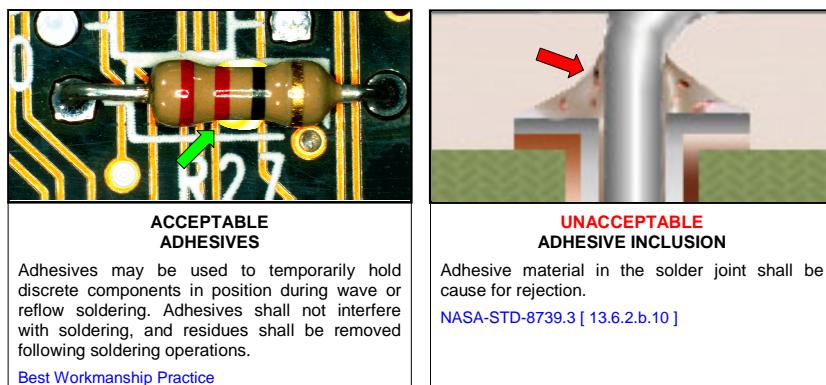
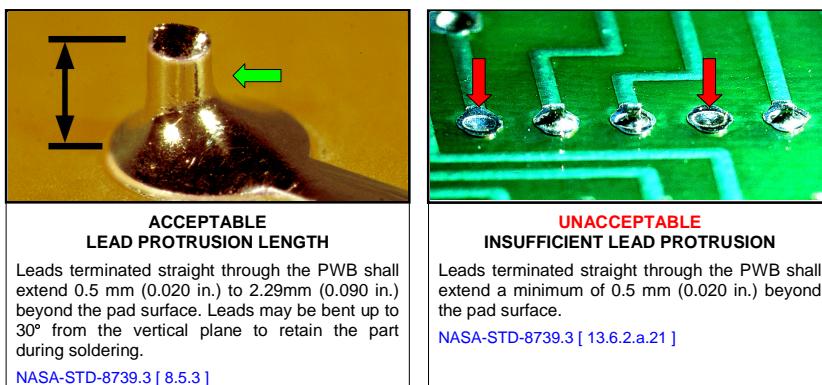
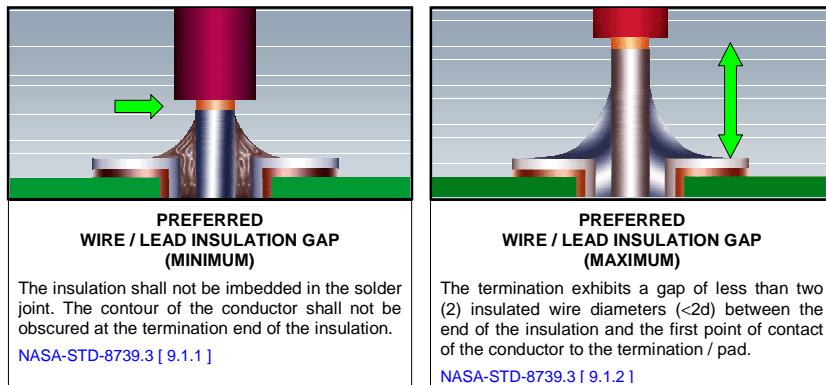
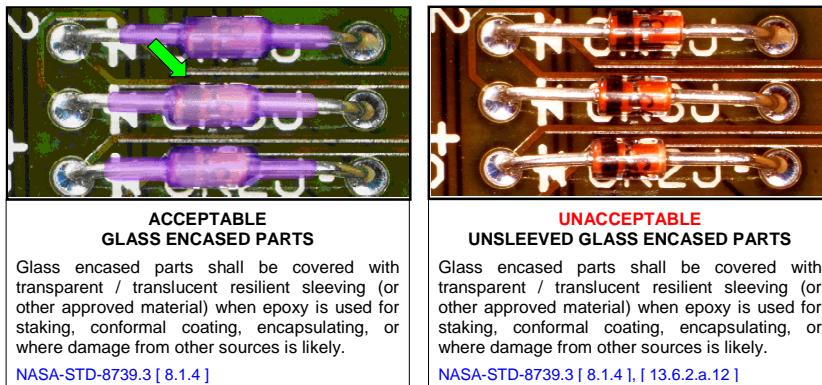
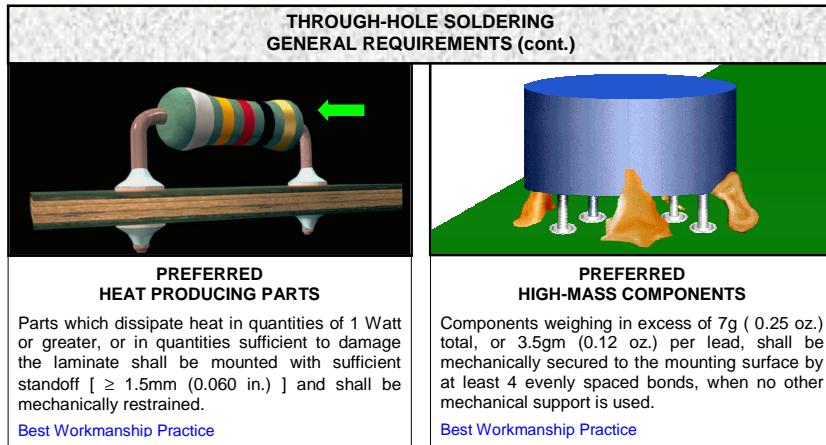
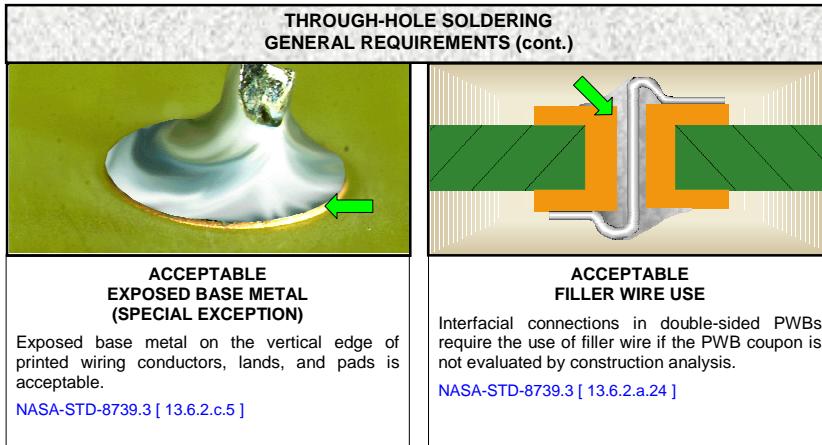


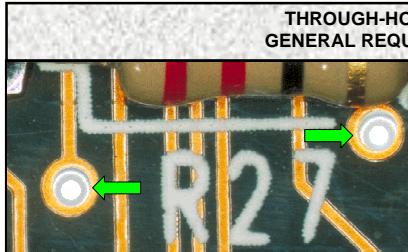
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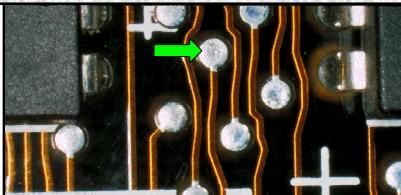
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ACCEPTABLE INTERFACIAL CONNECTIONS / VIAS (MULTILAYER PWBS)

Interfacial connections (vias) in multilayer PWBs do not require the use of filler wire, and shall not be solder filled.

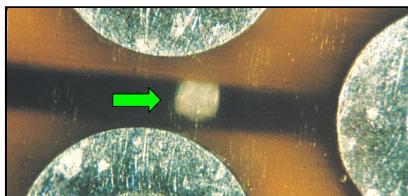
[NASA-STD-8739.3 \[11.2.4.b \]](#)



ACCEPTABLE SOLDER-FILLED INTERFACIAL CONNECTIONS (PTH / VIAS)

No dedicated effort shall be expended to remove solder from unpopulated plated through holes (PTH) and/or vias.

[NASA-STD-8739.3 \[11.2.4 \]](#)



ACCEPTABLE MEASLING

Whitish, discrete spots or crosses below the laminate surface - usually induced by thermal shock / stress. Measling that bridges uncommon conductors is unacceptable.

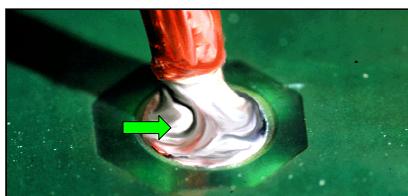
[NASA-STD-8739.3 \[13.6.1.i \], \[13.6.2.c.3 \]](#)



UNACCEPTABLE MEASLING

Measling that bridges uncommon conductors is unacceptable.

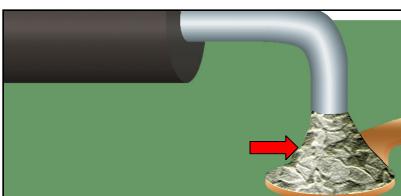
[NASA-STD-8739.3 \[13.6.2.c.3 \]](#)



ACCEPTABLE NON-UNIFORM / UNEVEN FLOW (DEMARCACTION LINES / FILLET SWIRLS)

A solder fillet exhibiting a nonuniform / uneven profile, demarcation lines, or swirls is acceptable, provided the fillet is shiny and there is evidence of complete wetting with smooth fillets at the swirls.

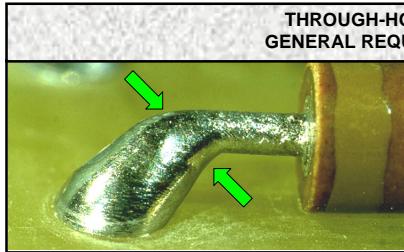
Best Workmanship Practice



UNACCEPTABLE UNEVEN FLOW / REFLOW

A solder fillet exhibiting nonuniform / uneven flow lines / swirls with hard demarcation lines (no fillet at swirl interfaces), and a dull finish are typically caused by an inadequate / uneven application of heat during the fillet formation.

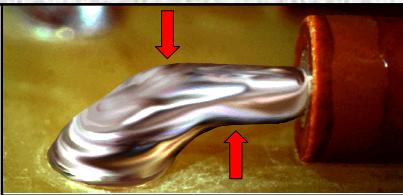
Best Workmanship Practice



ACCEPTABLE SOLDER IN STRESS RELIEF BEND

Solder which extends into the stress relief bend of any leaded part shall not be cause for rejection if the topside bend radius is discernable, and if the solder does not extend within one (1) lead diameter of the part body or end seal.

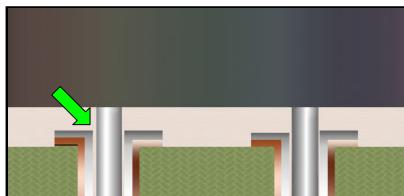
[NASA-STD-8739.3 \[13.6.2.b.6 \]](#)



UNACCEPTABLE SOLDER IN STRESS RELIEF BEND

Solder extends into the stress relief bend and contacts the part body or end seal. The topside of the lead is not discernable.

[NASA-STD-8739.3 \[13.6.2.b.6 \]](#)



ACCEPTABLE TEMPERED LEADS

Tempered / hardened leads (sometimes referred to as pins) shall not be bent or formed for mounting purposes since body seals and connections internal to the part may be damaged.

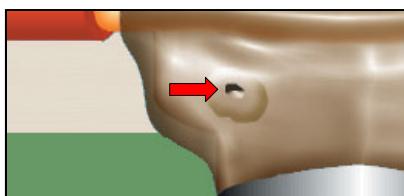
[NASA-STD-8739.3 \[8.1.6.e \]](#)



UNACCEPTABLE BENT TEMPERED LEADS

Tempered / hardened leads (sometimes referred to as pins) shall not be bent or formed.

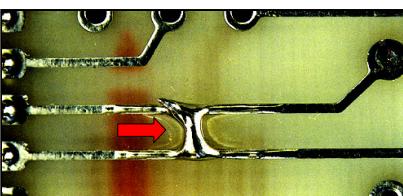
[NASA-STD-8739.3 \[8.1.6.e \]](#)



UNACCEPTABLE BLOWHOLE

Blowholes are typically caused by trapped gases or flux during the formation of the solder fillet, and are unacceptable.

[NASA-STD-8739.3 \[13.6.2.b.5 \]](#)



UNACCEPTABLE BRIDGING

Bridging is an indicator of poor process controls (i.e.: excess solder, smeared paste, improper placement, incorrect heat).

[NASA-STD-8739.3 \[13.6.2.c.4 \]](#)

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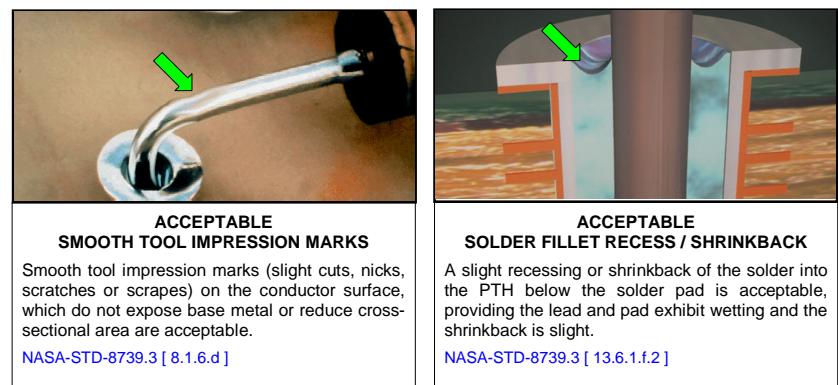
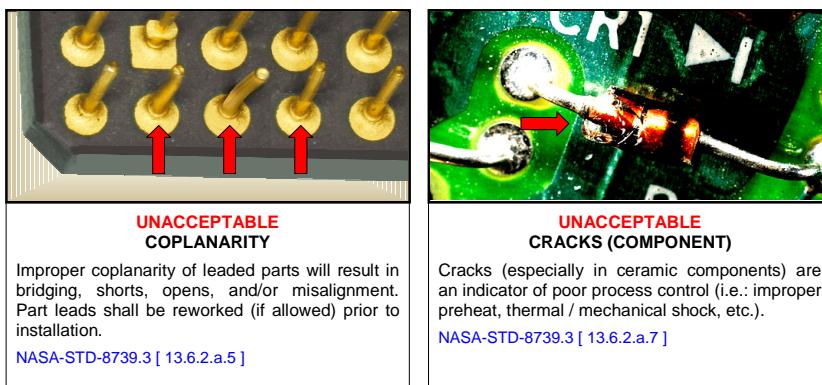
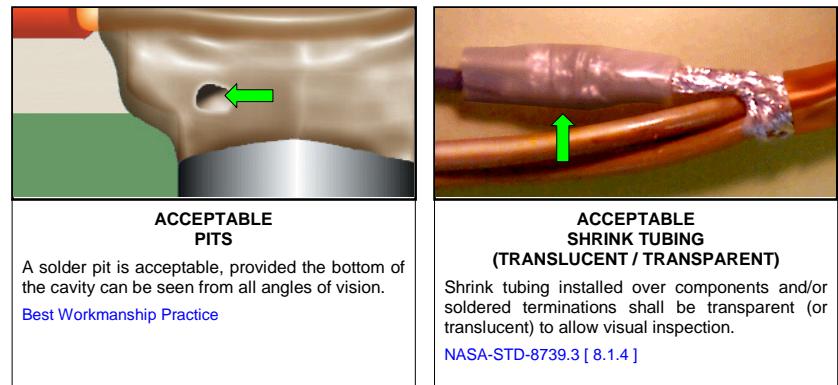
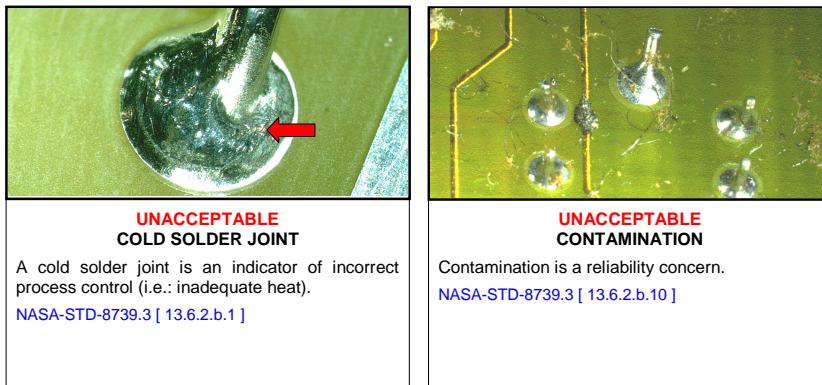
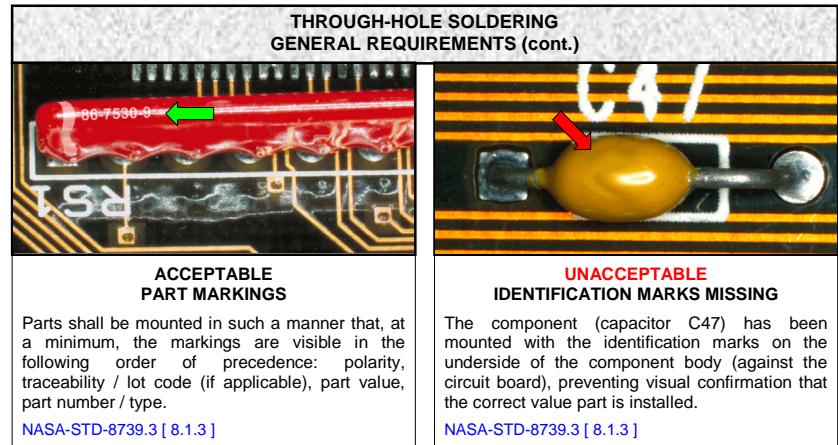
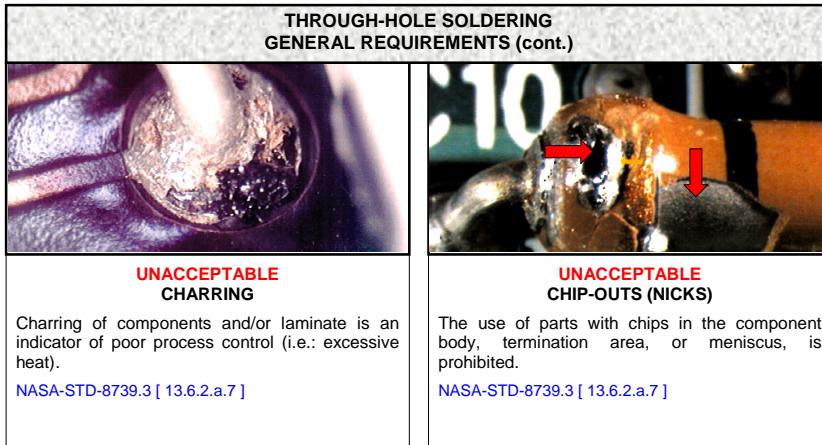
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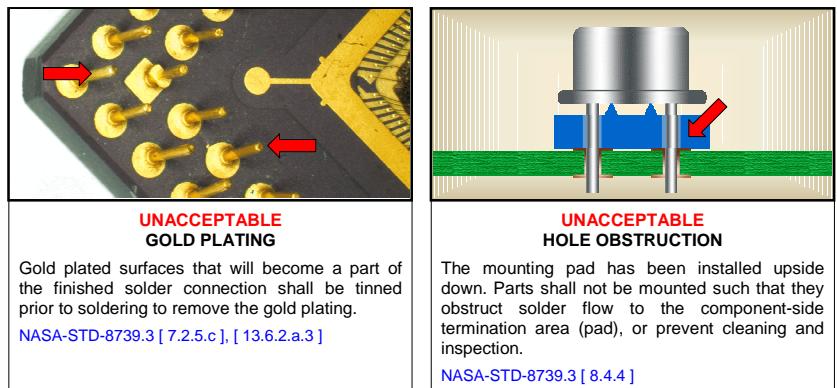
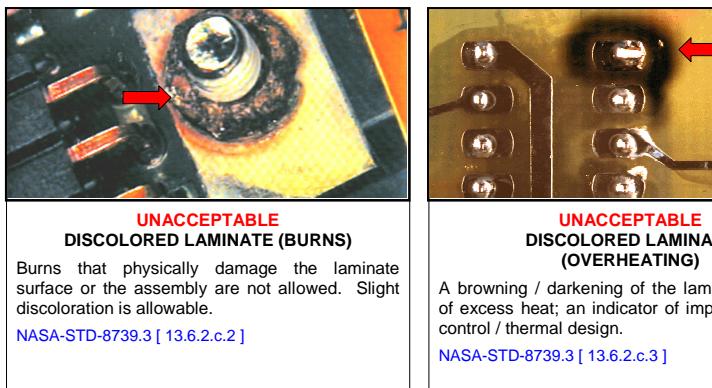
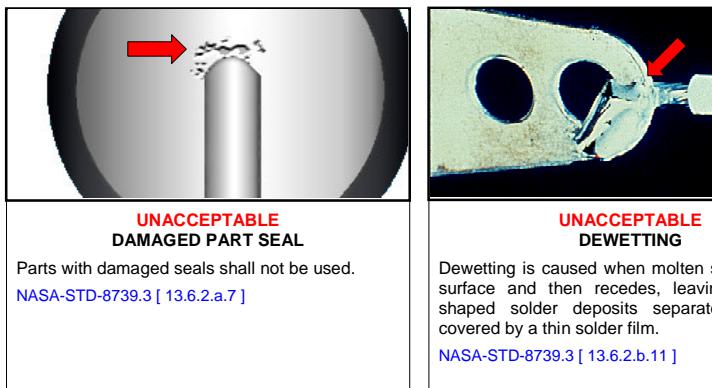
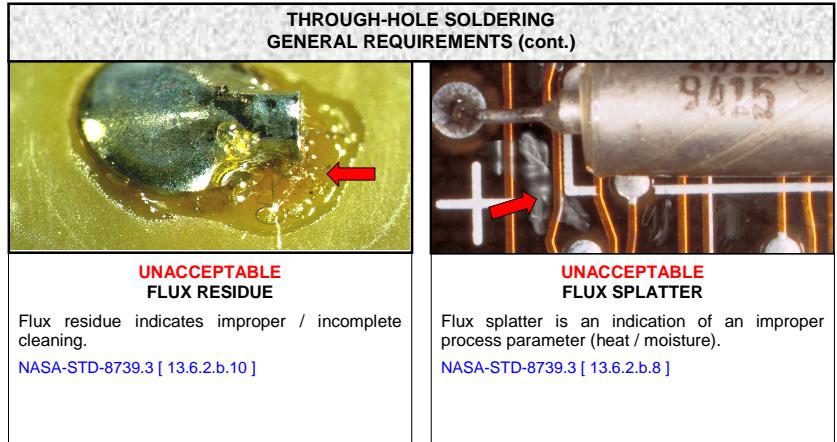
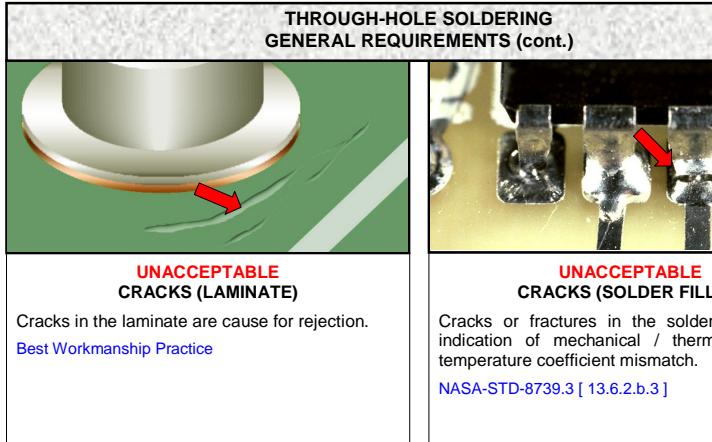
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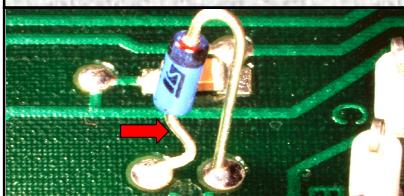
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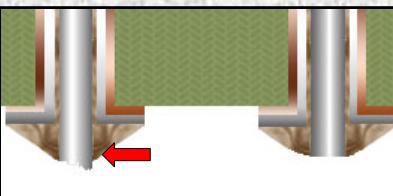
**THROUGH-HOLE SOLDERING
GENERAL REQUIREMENTS (cont.)**



**UNACCEPTABLE
IMPROPER LEAD BENDING**

The minimum distance from the part body / seal to the start of the bend shall be 2 lead diameters for round leads and 0.5 mm (0.020 in.) for ribbon leads. The bend radius shall not be less than one lead diameter (1d) or ribbon thickness (1 t).

NASA-STD-8739.3 [8.1.6.a]

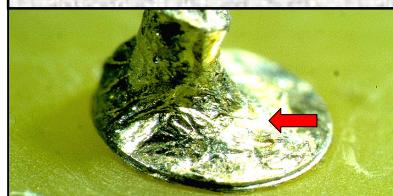


**UNACCEPTABLE
IMPROPER LEAD CUTTING**

Leads shall be cut per engineering documentation and by methods, which do not impart stress to the lead seal or internal terminations.

NASA-STD-8739.3 [8.1.6.a]

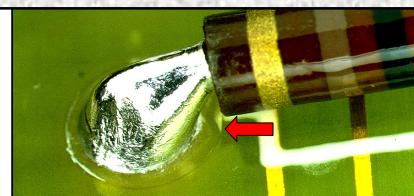
**THROUGH-HOLE SOLDERING
GENERAL REQUIREMENTS (cont.)**



**UNACCEPTABLE
DISTURBED SOLDER**

A disturbed solder joint is characterized by the appearance that there was motion between the metals being joined while the molten solder was solidifying.

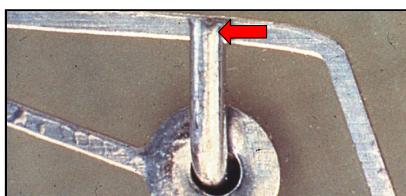
NASA-STD-8739.3 [13.6.2.b.3]



**UNACCEPTABLE
EXCESS SOLDER**

The solder fillet shall exhibit a positive wetting angle and shall not contact the component body.

NASA-STD-8739.3 [13.6.2.b.6]



**UNACCEPTABLE
IMPROPER LEAD LENGTH**

The clinched lead extends beyond the pad edge in excess of allowed limits and is bent over an uncommon electrical conductor.

NASA-STD-8739.3 [13.6.2.a.20]



**UNACCEPTABLE
IMPROPER ORIENTATION**

Parts shall be mounted parallel to the laminate surface, right side up, and aligned to the lands within design and engineering specifications.

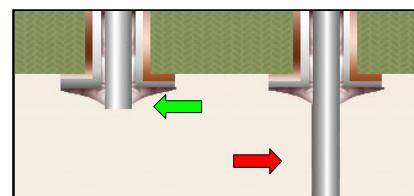
NASA-STD-8739.3 [13.6.2.a.5]



**UNACCEPTABLE
EXCESS SOLDER / SOLDER FLOODING**

Excess solder / Solder flooding / is an indicator of improper / incorrect process controls, and is typically seen in wave soldering.

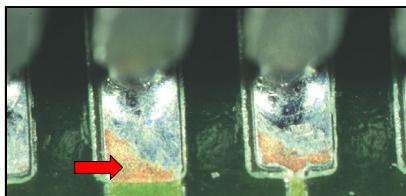
NASA-STD-8739.3 [13.6.2.b.6]



**UNACCEPTABLE
EXCESSIVE LEAD PROTRUSION**

Leads terminated straight through the PWB shall extend a maximum of 2.29 mm (0.090 in.) beyond the pad surface. Leads may not violate minimum electrical spacing requirements.

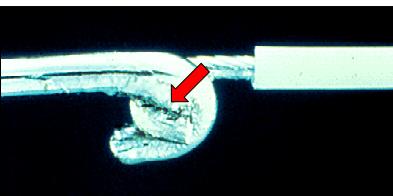
NASA-STD-8739.3 [13.6.2.a.21]



**UNACCEPTABLE
IMPROPER TINNING**

Tinned surfaces, which are to become part of the solder termination, shall exhibit 100% coverage.

NASA-STD-8739.3 [7.2.6], [13.6.2.a.3]



**UNACCEPTABLE
INSUFFICIENT SOLDER**

Insufficient solder is an indicator of improper process control, and may result in reduced reliability.

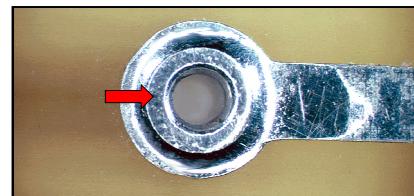
NASA-STD-8739.3 [13.6.2.b.7]



**UNACCEPTABLE
EXPOSED DIE / CIRCUIT ELEMENTS**

The unprotected exposure of die or circuit elements is not allowed unless specified in the engineering documentation.

NASA-STD-8739.3 [13.6.2.a.7]



**UNACCEPTABLE
EYELETS**

Eyelets shall not be used for interfacial terminations.

Best Workmanship Practice

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**THROUGH-HOLE SOLDERING
GENERAL REQUIREMENTS (cont.)**



**UNACCEPTABLE
INSUFFICIENT STRESS RELIEF / LEAD BEND**

Lead is improperly bent, placing strain on the weld bead. Conductors and part leads shall have sufficient stress relief to prevent damage to the solder termination and/or part.

NASA-STD-8739.3 [13.6.2.a.10]

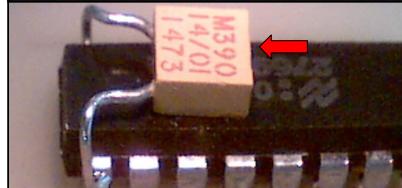


**UNACCEPTABLE
MENISCUS CONTACT**

Parts exhibiting contact with, or embedment of, the meniscus and the solder joint, shall be rejected.

NASA-STD-8739.3 [8.1.7], [13.6.2.b.13]

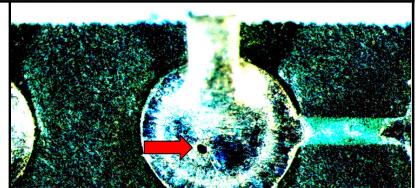
**THROUGH-HOLE SOLDERING
GENERAL REQUIREMENTS (cont.)**



**UNACCEPTABLE
PIGGYBACKED PARTS**

The piggybacking of parts not designed specifically for that configuration is prohibited.

Best Workmanship Practice



**UNACCEPTABLE
PINHOLE**

Pinholes are typically small holes in the solder surface, leading to a void of indeterminate size within the solder termination.

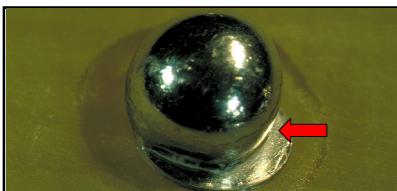
NASA-STD-8739.3 [13.6.2.b.5]



**UNACCEPTABLE
NICKS**

The use of parts with nicks in the component body or termination area is prohibited.

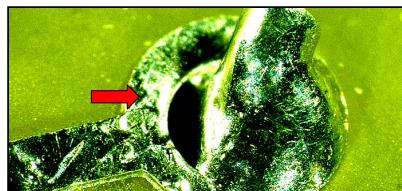
NASA-STD-8739.3 [13.6.2.a.7]



**UNACCEPTABLE
NONWETTING**

Nonwetting results in the solder forming a ball or beading on the termination surface. The fillet is convex; no feathered edge is apparent.

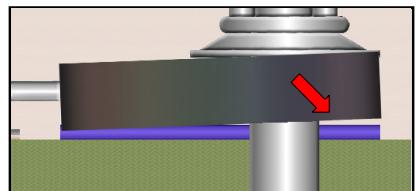
NASA-STD-8739.3 [13.6.2.b.12]



**UNACCEPTABLE
POOR WETTING**

Poor wetting is an indicator of poor solderability, improper flux, or contamination.

NASA-STD-8739.3 [13.6.2.b.4]



**UNACCEPTABLE
POPCORNING**

Popcorning is caused by the release of entrapped moisture during the soldering process.

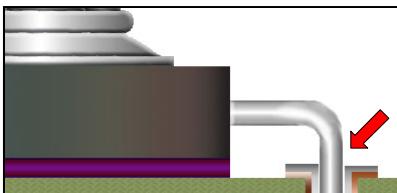
Best Workmanship Practice



**UNACCEPTABLE
NO FLOW / REFLOW**

The lack of flow / reflow of solder is an indicator of poor process control or layout design (i.e.: inadequate heat, shadowing).

NASA-STD-8739.3 [13.6.2.b.1]



**UNACCEPTABLE
NO SOLDER**

The lack of solder is an indicator of poor process control.

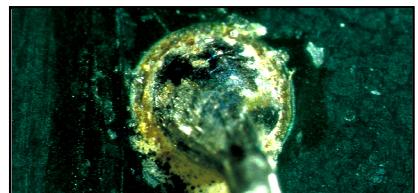
NASA-STD-8739.3 [13.6.2.b.7]



**UNACCEPTABLE
POROUS SOLDER**

Porous solder exhibits an uneven surface and a spongy appearance that may contain a concentration of small pinholes and voids.

Best Workmanship Practice



**UNACCEPTABLE
ROSIN SOLDER JOINT**

A rosin solder joint is similar in appearance to a cold solder joint, but exhibits evidence of entrapped flux in the fillet and at the surfaces to be joined.

NASA-STD-8739.3 [13.6.2.b.9]

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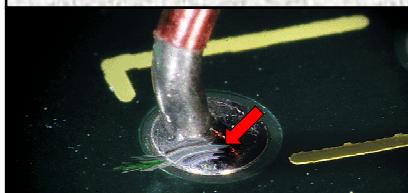
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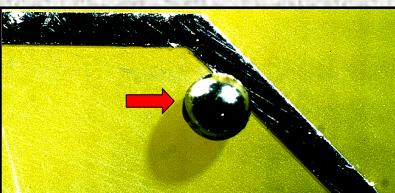
**THROUGH-HOLE SOLDERING
GENERAL REQUIREMENTS (cont.)**



**UNACCEPTABLE
SCRATCHES (SOLDER FILLET)**

Scratches in the solder are prohibited.

NASA-STD-8739.3 [13.6.2.b.3]



**UNACCEPTABLE
SOLDER BALLS**

Solder balls are considered a contaminant, and are an indication of improper process control (inadequate preheat), and/or the use of outdated solder/flux.

NASA-STD-8739.3 [13.6.2.b.10]

**THROUGH-HOLE SOLDERING
GENERAL REQUIREMENTS (cont.)**



**UNACCEPTABLE
OBSCURED SOLDER TERMINATIONS**

The placement of a part, which obscures the inspectability of another part's terminations, is unacceptable, unless interim inspection is performed (part depicted is mounted over previously installed surface mount components).

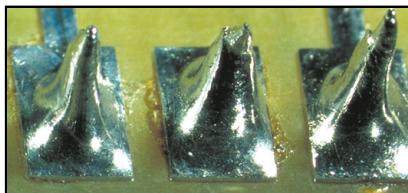
NASA-STD-8739.3 [13.6.2.a.23]



**UNACCEPTABLE
OPENS / VOIDS**

Cavities (opens / voids) reduce the circumferential wetting of lead and barrel, land coverage, and vertical solder fill below minimum acceptable requirements.

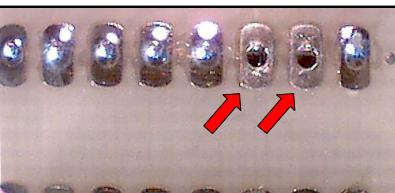
NASA-STD-8739.3 [13.6.2.b.5]



**UNACCEPTABLE
SOLDER PEAKS, ICICLES, SHARP EDGES**

Solder peaks, icicles, and/or sharp edges are an indicator of an improper process parameter and are a reliability and short-circuit concern.

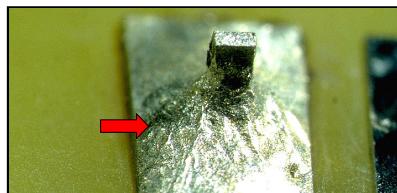
NASA-STD-8739.3 [13.6.2.c.4]



**UNACCEPTABLE
SOLDER SKIPS**

Solder skip is the random non-formation of solder fillets, and is an indicator of poor process control. Solder skip may be caused by insufficient solder, contamination, non-solderability (oxide), improper flux, solder thieving, etc.

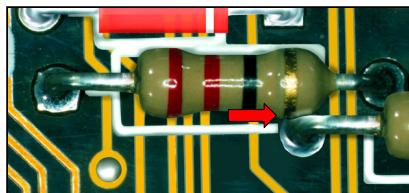
NASA-STD-8739.3 [13.6.2.b.7]



**UNACCEPTABLE
OVERHEATED SOLDER**

Overheated solder has a dull, gray, frosty, and/or crystallized appearance and is the result of excessive exposure to heat.

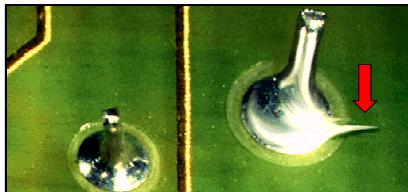
NASA-STD-8739.3 [13.6.2.b.2]



**UNACCEPTABLE
PART BODY CONTACT**

Part bodies shall not be in contact with soldered terminations. The spacing between components is below recommended values, resulting in contact between the resistor body and the lead, which may eventually result in a short circuit.

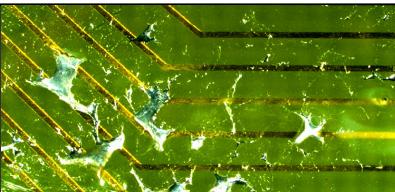
NASA-STD-8739.3 [8.1.7], [13.6.2.b.13]



**UNACCEPTABLE
SOLDER SLIVERS**

Solder slivers are an indication of improper process control.

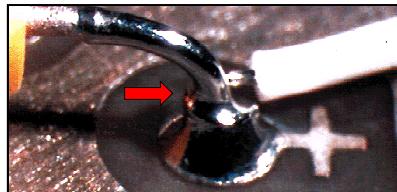
NASA-STD-8739.3 [13.6.2.c.4]



**UNACCEPTABLE
SOLDER SPLATTER**

Solder splatter is typically caused by moisture contamination and is an indicator of poor process control.

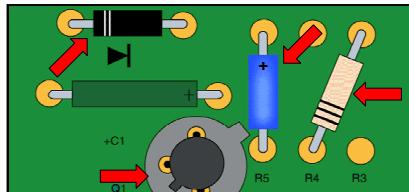
NASA-STD-8739.3 [13.6.2.b.8]



**UNACCEPTABLE
PART LEADS USED AS TERMINALS**

Part leads shall not be used as terminals, unless the part lead is designed to function as a terminal.

NASA-STD-8739.3 [13.6.2.a.18]



**UNACCEPTABLE
PART MISALIGNMENT**

Part misalignment is an indicator of improper process control.

NASA-STD-8739.3 [13.6.2.a.5]

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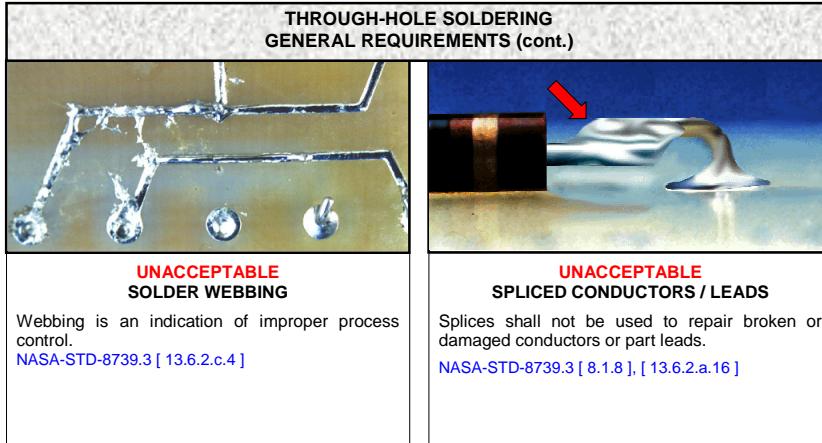
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THROUGH-HOLE SOLDERING
GENERAL REQUIREMENTS (cont.)

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