**THROUGH-HOLE SOLDERING**

**MECHANICAL ASSEMBLY, SWAGED TERMINALS**

### TERMINALS

Terminals are generally restricted to applications requiring components to be routinely removed and replaced, such as in high-gain analog tuning circuits. The installation of terminals increases the vertical profile of the printed wiring assembly (PWA) significantly, requiring the designer to ensure minimum electrical spacing requirements are not violated.

See Section 6.01 “Through-Hole Soldering, General Requirements”, for common accept / reject criteria.

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**MANDATORY**

**SOLDER SIDE TERMINATION**

**V-FUNNEL SWAGE**

Designs calling for soldering of the swaged end of the terminal to the printed wiring conductor on a single-sided PWB shall be secured with a V-funnel swage.

NASA-STD-8739.3 [8.2.3]

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**UNACCEPTABLE**

**IMPROPER SWAGE USED**

Designs calling for soldering of the swaged end of the terminal to the printed wiring conductor on a single-sided PWB shall be secured with a V-funnel swage.

NASA-STD-8739.3 [13.6.2.a.14]

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**ACCEPTABLE**

**SWAGE SETTING**

The terminal shall be swaged sufficiently tight to prevent Z-axis movement, while allowing finger force twisting for adjustment. Swaging shall not damage the PWB.

NASA-STD-8739.3 [8.2.1.a]

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**ACCEPTABLE**

**SMOOTH IMPRESSION MARKS**

Smooth impression marks (base metal not exposed) resulting from tool holding forces shall not be cause for rejection.

NASA-STD-8739.3 [7.2.3]

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**ACCEPTABLE**

**RADIAL ALIGNMENT**

(BIFURCATED TERMINALS ONLY)

The terminal is slightly twisted out of radial alignment, but the alignment will not adversely affect component installation or strain relief.

Best Workmanship Practice

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**UNACCEPTABLE**

**IMPROPER ALIGNMENT**

Bifurcated terminals shall be aligned to allow the proper termination of leads or conductors.

Best Workmanship Practice

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**PREFERRED**

**BIFURCATED TERMINAL**

The terminal is properly set, aligned, and straight. Tines are straight. No exposed base metal. Flange is swaged sufficiently tight to prevent Z-axis movement, while allowing finger force twisting for adjustment. No damage to the PWB.

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**PREFERRED**

**ELLIPICAL FUNNEL SWAGE**

The flange is uniformly shaped and concentric to the hole or termination pad. Strain / stress marks are minimum, no splits or cracks. Flange is swaged sufficiently tight to prevent Z-axis movement, while allowing finger force twisting for adjustment. No damage to the PWB.

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**PREFERRED**

**ROLL FLANGE SWAGE**

The flange is uniformly rolled and concentric to the hole or termination pad. Strain / stress marks are minimum, no splits or cracks. Flange is swaged sufficiently tight to prevent Z-axis movement, while allowing finger force twisting for adjustment. No damage to the PWB.

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**PREFERRED**

**TURRET TERMINAL**

The terminal is properly set and straight. No exposed base metal. Flange is swaged sufficiently tight to prevent Z-axis movement, while allowing finger force twisting for adjustment. No damage to the PWB.

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**PREFERRED**

**SMOOTH IMPRESSION MARKS**

Smooth impression marks (base metal not exposed) resulting from tool holding forces shall not be cause for rejection.

NASA-STD-8739.3 [7.2.3]

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ACCEPTABLE
RADIAL SPLITS / CRACKS
The rolled area or flange may have a maximum of 3 radial splits or cracks, which are separated by at least 90°, and/or which do not extend beyond the coiled or flared area.
NASA-STD-8739.3 [ 8.2.1.b.1 ]

UNACCEPTABLE
RADIAL SPLITS / CRACKS
The rolled area or flange shall not have more than 3 radial splits or cracks, which are separated by less than 90°, and/or which extend beyond the coiled or flared area.
NASA-STD-8739.3 [ 8.2.1.b.1 ]

ACCEPTABLE
VERTICAL MISALIGNMENT
The terminal is slightly bent, but the top edge does not extend beyond the base, and alignment will not violate minimum electrical clearance.
Best Workmanship Practice

UNACCEPTABLE
CIRCUMFERENTIAL SPLITS / CRACKS
After swaging or flaring, the rolled area or flange shall be free of circumferential splits or cracks.
NASA-STD-8739.3 [ 8.2.1.b.1 ]

MANDATORY
COMPONENT SIDE TERMINATION ROLL SWAGE
Swage type terminals in non-PTH’s, designed to have the terminal shoulder soldered to the printed wiring conductor, shall be secured to the PWB by a roll swage.
NASA-STD-8739.3 [ 8.2.2 ]

ACCEPTABLE
PLATED-THROUGH HOLE (PTH) TERM. V-FUNNEL / ELLIPTICAL SWAGE
Terminals mounted in plated-through holes (PTH) shall be secured with a V-funnel or elliptical funnel swage. The elliptical funnel is preferred.
NASA-STD-8739.3 [ 8.2.4 ]

MANDATORY
PLATING
Terminals shall be copper; hot dipped, tin-lead coated, or hot reflowed, electrodeposited tin-lead solder. Finish shall be smooth and shiny.
NASA-STD-8739.3 [ 9.1.12 ]

UNACCEPTABLE
PLATING DEFECTS
Flaking or peeling plating shall be grounds for rejection.
Best Workmanship Practice

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UNACCEPTABLE INTERFACIAL CONNECTIONS
Terminals shall not be used as interfacial connections in non-plated through holes.
NASA-STD-8739.3 [8.2.1.a], [13.6.2.a.14]

UNACCEPTABLE NONCONCENTRIC SWAGE
The swage shall be set approximately concentric to the hole and/or termination pad.
Best Workmanship Practice

UNACCEPTABLE MODIFICATIONS
Terminals shall not be modified to accommodate improper conductor sizes.
NASA-STD-8739.3 [7.3.2], [13.6.2.a.19]

UNACCEPTABLE PWB DAMAGE
The terminal has been swaged to the point that the substrate has been fractured and glass fiber is exposed.
NASA-STD-8739.3 [8.2.1.a]

UNACCEPTABLE TERMINAL DAMAGE
Terminals exhibiting physical damage (i.e.: nicks, gouging, bent / missing tines, reduced cross-section, etc.) shall be rejected.
Best Workmanship Practice

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