


REVISION RECORD

EFFECTIVE	REVISED BY	APPROVED BY	REVISION
10-02-2012	R. Montfort	P. Robino	Revision N/C
10-23-2012	R. Montfort	P. Robino	Revision A – Revised to clarify visual criteria
07-19-2013	R. Montfort	P. Robino	Revision B – Revised to reflect current process used by the company
08-19-2013	B. Sheikvand	P. Robino K. Suri	Revision C – Revised to incorporate customer comments
12-04-2017	J. Marban	R. Lopez K. Suri	Revision D – To clarify/ redefine criteria and update formatting.

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1.0 PURPOSE

This procedure defines and establishes acceptance criteria for surface imperfections. Inspection of workmanship on PTI products without explicit inspection instructions will default to this procedure.

Six categories of visible surface irregularities are addressed, and all requirements apply at the assembly level as well as the detail level. The six categories of visible irregularities are those relating to (1) as cast or as forged non-functional surfaces, (2) functional machined interface surfaces, (3) functional sealing surfaces, (4) non-functional machined surfaces, (5) plated or chemically coated surfaces, and (6) end item detailing (paint / primer added) including dry film lubricant and other similar coatings.

2.0 SCOPE

This procedure applies to all products manufactured at PTI facility. Customer requirements may override this procedure if agreed upon by PTI Technologies Manufacturing & Engineering.

2.1 Responsibility


Visual inspection for surface imperfections will be the responsibility of all PTI personnel. Verification of any non-conformance shall be conducted by Quality and/or Manufacturing personnel or its designee.

It shall be the responsibility of the Quality Department to assure the requirements outlined in this procedure are complied with. It shall also be the responsibility of this department to provide the Inspection Department with the necessary tools and visual aids to determine compliance with all requirements outlined and defined in this procedure.

All parts and assemblies that do not meet the requirements of this procedure shall be referred to the Material Review Board (MRB) for disposition (Ref. QAP 7.1-1).

3.0 REFERENCES

- 3.1 QAP 7.1-1 – Control of Nonconforming Material
- 3.2 MIL-DTL-5541 – Chemical Conversion Coating on Aluminum

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4.0 FORMS

None


5.0 DEFINITION

- 5.1 Assembly Tool Mark – Marks made by normal process tooling during clamping, forming, and straightening that does not remove material.
- 5.2 Burrs – A rough ridge or edge left at the intersection of two surfaces.
- 5.3 Chatter Mark – A tool mark on material caused by vibration or jumping of a machining cutting tool.
- 5.4 Corrosion – A deterioration of the metal resulting in change of color and leaving a rough surface that may show pits (small cavities).
- 5.5 Crack – A separation of material visible to the naked eye.
- 5.6 Nicks, Dings, Gouges, Scratches – Cuts, cavities, or breaks in the surface usually caused by handling and typically resulting in elongated grooves or cavities. Tactile inspection with a fingernail can be used to determine if the surface condition being examined is or is not easily detectable.
- 5.7 MRB – Material Review Board (Ref. QAP 7.1-1)
- 5.8 Run Out Area – The transition between a plated, coated, primed, or painted surface and an adjacent bare surface.
- 5.9 Orange peel – a certain kind of finish that may develop on painted and cast surfaces. The texture resembles the surface of the skin of an orange.

6.0 PROCEDURES

6.1 Visual Inspection

- 6.1.1 Assemblies and detail components should be visually inspected per this procedure and the applicable drawings by an inspector possessing normal or near-normal vision.
- 6.1.2 Visual inspection should be performed without magnification at a sightline of 18 to 24 inches. Magnification may be used as an aid in the evaluation of suspect areas.
- 6.1.3 Lighting should be adequate and diffused so shadows are not a factor.

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- 6.1.4 Parts should not be manipulated to reflect a single light source in order to accentuate surface flaws.
- 6.1.5 A dwell time of approximately 8 to 10 seconds should be used to inspect any feature.
- 6.1.6 It is permissible to verify length and depth values by any practical means.

6.2 Functional Areas Definition

The following are considered Functional Areas:


- Customer Interface Splines
- Customer interface mounting holes
- Mounting Surfaces that physically contact a mating part/ assembly.
- Sealing surfaces (o-ring interface surfaces, hydraulic ports, etc.)
- O-ring grooves
- Electrical connectors
- Threads (including helical inserts)

All other areas are considered non-functional.

6.3 Acceptance Criteria

The limits in this section should be used for surface imperfection acceptance criteria. Surface imperfections that have an adverse effect on Form/Fit/Function are not acceptable.


- 6.3.1 Burrs are not acceptable, part found with burrs should be sent to MRB for disposition.
- 6.3.2 Chatter marks are acceptable provided part meets drawing roughness requirement.
- 6.3.3 Corrosion is not acceptable, part found with corrosion should be sent to MRB for disposition.
- 6.3.4 Nicks, Dings, Gouges and Scratches. The allowances of these detected irregularities are determined by engineering drawing requirements. All visible surfaces have a need to be cosmetically acceptable, regardless of finish call outs on the engineering drawings. If the drawing does not specify, the following apply:

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- 6.3.4.1 The part surface texture and finish shall be in accordance with the drawing and shall be uniform in appearance across the entire surface.
- 6.3.4.2 Nicks/Dings/Scratches/Gouges on sealing surfaces are not acceptable.
- 6.3.4.3 Visible Nicks/Dings/Scratches/Gouges on non-functional surfaces shall meet the following criteria to be considered acceptable: If the surface finish requirement is below 63√ then the surface irregularity can be no greater than 0.003” in depth and 0.005” in width; If the surface finish requirement is 63√ or above then the surface irregularity can be no greater than 0.005” in depth and 0.010” in width.

- 6.3.5 Paint: Painted surfaces should be defect free with texture and color uniform throughout the entire part surface, including all breaks (angles) or change in shape. The finish on a continuous surface shall exhibit no gross imperfections such as gouges, large chips, runs, blisters, oil spots, flaking, orange peel, overspray, under spray or any defects that will affect the functional or appearance properties of the finish. Paint or Primer surfaces should have no bare material exposed. Scratches are acceptable provided no bare material is showing. Paint touch-up is acceptable. Touch-up is not acceptable if evidence of the touch-up is visible at the respective viewing distance (see Paragraph 6.1)

- 6.3.6 Plated and Chemical Coated Surface Requirements
 - 6.3.6.1 Plating and coatings may vary in appearance significantly within the run out area. This is acceptable.
 - 6.3.6.2 Flaking, blistering, or any other evidence of lack of adhesion is unacceptable.
 - 6.3.6.3 Non-uniform coloration is acceptable on anodized, chemical filmed, cadmium plated, tungsten carbide, aluminum plated parts providing that no evidence of corrosion or oxidation is present. Staining from dripping or run down of process solutions is acceptable
 - 6.3.6.4 Solid film Coatings – The bonded solid film lubricant shall appear free from any cracks, pinholes and rough particles. There shall be uniform coverage of surfaces required by the blueprint. Due to its nature a certain amount of wear is to be expected if part has been inspected or tested. Where a finish process is required such as anodize or solid films, no scratch or blemish shall expose unfinished material. Stains resulting from specified pro-

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cesses are allowed – i.e. anodize rack marks (Review applicable coating standard for acceptance criteria).

6.3.7 Name Plates – Name plates should be visible and easily read, minor nicks that do not detract from the marking are acceptable. Nicks that break the surface coating should be protected with appropriate coating applicable for the name plate material. Aluminum name plates require chemical conversion coat per MIL-DTL-5541. Letters on name plate with double impressions or incomplete digits are not acceptable. The straightness of the name plate shall be per the drawing requirement.

6.3.8 End Item Requirements

- 6.3.8.1 Parts shall be clean and free of dirt, grease, machine chips, and other foreign material, other than corrosion protection.
- 6.3.8.2 Nameplates and all identification shall be clear and legible. Double impressions or incomplete digits are not acceptable.
- 6.3.8.3 Potting shall be applied neatly, without smearing, and shall be fully cured.
- 6.3.8.4 Lockwire may have marks or abrasions from the use of lockwire pliers providing no such mark or abrasion is in excess of 10% of the wire diameter.
- 6.3.8.5 Unless stated in this document or on engineering drawings, the general surface finish requirement is to be 125 or better on all non-functional surfaces.