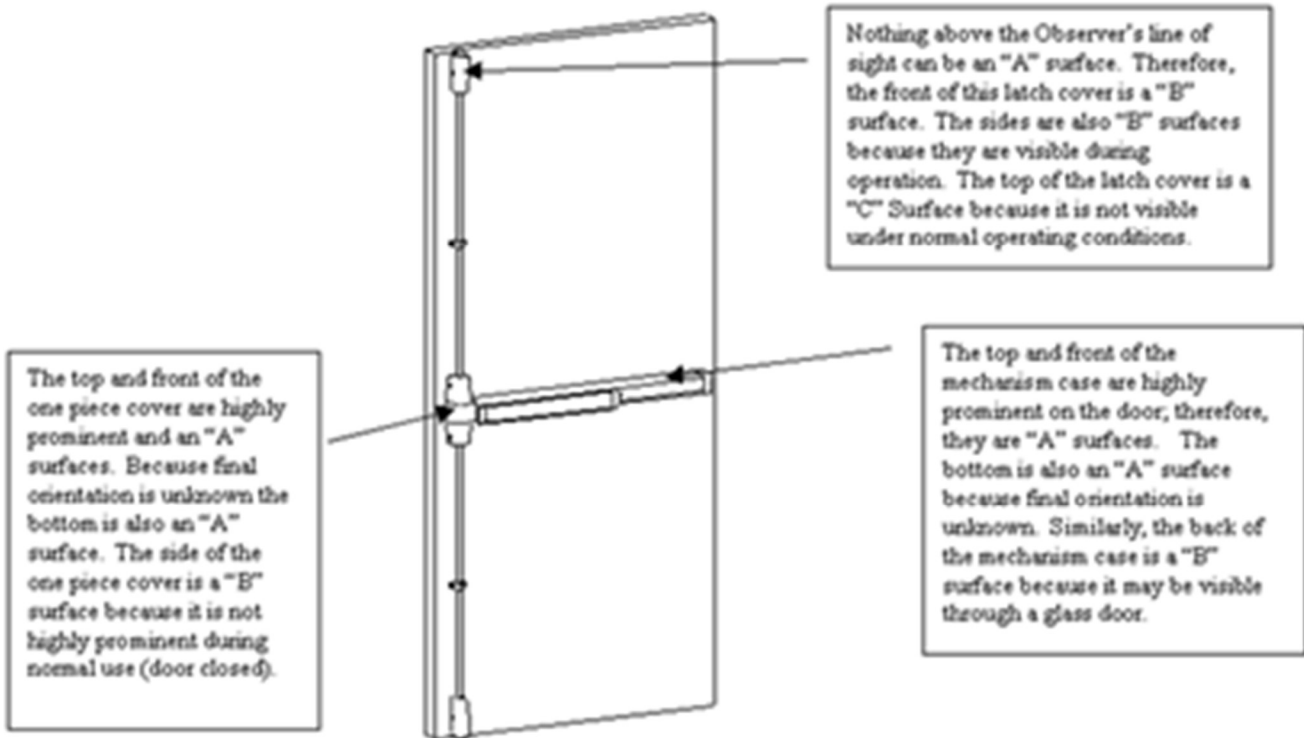


Figure 8 All Grip Handles

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6.6.2 Figures illustrate various common defects. These defect illustrations are not intended to define all possible or all listed defects, but are used as examples of some of the more common ones.

Chrome burn - This defect manifests itself as areas that are dull, lusterless, and cast-iron gray, blue or brown in color. Chrome burn is usually found on corners or outer radii of plated surfaces.



Figure 1. Chrome burn on a 334 cylinder control housing

Chrome Coverage - This defect can appear as a portion of a part lacking the silver color of the chrome (see Figure 2) or as an area of dark brown smudging (see Figure 3).

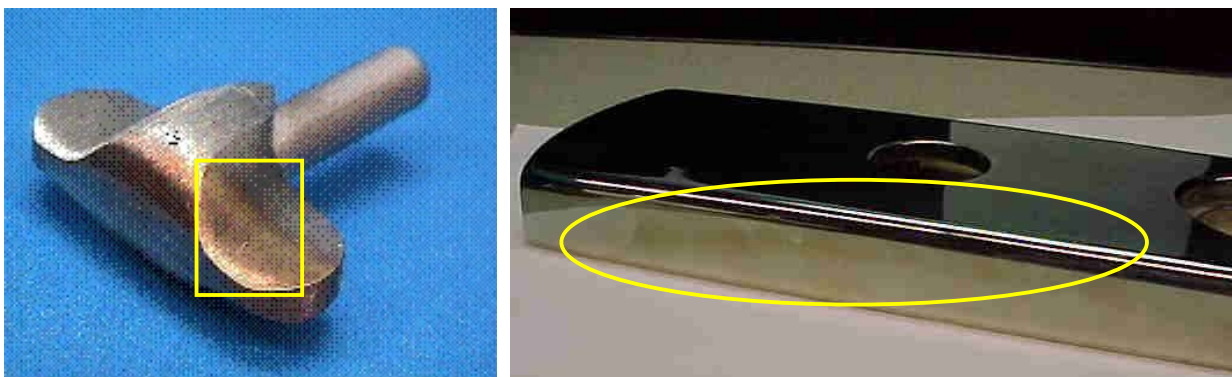


Figure 3. Poor Chrome Coverage on a 992 Trim.

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Figure 2. Poor chrome coverage on a GJ plunger handle.

Dents / Sinks - A dent is generally a large impression left by some forceful contact. For the sake of visual inspection, dents will also include impressions or depressions resulting from casting cooling or ejector pins during casting.

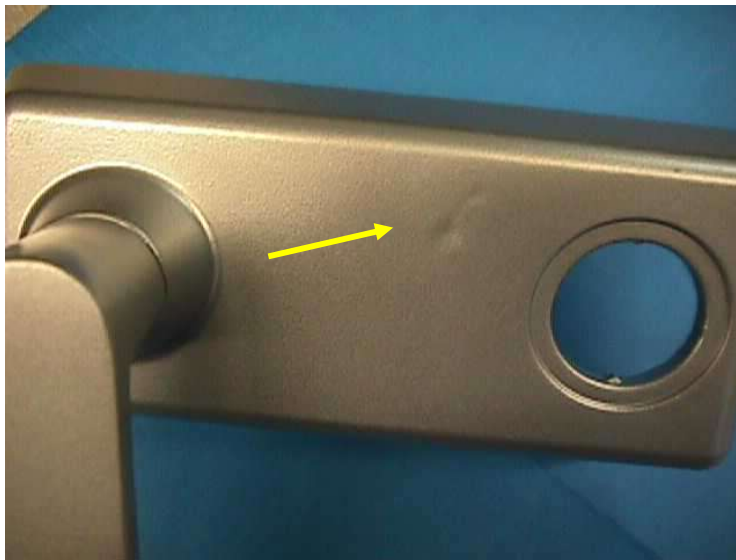


Figure 4. Dents in a 230L Trimplate.

Orange Peel - This defect is a rippling of the cured finishing material and appears rough and uneven, much like the skin of an orange or the exterior of a new basketball.

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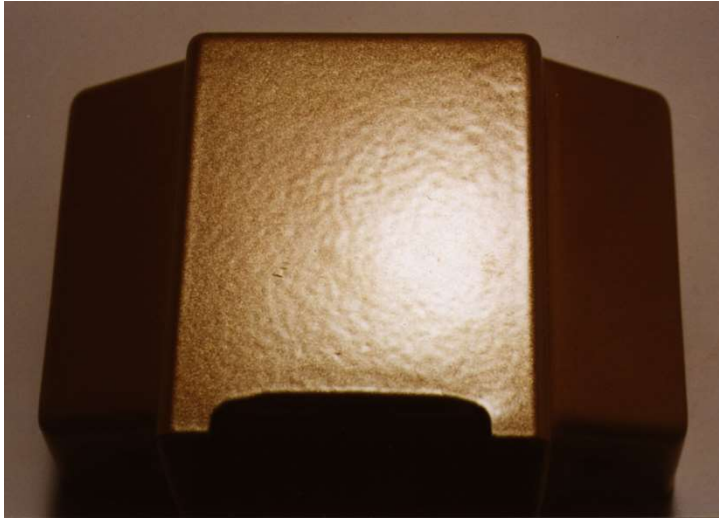


Figure 5. Shows orange peel on a 22 center case cover.

Paint Coverage - This defect appears as a portion of unpainted material or an area of lighter color.



Figure 6. Light Paint Coverage on a One Piece Center Case Cover.

Polishing Compound Contamination - This defect appears to be small brown spots under the clear finish on a polished part.

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Figure 7. Polishing compound splattered on a 994 trimplate.

Porosity / Pinholes - This defect appears to be tiny holes that range from barely visible to the size of a pinhead. The holes may appear in clusters.



Figure 8. Shows porosity on a push bar end cap. The cluster is too dense for an A surface.



Figure 9. Shows pinholes on a lever. These holes are too large for an A surface.

Roughness - This defect appears to be tiny holes in the surface; however, when touched the holes are actually raised surfaces that are rough to the touch.

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Figure 10. Push Bar End Cap with Roughness.

Revision record

Date	Description of change	Doc owner	Approval
12/05/15	Original Release	Jim Sweney, Manager, Finishing COE, OP Advanced Manufacturing Engineering	Jan Peels – Vice President, Global Quality
08/09/17	Changed number of Supplier Quality Manual and added revision record	Jim Sweney, Manager, Finishing COE, OP Advanced Manufacturing Engineering	Jan Peels – Vice President, Global Quality