A. PURPOSE AND SCOPE

This document establishes and defines supplemental workmanship criteria to be used in conjunction with engineering drawings and specifications. This document is to be used to establish acceptable standards of quality, good workmanship and acceptable shop practice when a specific designation covered herein is not specified or is incompletely defined in the applicable drawing or specification.

B. REFERENCE DOCUMENTS

1. POLICY
DP 4.2.1, Quality Manual

2. PROCEDURE
N/A

3. WORK INSTRUCTION
N/A

4. FORMS
N/A

C. INSTRUCTIONS

ORDER OF PRECEDENCE
In the event of a conflict, the following Order of Precedence shall govern:

- Engineering Drawing
- Purchase Order
- WI 7.5.1.20
- Referenced Specification

NOTE: Unless otherwise specified, interpret drawings in accordance with ASME Y14.100, latest released revision.

RESPONSIBILITY AND AUTHORITY

It is the responsibility of the Quality Management Representative or their Quality designee to coordinate the requirements of this Work Instruction with other responsible work functions as outlined in the following pages.

DEFINITIONS

Anodizing – An electrolytic oxidation process in which the surface of a metal, when anodic, is converted to a coating having desirable protective, decorative, or functional properties.

Base metal – Material upon which coatings are deposited.

Burr – A non-functional piece of material extending from the parent surface of a part. A burr can be a sharp, ragged projection, firmly adhered, or a loose hanging projection.

Blister – A dome-shaped imperfection or defect, resulting from loss of adhesion between a surface coating and the substrate.

Break Edge – Similar to a chamfer, a break edge is a machined inclined surface cut at a part edge. Break edges are used when size and angle controls are less critical.

Chamfer – A machined inclined surface cut at a part edge.

Color Uniformity – Surface color varying in uniformity resulting in spots, blotches and striations of different color.

Corner – The intersection of three or more edges.

Contamination – An inclusion of foreign material detectable on or under surface of the part.

Corrosion – The deterioration of materials by chemical interaction with their environment. The term corrosion is sometimes also applied to the degradation of plastics, concrete and wood, but generally refers to metals.

Crack – A linear imperfection in the form of a narrow break or fissure resulting in a partial or complete parting of the parent material.

Crazing- A network of fine hairline cracks in a coating.

Cross Threading – Usually the result of attempted use of mismatched threaded parts, or improper thread starting followed by extreme force.

Cure Date – The date the rubber is fully cured. Two methods in expressing the cure date are as follows:

Shelf life to a maximum of 3 years. Cure date stated in terms of month of calendar year and the year, i.e., 6-97

Shelf life in excess of 3 years. Cure date stated in terms of the quarter of calendar year and the year, i.e., 2Q-97.

Deformation – A condition whereby two parts do not smoothly interact with one another. This is usually discovered by an irregular non uniform gap between two mating surfaces. Most commonly found in sheet metal, thin wall machined surfaces or composite parts.

Deformed – A departure from normal shape greater than the dimensional tolerance. Parts often deform out of round, out of square, twisted, warped, bent or flattened.

Dent – A completely smooth surface depression caused by pressure or impact. The parent material is displaced but none is separated.

Edge – The intersection of two surfaces.

Edge Break – See Break Edge.

Elastomer – A material that possesses elastic properties and has undergone vulcanization and/or conversion into a finish product.

Electroplating – The electro-deposition of an adherent metallic coating upon an electrode for the purpose of securing a surface with properties or dimensions different from those of the base metal.

Flash – Related to electroplating – A very thin electro-deposit used for a final coat: for intermediate coating of the same nature, use strike.

Flash – Related to molded parts – Excess material adhering to part.

Foreign Material – any form of contaminate such as the migration of loose tools, hardware, personal items or other objects in the product that is either loose or not specified in the Parts List/Bill Of Materials (BOM).

Gouges – A, trough-like depression caused by scooping out of material by another object. Gouges in material often leave sharp edges and Burrs. Gouges are usually reported with nicks, scratches and pits.

Magnified Visual Examination – See Visual Examination, Magnified.

Masking – Materials applied to specific areas of parts to prevent coatings from being deposited. Materials vary by application and may or may not be specified on the engineering drawing or Assembly instruction.

Nicks – Small surface impressions having sharp edges, corners, or bottoms. Nicks are usually found along the edge of a part. This differs from a gouge, which is usually found in the middle of a surface. Nicks are usually reported with gouges, scratches and pits.

Non-fill/Void – An incomplete part due to insufficient material.

Pit – A small, irregular cavity in a surface, usually having a rough bottom. May be caused by corrosion. Pits are usually reported with gouges, scratches and nicks.

Pin Hole – A small sharply defined hole in surface of part.

Scratch – A long, narrow, sharp-cornered impression Scratches may result in removal or relocation of material and differ from gouges because they are longer and narrower. Scratches are usually reported with gouges, nicks and pits.

Scuff – A mark caused by abrasion, which changes surface smoothness or texture and color.

Seal – A condition whereby a barrier exists between two areas. This condition prevents the passage of liquid or gas from one area to another. This condition can be created by a fit between two parts or by the addition of a part with elastomeric properties.

Sharp Edges – Edges that can readily cause a cut or tear.

Soot – A black powdery finish that is easily removed with a mild abrasive.

Storage Life – The maximum period of time, starting from the time of manufacture, that a part, appropriately packaged, may be stored under specific condition, after which time it is regarded as unserviceable for the purpose for which it was originally manufactured. Refer to the manufactures specifications on all parts for acceptable storage life.

Strike – A thin film of metal to be followed by other coatings.

Surface Discoloration – An apparent inconsistency in the surface finish of a material.

Visual Examination – An examination conducted using only the unaided eye (1x).

Visual Examination, Magnified – An examination conducted using a magnifying glass (7 – 10 x).

D. STANDARDS

The following standards are listed or referenced within this Work Instruction, Please refer to the latest released revision of each standard. To access these use the approved standards access tool (example: IHS Engineerig Resource Center). In the case of Internal company specifications, please use the appropriate system to review these documents (example: Digital Paper XE ot Teamcenter).

ASTM B374-06, Standard Terminology Relating to Electroplating

NASM 33540, Safety Wiring, Safety Cabling, Cotter Pinning, General practice for

ASME Y14.5, Dimensioning and Tolerancing

ASME Y14.100 Engineering Drawing Practices

ASME B46.1, Surface Texture

ASME B18.3, Socket Head Cap, Shoulder, and Set Screws

SAE AS4330, Design Standard, Tubing, Flared, Standard Dimensions

SAE J429, Mechanical and Material Requirements for Externally Threaded Fasteners

SAE J995, Mechanical and Material Requirements for Steel Nut

AS568C, Aerospace Size Standard for O-Rings

MIL-STD-413C, Visual Inspection Guide for Rubber Elastomeric O-Rings

MIL-HDBK-695D, Rubber Products: Recommended Shelf Life

SAE ARP5316, Storage of Elastomer Seals and Seal Assemblies

AMS2817, Packaging and Identification, Preformed Packing's

ASTM D 1418, Standard Practice for Rubber and Rubber Lattices – Nomenclature

NP-6608, Shelf Life of Elastomeric Components

SAE ARP5316 Storage of Elastomer Seals and Seal Assemblies which include and Elastomer Element Prior to Hardware

Internal Company specification S-369 – Part Identification and Serialization

Internal Company specification S-158 General Assembly Procedure

E. INSPECTION CRITERIA

F1. GENERAL

F.1.1 When nondestructive testing or other inspection requirements are specified on the engineering drawing, flaws are permitted up to the limits of those specifications.

F.1.2 Cracks are not acceptable.

F.1.3 Discoloration due to normal processing is acceptable if not specifically disallowed by other specifications. Discoloration due to corrosion is not permissible. Ref. Appendix E.

F.1.4 Parts with indications (flaws, corrosion, surface finish irregularities, etc.) that will be removed and re-inspected during subsequent machining and inspection operations are acceptable.

F.1.5 In addition, if any of the following conditions exist the part will be rejected.

- Handling damage
- Incorrect part number or revision letter
- Inadequate surface finish
- Incompleteness
- Improper packaging
- Distortion or misalignment
- Improper matching of mating parts

NOTE: If clarification is needed, consult with Onboard Systems Manufacturing Engineering.

F2. IDENTIFICATION

Identification of parts, subassemblies, assemblies, components, cable harnesses, etc., will be inspected for conformance with the marking requirements of the appropriate drawing(s) and internal company specification S-369.

F.2.1 Acceptance of Markings

Acceptance of identification will be based on the followings requirements:

- Identification complete as specified in the drawing.
- Identification is positioned in such a manner as to not be visible at the next level assembly unless specified on the engineering drawing.
- All markings are clean, legible, well-defined, and uniform.

F.2.2 Impression Stampings

If impression stamping is chosen as an acceptable marking method, the following criteria shall be met in order for the impression to be considered acceptable:

- Impressions are uniform and deep enough to be entirely legible.
- Stampings leave no sharp edges.
- Impression markings will be utilized only where specifically authorized by the appropriate drawing or specification.

F.2.3 Identification of Cable Harnesses

Cable harnesses often have multiple methods of identification, please refer t the Engineering drawing for the required methods of identification and shipping protection. In addition to the engineering drawing requirements, the following conditions must be met in order for the harness to be considered acceptable:

- All markings will be permanent, well defined and legible.
- Identification will be located so that it is not visible after cable installation.
- All cable harnesses will be identified.
- All connectors and pigtails will be identified. However, part marking may become illegible during assembly and test. This condition is acceptable provided that cable harness assembly is still properly identified.

F.3 CASTINGS AND FORGING REQUIREMENTS

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all cast or forged parts must meet the following criteria to be considered acceptable:

- Porosity not to exceed drawing requirement allowance is acceptable. Ref. Appendix C.
- Gouges are not acceptable unless reworked to the requirements of paragraph 5.3.3.

- Visible imperfections such as dents, nicks, pits, and scratches are acceptable provided that the detail drawing dimensional and surface finish criteria, minimum wall thickness are not violated, all sharp edges are blended smoothly into adjacent surfaces, and that the bottoms of all imperfections are rounded and not notched.
- Any part that has been reworked to the requirements of paragraph 5.3.3 is acceptable.
- After reworking, protective coatings that have been affected by the rework must be reworked to the extent that the original coatings specification permits.

F.4 MACHINED PART REQUIREMENTS

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all machined parts must meet the following criteria to be considered acceptable:

- Surfaces that remain in the as-cast or as-forged condition on machined parts shall be governed by the requirements of paragraph 5.3 herein.
- On working surfaces, nicks, scratches, or dents are acceptable only to the extent that they do not violate the finish requirements stated on the detail drawing. Ref. Appendix B.
- On non-sealing mounting surfaces and non-functioning external surfaces in general, nicks, dents, and scratches are acceptable provided they are rounded-bottomed, blended smoothly into the adjacent surfaces, and do not violate the detail drawing minimum wall thickness or dimensional requirements.
- Raised material is not permissible on working or mounting surfaces.
- Surface finish imperfections are permitted up to the general surface finish requirement on the engineering drawing. If no requirement exists on the engineering drawing, use the following: 

for all machined surfaces


for all cast or forged surfaces.

(Surface finish symbol references, please see Global DRM or ASME B46.1)
- This includes all nicks, gouges, pits and scratches.
- Cracks are not permitted.

F.5 SHEET METAL

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all sheet metal parts must meet the following criteria to be considered acceptable:

- Bend Condition – Bends should show no evidence of fracture. Reduction of metal section (pinching) may not exceed 20% of the stock thickness unless otherwise specified by the drawing.
- Blended Corners – Fillets or radii on machined or grounded surfaces shall be blended smoothly at tangent points.
- Bend Radii – All bends shown square shall have maximum inside radii of the stock thickness unless otherwise specified on the drawing.
- Burr Removal – All manufactured parts are to be free from burrs or loose metal chips which may cause hazardous handling.

F.6 MECHANICAL FASTENERS

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all mechanical fasteners must meet the following criteria to be considered acceptable:

- Thread Damage – Unless thread deformation is required by the fastener specification document, no thread deformation will be acceptable. Extreme care shall be exercised during the assembly of threaded parts to avoid cross-threading or deformation.
- Thread Protrusion
    - Screws/Bolts shall extend beyond nut or threaded surface by a minimum of 1 ½ threads unless otherwise specified in applicable drawing.
    - Screws/Bolts entering blind holes shall engage threads for a minimum depth equivalent to 1 ½ times the screw diameter. This shall apply to self-tapping screws or screws entering tapped holes.

F.7 PLATING AND COATING REQUIREMENTS

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all plating and coating of parts must meet the following criteria to be considered acceptable:

- The plating and coating shall be uniform in appearance.
- The plating and coating shall be continuous and free from areas of powdery or loose coating, voids, scratches, dents, flaws, pits, blisters, cracks and other defects or damages which reduce the serviceability of the part or is detrimental to the protective value and bonding characteristics (exhibiting bare metal). Ref. Appendix F.
- Corrosion, rust, peeling, delamination are not acceptable.
- There shall be no contamination on the finish.

F.8 END ITEM REQUIREMENTS

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all end item assemblies must meet the following criteria to be considered acceptable:

- Parts shall be clean and free of dirt, grease, chips and other foreign material.
- Painted parts must be free of discoloration, chips, scrapes, blistering, fish eye, orange peel, water/oil marks … etc. Ref. Appendix D
- Nameplates and all identification shall be clear and legible. Double impressions or incomplete digits are not permissible.
- Harness assemblies must meet the requirements of the drawing and IPC/WHMA-A-620. Ref. Appendix A.
- Potting shall be applied neatly in accordance with the drawing, without smearing, and shall be fully cured prior to packaging.
- Safety wire and safety cable size, type and method shall be in accordance with the drawing, NASM 55340 and internal company specification S-158.

F.9 FAIRINGS AND EXTERNAL COVERS

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all end item assemblies must meet the following criteria to be considered acceptable:

- Fairings shall fit smoothly over all parts with no overlaps unless intended by design (e.g., hoist configurations 44315-10 and 44318-16 on main fairings by design do not have overlap). Fairing to Fairing and fairing to part interfaces shall have no gap or deformation in excess of .090”. For examples see Appendix G.
- Covers shall fit smoothly over all parts. Cover to part fit shall have no gap or deformation in excess of .090”. For examples see Appendix G.
- Mounting screws, rivets and external mounted identification plates must not damage the finish of the fairing. No chips, cracks or wrinkles in fairing coatings are permitted.
- Fairings fabricated from high-temperature material (e.g., silicone) shall not have excess silicone spots, multiple wrinkles, scratches, and indentation. See Appendix L
- Fairing windows shall be free from scratches, cracks, damages, particularly around rivet area. See Appendix J
- Fairing holes shall be aligned with housing holes with enough clearance for screws, bolts, and eyebolts. See Appendix M

F.10 SEALING SURFACES

All sealing surfaces including hydraulic sealing grooves shall conform to the surface finish requirements defined on the drawing. Beyond the surface finish requirements, there shall be no scratches, nicks, dings, gouges, raised material or any contamination (FOD).

F.11 LUBRICATED BEARINGS

Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all lubricated bearings must meet the following criteria to be considered acceptable:

- All lubricated bearings shall be identified with lubrication type, the date that they were lubricated and the date when the bearing needs to be re-lubricated.
- Lubricated bearings received from suppliers that do not have either lubrication date or expiration date must be rejected.
- All lubricated bearings to be shipped to customers must have
    - Both lubrication date and
    - Expiration date and
    - At least 75% remaining shelf life, unless otherwise specified by customer.

F.12 ELASTOMER SEALS

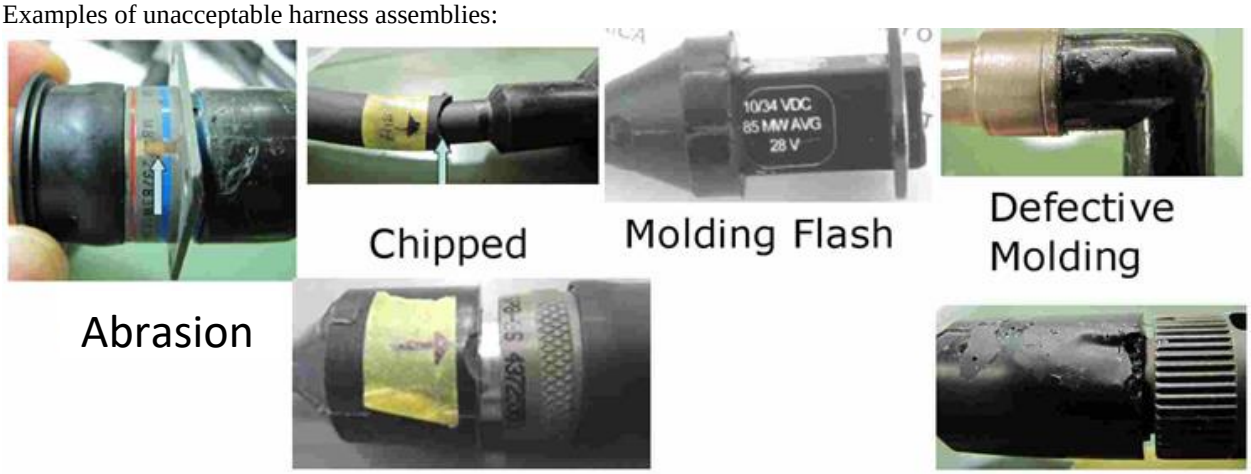
Unless otherwise speicified by a superceeding document, the requirements on the engineering drawing, all elastomer seals must meet the following criteria to be considered acceptable:

- All seals and o-rings shall be free from dents, cracks, dings, gouges, and any deformaties. See Appendix K
- Packaging: Unless otherwise specified, the elastomeric seal or seal assembly shall be received:
    - in individually sealed envelopes by the manufacturer, or,
    - in individually sealed packets in multiple envelopes by the manufacture provided that individually packaged elastomeric seals or assemblies can be removed without affecting the seal integrity of the other packets.
- Labeling: Each package or container shall be labeled with the following information which shall be visible from the outside of the package without breaking the seal:
    - Manufacturers' part number.
    - Specification number.
    - Manufacturer's name and/or identity number (such as CAGE Code)

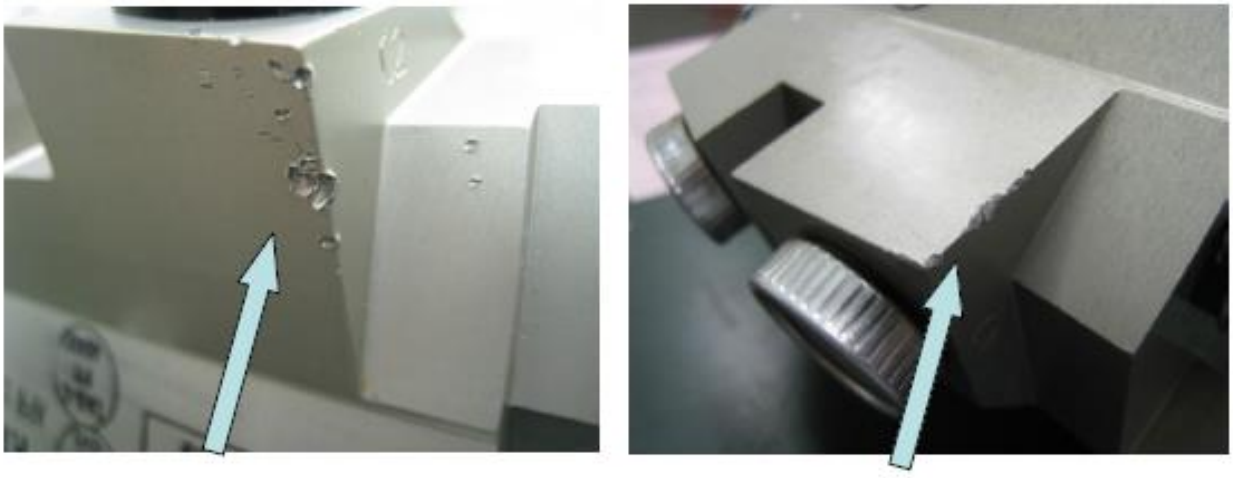
- Quarter and Year of cure or manufacturer of the rubber component (e.g., 3Q10)
- Expiration date.
- Manufacturer's batch number.
- Rubber class designation in accordance with the drawing.

- Storage Period: Unless otherwise specified in the product specification, the maximum storage periods for unassembled elastomeric seal elements shall be those described in the drawing and/or Tables 1 and 2 of SAE ARP5316, Storage of Elastomer Seals and Seal Assemblies.

Appendix A
Examples of unacceptable harness assemblies:



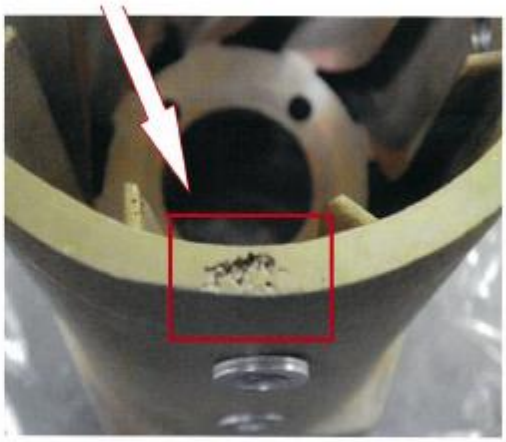
Appendix B
Examples of unacceptable machined parts



Unacceptable nicks and dings

Appendix C

Examples of unacceptable casting defects:

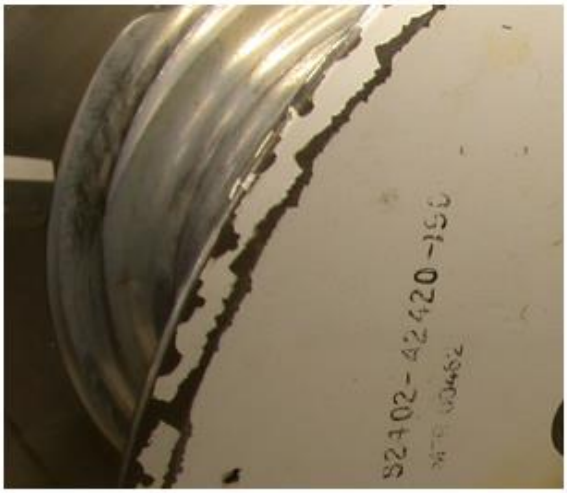


Porosity

Appendix D:

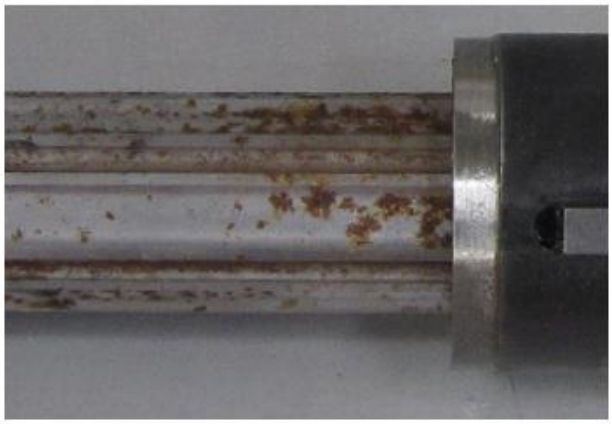
Examples of unacceptable of paint damage:

Unacceptable paint scuff



Unacceptable: Paint damage

Appendix E:
Examples of unacceptable of rust and corrosion:



Unacceptable rust and corrosion

Appendix F:
Examples of unacceptable of finish damage:

Unacceptable: Violation of surface treatment

Appendix G:

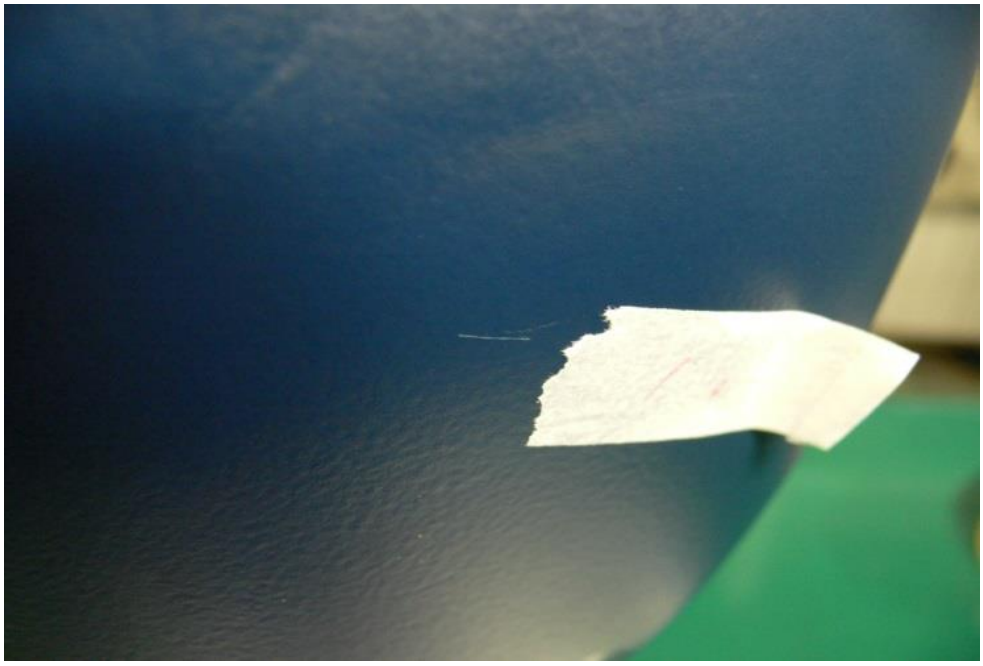
Unacceptable Fairing deformation and Gap:

Shall not exceed .090”

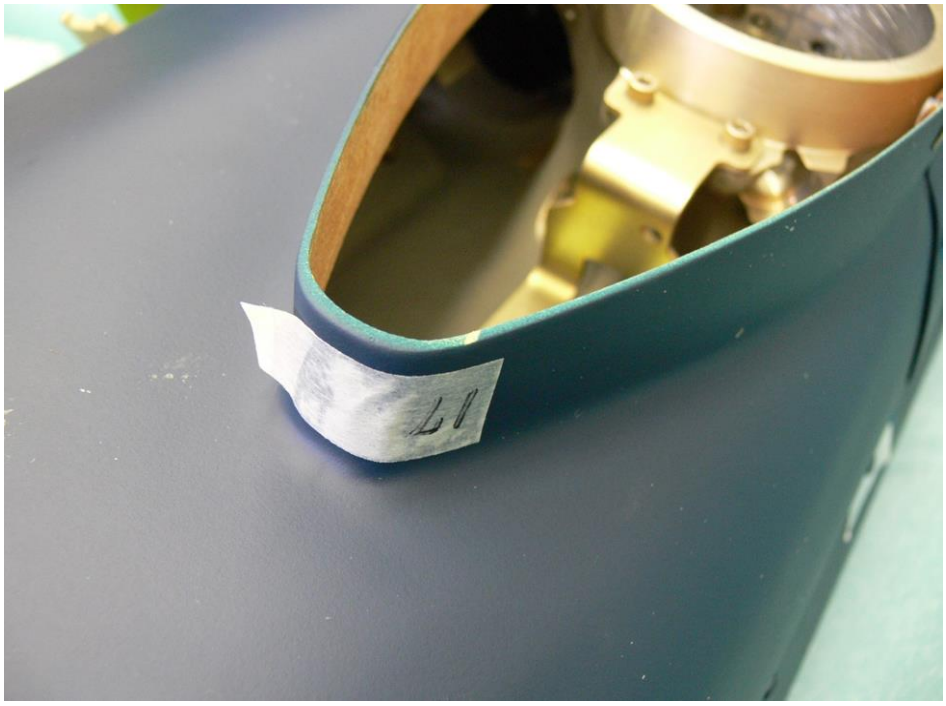
Appendix G Continued…:

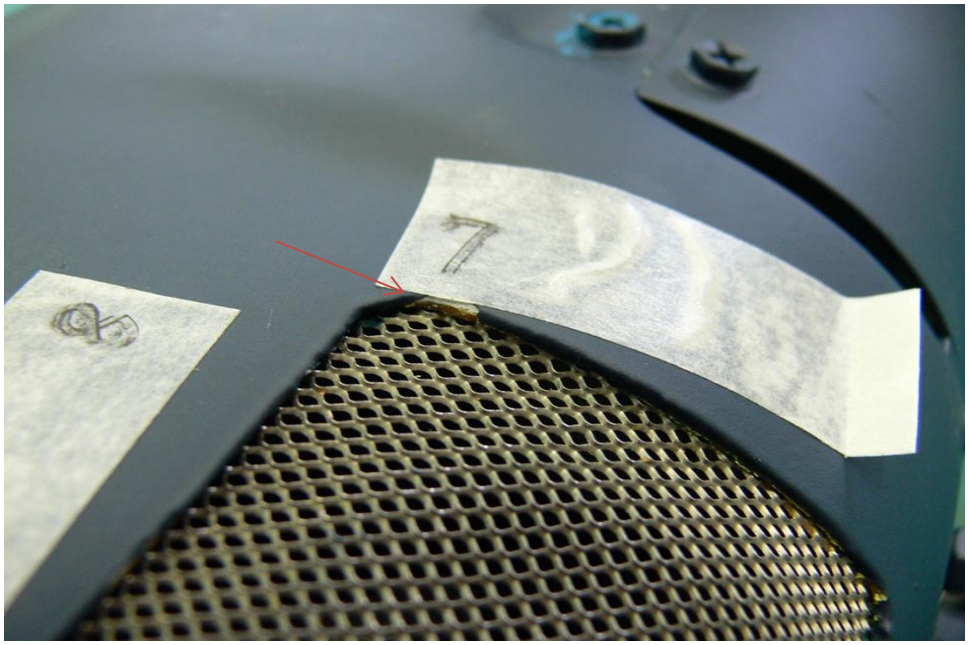
Unacceptable Fairing deformation and Gap:

Appendix H: Acceptable Condition: Here are some examples (pictorial view) of indications which are acceptable per Onboard Systems criteria.



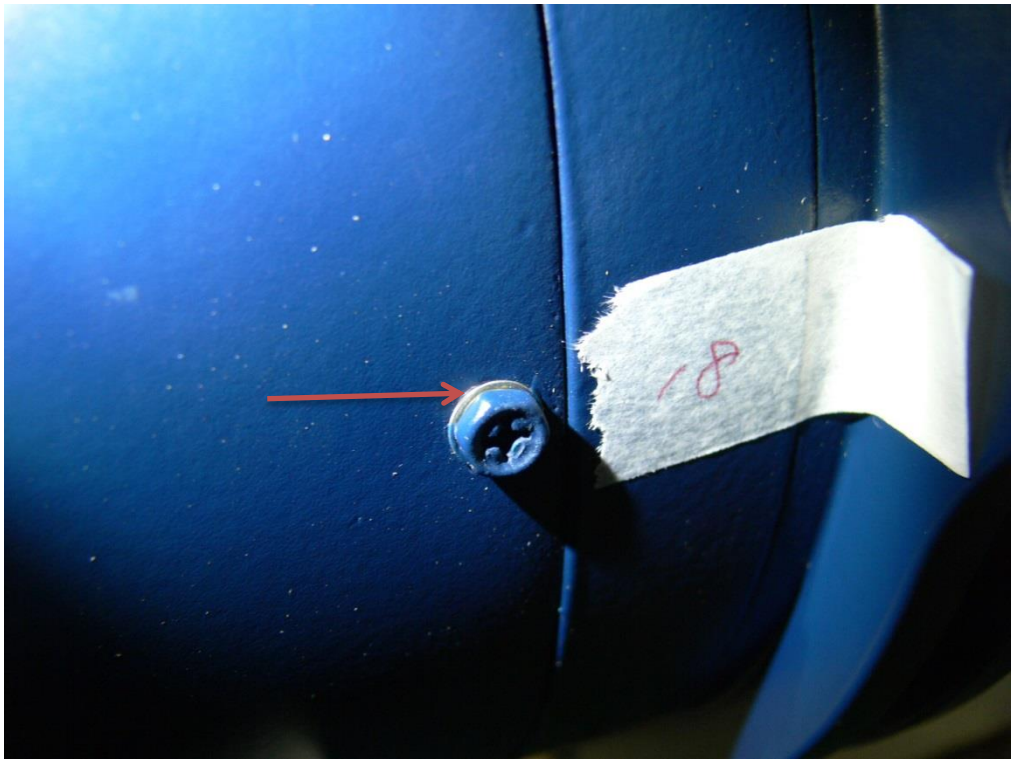
Not to exceed ½ “ in length hairline





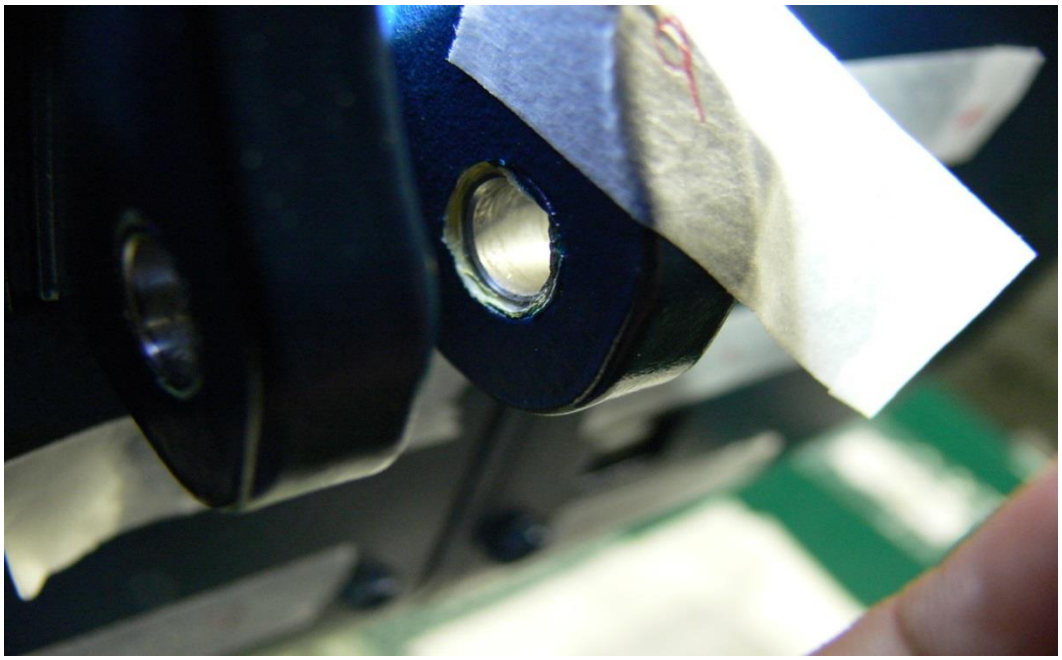
Acceptable – Not to exceed ½” in length

Acceptable; if not to exceed ¼” in length and 1/8” in width.

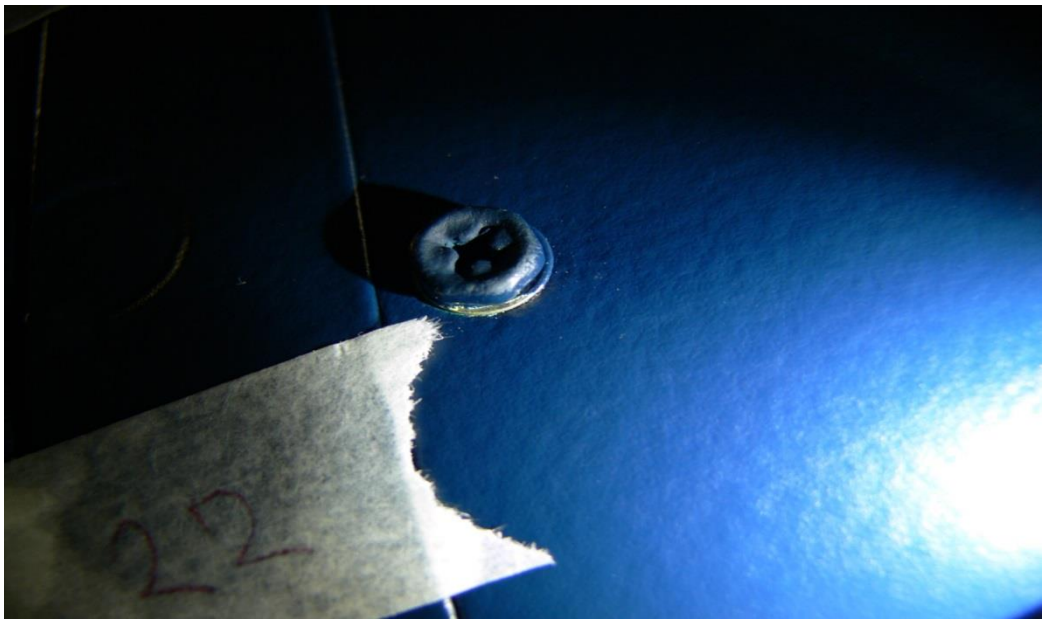


Acceptable; if not to exceed 1/8” in width

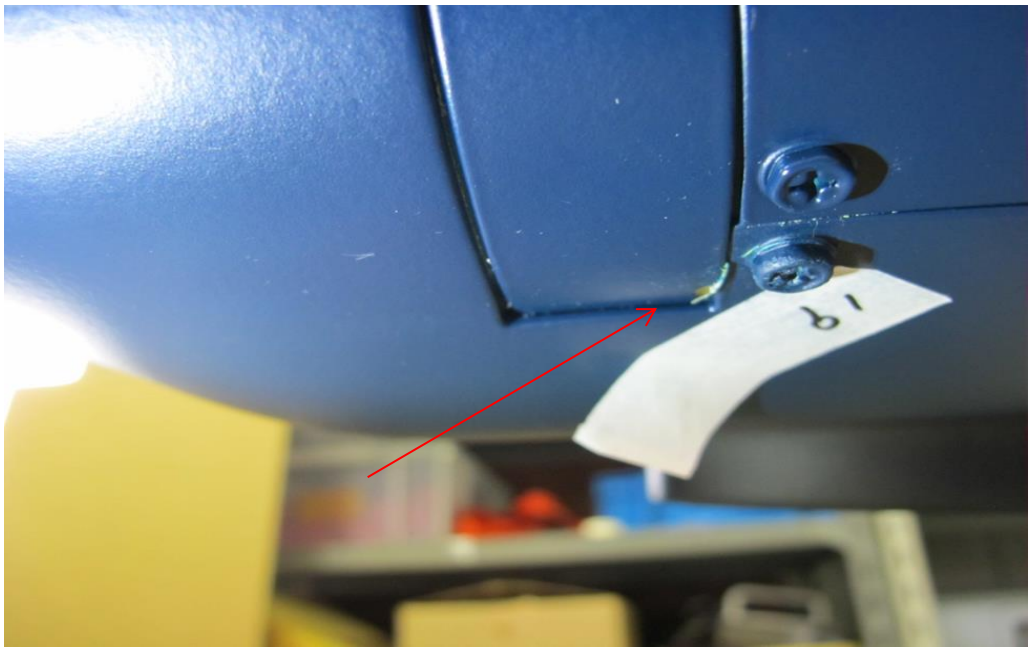
Appendix I: Unacceptable Condition



Need to Clean up remnants of tape

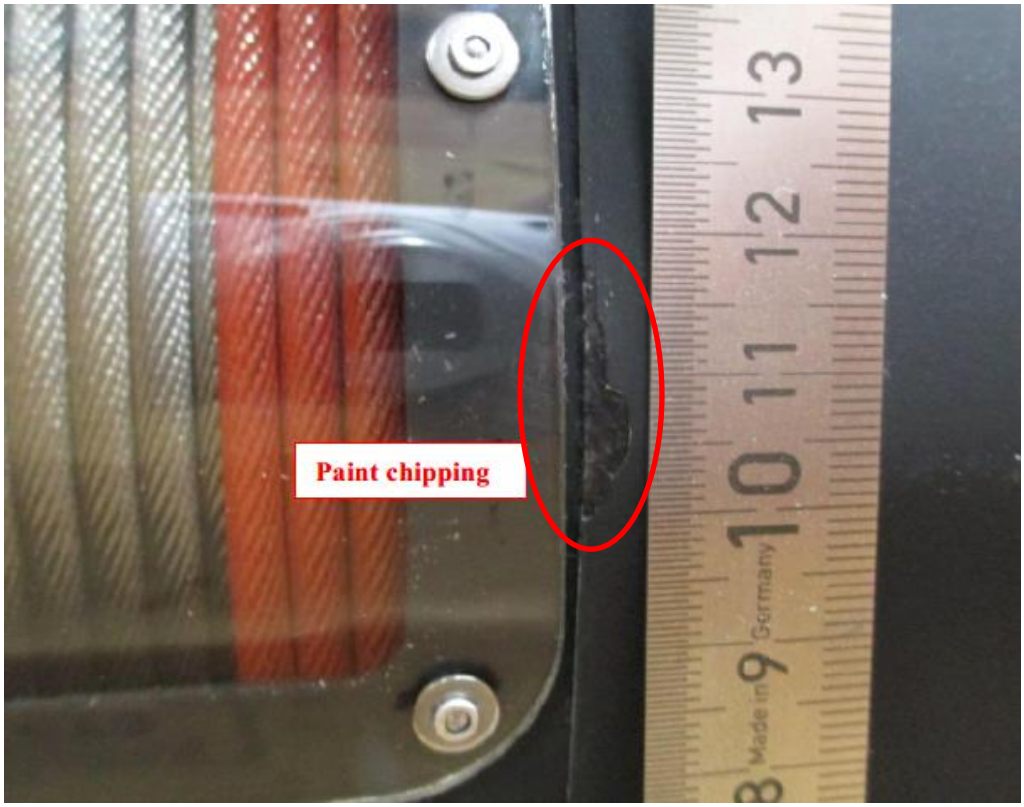


Apply touch up on the bare surface



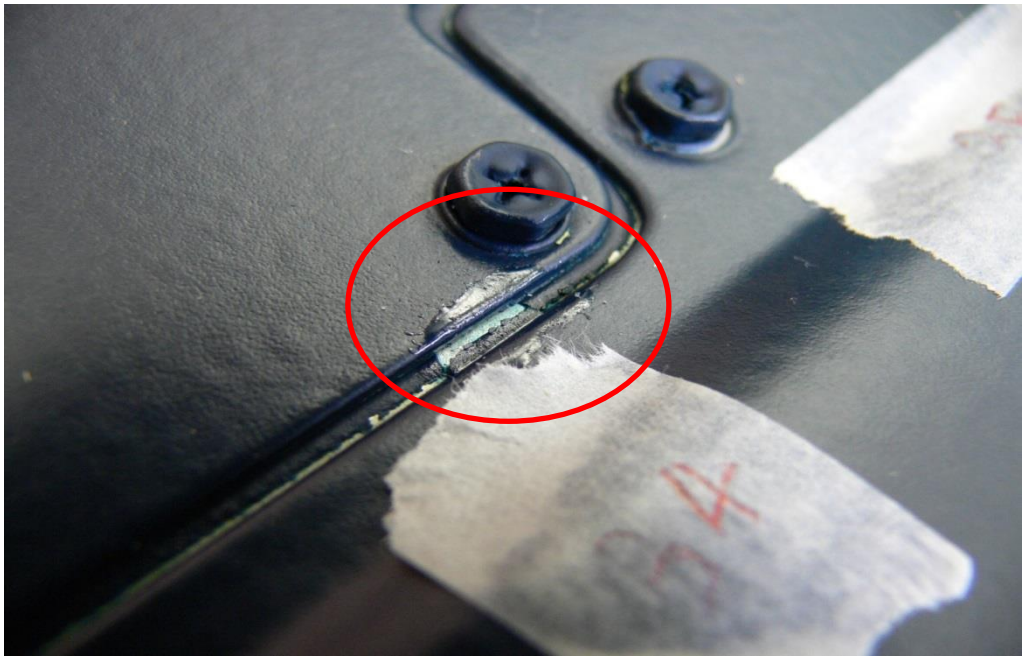
Remove foreign material

Orange Peel is not acceptable

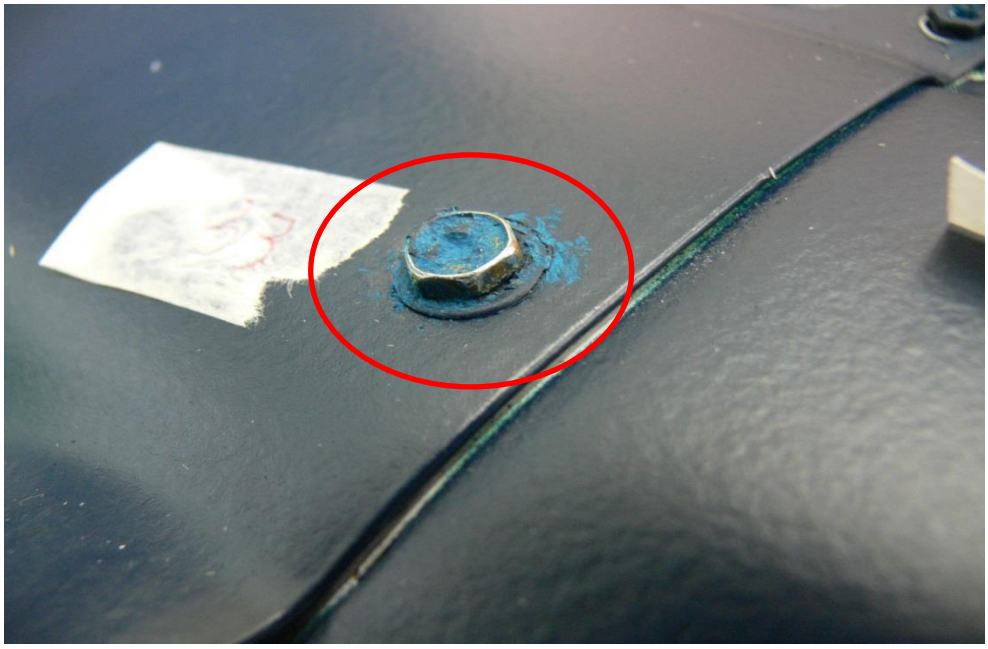


Paint chipping not acceptable

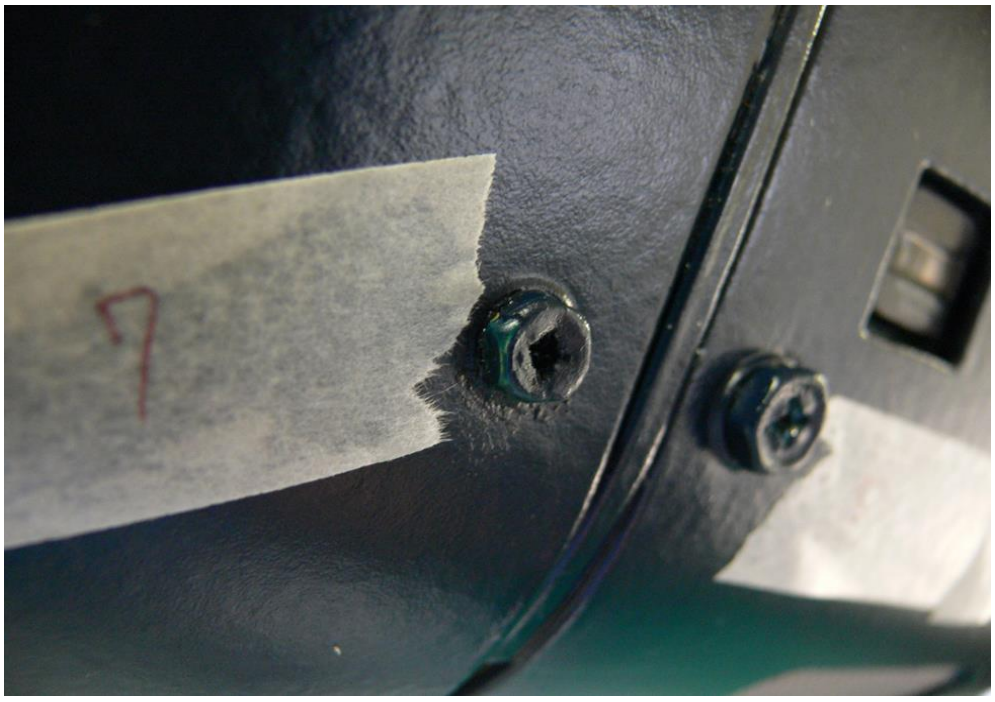
Rework needed



Touch up needed if damage exceed ½” in length



Rework & Touch up needed

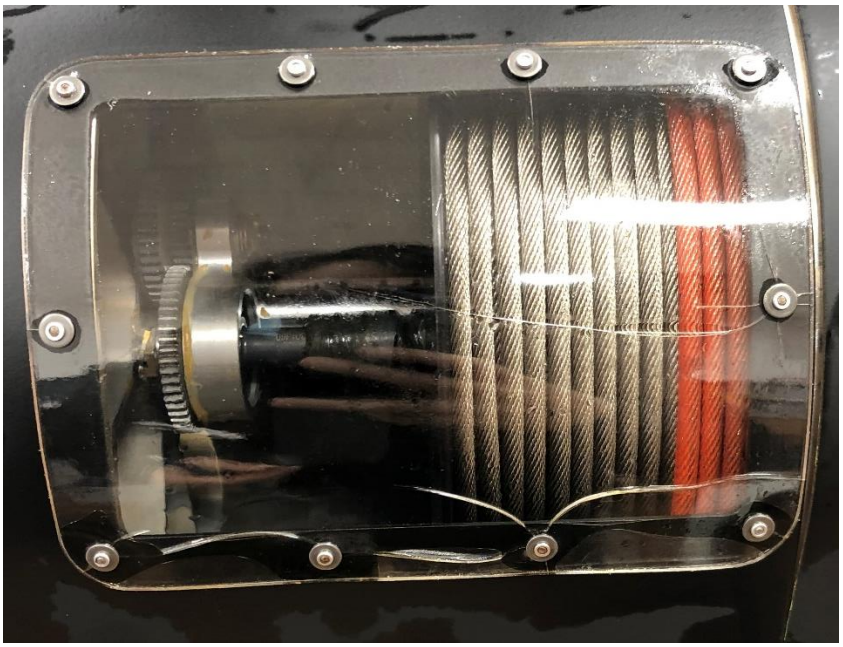


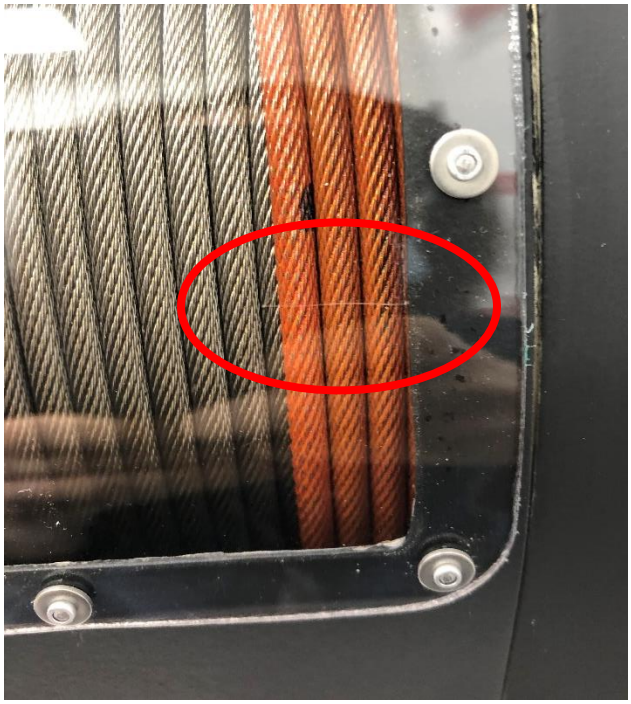
Rework – Replace screw and touch up

Touch up needed

Remove Tape

Appendix J: Unacceptable Fairing Window Condition





Appendix K: Unacceptable Oil Seal Condition

Appendix L: Fairing with High Temperature Material (Silicone)
Acceptable Condition

Silicone touch up applied only on seam

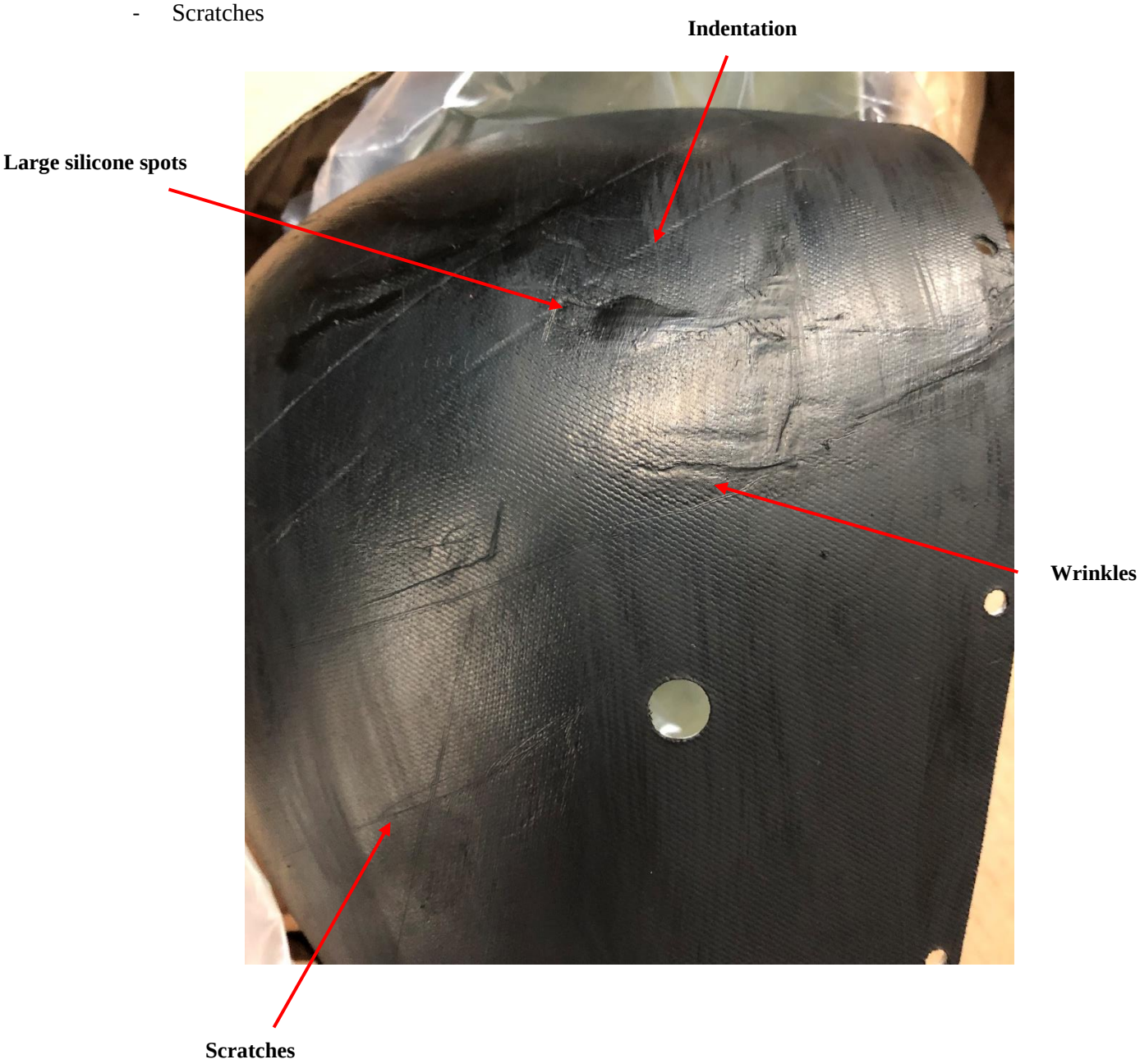
Acceptable:
Silicone touch up applied only on seam/edge

Acceptable:

Appendix L Continued…: Fairing with High Temperature Material (Silicone)
Unacceptable Condition

Reject for any:

- Indentation
- Large additional silicone spots
- Multiple Wrinkles
- Scratches



Unacceptable Condition

Appendix M: Fairing Hole Alignment

Acceptable conditions:

Unacceptable condition: