



Machining Supplier Workmanship Standards

Sea-Bird Electronics

Procedure Number: 76180

Title: Machining Supplier Workmanship Standards

Revision: 00

Effective Date: August 11, 2015

Written By: Mackenzie Williams ;

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Introduction

Sea-Bird is known in the industry for an extremely high quality product. We have a gold standard that we hold for ourselves, as well as for our suppliers. Quality workmanship will help Sea-Bird meet or exceed customer expectations, and assure our success in the marketplace.

Cleanliness, Handling & Packaging

Parts should be handled and packaged as required to prevent damage.

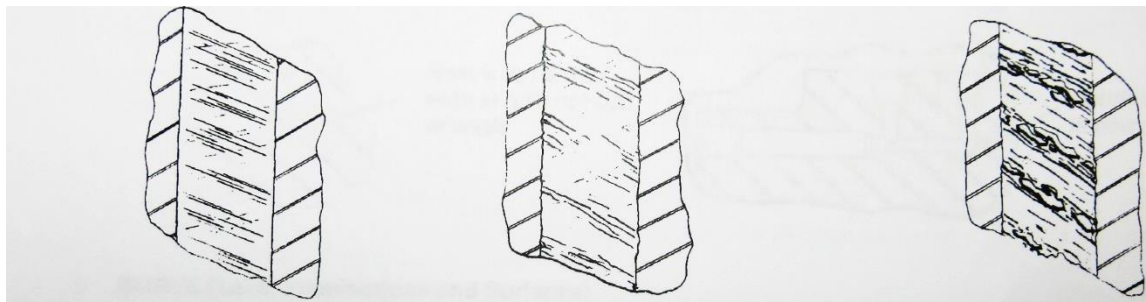
Prior to stocking and/or prior to shipping parts, all parts are to be free of process related material (i.e. chips, coolant, bead blast material, de-burring media, etc.). If required, parts should be protected using an appropriate corrosion preventive prior to packaging. Packaging should prevent damage due to contact of parts with one another during shipment.

Guidelines for Machining

1. Machined Hole Surfaces
2. Threaded Bores/Holes
3. Burrs
4. Intersecting Passages
5. Surface Finish (63 Ra Max, Check 32 Surface Finish on all sealing surfaces)
6. Welding

1. Machined Hole Surfaces

Surfaces of machined holes should be free of stripped and potentially loose metal particles.



Uniform

*Rough surface but no
potentially loose
particles*

*Potentially loose
friction welded particles*

ACCEPTABLE

UNACCEPTABLE

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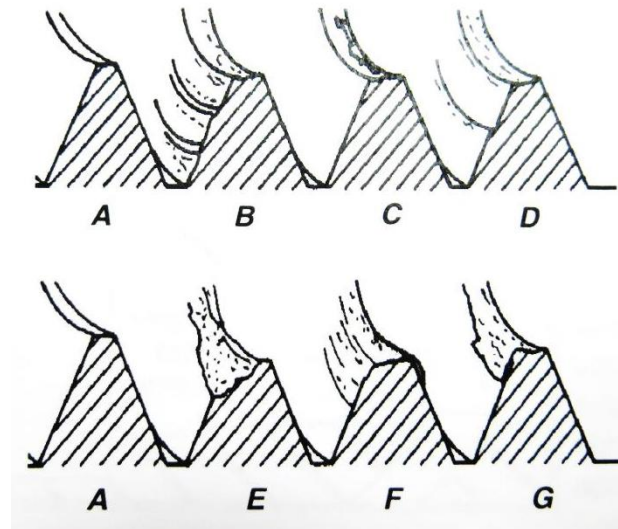
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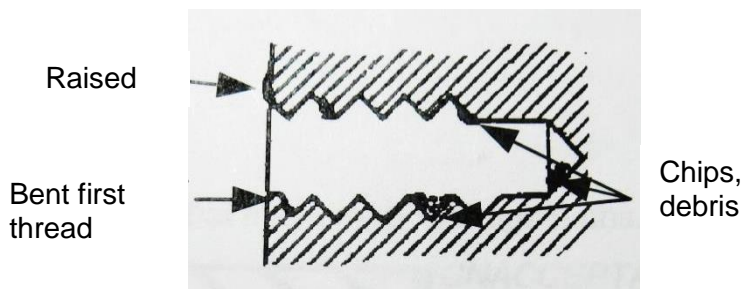
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2. Threaded Bores/Holes

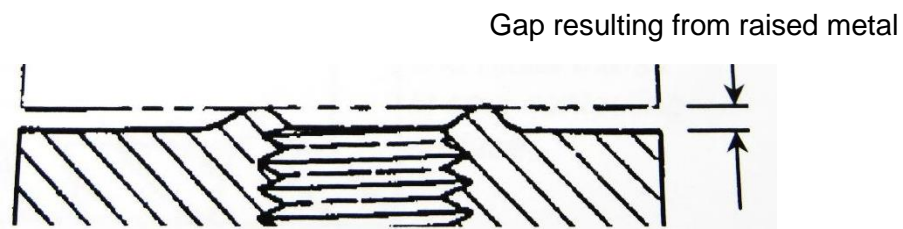
Threaded bores/holes should be free of chips, burrs and major discontinuities. Chips and dislodged burrs may degrade or entirely disable systems, while major discontinuities may damage mating parts or complicate assembly.



- A. *As designed thread configuration*
- B. *Tool marks or ribbed sidewall; ACCEPTABLE*
- C. *Burr rolled over material on crest; UNACCEPTABLE*
- D. *Stepped sidewall and crest; ACCEPTABLE*
- E. *Torn sidewall & crest; UNACCEPTABLE unless sharp edges are blended*
- F. *Loose burr turned partially concealed on sidewall; UNACCEPTABLE*
- G. *Same condition as in F shown in the exposed position; UNACCEPTABLE*



UNACCEPTABLE conditions in Threaded Holes



Extruded Material Surrounding Threaded Hole
UNACCEPTABLE

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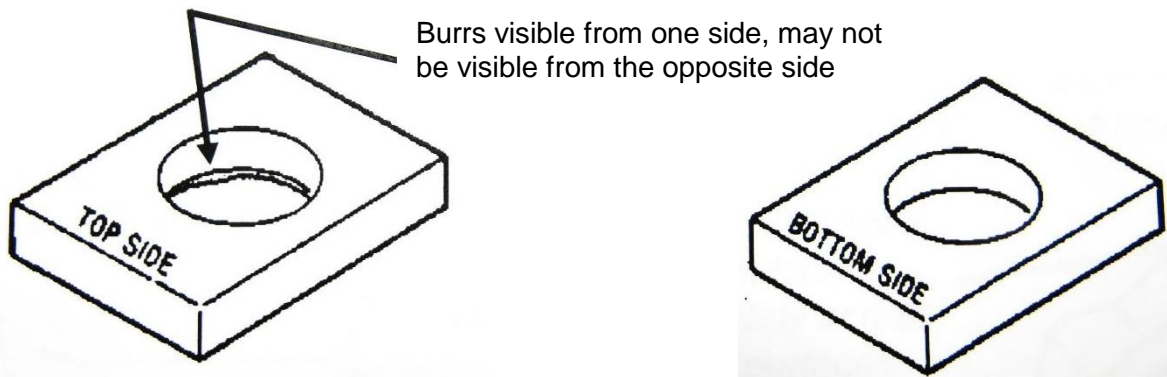
3. Burrs

Parts should comply with drawing requirement to deburr and break sharp edges. Burrs may cause product failures. Burrs that are visible at 5-10X magnification or may be dislodged should be removed.

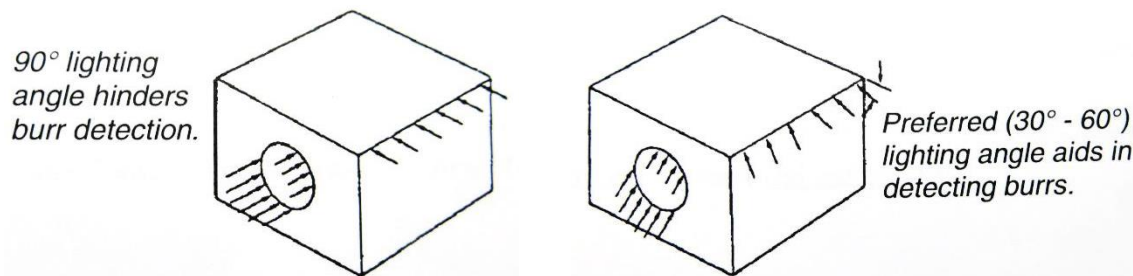
Detection

Consideration for the following may simplify the burr detection process:

- Part cleanliness – Cleanliness may be essential for efficiently detecting burrs. Confused with dirt or other contaminants, burrs may be overlooked.
- Viewing angle – Frequently, easily detectable burrs are overlooked when viewing a part from a single direction. It is good practice to view from varying directions and angles.



- Proper lighting – Intensity, type, color and angle of lighting used, shall be mainly dictated by the size, shape, material and detail of the work piece.



- Inspection aids – Eye loupes, microscopes and other inspection equipment aid in detecting burrs.

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Removal

Methods for removing burrs may be influenced by factors including:

- Feature tolerances
- Part geometry
- Material hardness
- Dimensions near Least Material Condition (LMC)
- Critical surfaces (≤ 32 finish) nearby
- Contamination produced

Depending on the deburring process, it may be advisable to:

- Verify compliance with drawing requirements
- Inspect recesses (blind holes, interconnecting passages, etc.) for migrated particles
- Verify that all burrs have been removed
- Inspect for, and remove, contamination

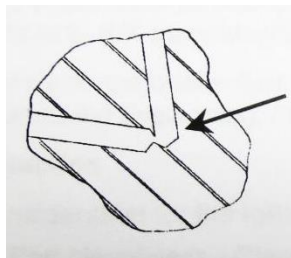
Geometry Challenges

Part geometry may present challenges to detection or removing burrs.

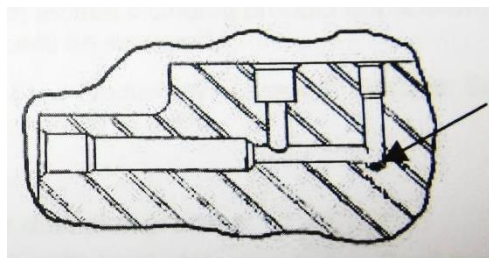
- Holes – Dependent upon the material, machining process, and dimensions, difficult to detect burrs and other imperfections may be created.

4. Intersecting Passages

Intersections should be verified, and passages should be free of chips and burrs.



Restriction due to error in hole position or angle



Trapped debris

5. Surface Finish

Sealing surfaces are critical in the design of our instruments due to the environment they function in. All areas with a 32 Finish or more fine need to be blemish free, no scratches, pits, or other visible imperfections. In addition, surfaces with Finish callout should be free of tooling paths and marks from tool chatter.

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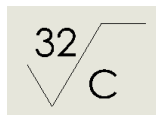
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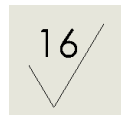
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Where specified, surface lay is important to ensure proper fluid sealing during use. When manufacturing method is not conducive for generating the specified lay, the manufacture may substitute the next finer standard ASME finish and disregard the lay specification.

For example:



may be replace with



at the supplier's discretion.

6. Welding

Surfaces around weld joints should be free and clear of any material deposit from welding process.

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