NASA

HAND SOLDER TRAINING

to

NHB 5300.4 (3A-2)

“REQUIREMENTS FOR SOLDERED ELECTRICAL CONNECTIONS”

NASA soldering
SOLDERING THEORY
Tin and Lead = 60/40 solder
Tin/Lead ratio/melting point

**TIN/LEAD RATIO**
- Sn 63/37 (Eutectic)
- Sn 60/40
- Sn 50/50

**MELTING POINT**
- 183°C/361°F
- 191°C/375°F
- 216°C/420°F
63/37 Eutectic solder liquid temperature
60/40 solder with solid/plastic/liquid temperatures
THE WETTING ACTION

SOLDER

COPPER
SOLDER

OXIDE FILM PREVENTS PROPER WETTING

COPPER
TIP TEMPERATURE

MASS OF TIP

MASS OF WORK

IRON CAPACITY

SURFACES

THERMAL LINKAGE
Small tip takes longer to heat the parts to the melting temperature
Larger tip takes less time to heat the same part to the melting temperature
Proper sized tip
Small linkage
Large linkage
Burned printed circuit board
Delaminated printed circuit board
WIRE STRIPPING
Disturbed lay of stranded wire - Reject
Disturbed lay of stranded wire - Reject
Discoloration burn to insulation - Accept
Charring: burning or damage to insulation - Reject
Cut or nicked leads or wires - Reject
WIRE TINNING
Preferred tinning of stranded wire with heat sink - Accept
Poor tinning, no wetting - Reject
Tinning, good wetting - Accept
Preferred wrap, 180 degrees - Accept
Maximum wrap, 270 degrees - Accept
Preferred solder - Accept
Minimum solder - Accept
Double wrap - Accept
Rosin connection – Reject
PIERCED TERMINAL
Preferred wrap - Accept
Preferred wrap “Z bend” - Accept
Minimum insulation clearance - Accept
Preferred insulation clearance - Accept
Disturbed/Fractured connection - Reject
Dewetting - Reject
Insufficient wrap, less than 180 degrees - Reject
Birdcaged wire strands - Reject
Loose/Excessive lead wrap - Reject
Terminal fill, all wires touching post - Accept
Excessive wicking - Reject
Minimum insulation clearance, possible contamination
Reject
Excessive solder - Reject
Dewetted - Reject
Dewetted - Reject
BIFURCATED TERMINAL
Preferred wrap (single) - Accept
Preferred Wrap (double) - Accept
Preferred wrap (bottom route) - Accept
Improper mechanical wrap - Reject
Excessive solder (should see strand contour) - Reject
Excessive solder - Reject
SOLDER CUP TERMINAL
Preferred solder - Accept
Improper seating to back of cup - Reject
Void, pin hole - Reject
Excessive solder/spillage - Reject
Gold embrittlement (amalgamation) - Reject
Solder spike - Reject
PRINTED WIRING BOARD
Left side, excessive solder/void/measle – Reject
Right side, preferred solder - Accept
Top, excessive solder/measle – Reject
Bottom, preferred solder - Accept
Top left, bad swage, top right, bad swage, burned – Reject
Bottom left, good swage, bottom right, radial split - Accept
AXIAL LEAD MOUNTING
Axial component mounting - Accept
Axial component not seated against board - Reject
STUD TERMINATION
Exposed bare copper - Reject
Blowhole - Reject
Preferred solder - Accept
Minimum solder - Accept
Excessive solder - Reject
Lifted pad - Reject
CLINCHED TERMINATION
Clinched lead - Accept
Cold solder, non wetting - Reject
Minimum solder (should cover pad) - Accept
Disturbed solder - Reject
Overheated - Reject
Rosin - Reject
Lifted pad - Reject
VERTICAL MOUNTING
T05 transistor component mounting - Accept
DUAL-IN-LINE PACKAGE
Solder bridge between leads - Reject
Solder bridge between leads - Reject
Solder splashes/splatters/balls - Reject
Pin hole - Reject
Measling - Reject
Solder spikes, peaks and icicles - Reject
Non wetting/stress lines - Reject
INTERFACIAL CONNECTIONS
Void under end of wire - Reject
Insufficient solder - Reject
FLAT PACK
Preferred mounting - Accept
Toe up/curl - Reject
Heel fillet, lack of solder - Reject
Heel fillet, not smooth - Reject
Toe overhang, excessive - Reject
CONTINUOUS WRAP
Turret terminals - Accept
Loose wrap/greater than 180 degrees end wraps - Reject
HIGH VOLTAGE TERMINATION
Left, solder lead/contamination – Reject
Right, projection, voids - Reject
INSPECTION
Flux residue - Reject
Metal encased component mounted over circuitry - Reject
Markings not discernible - Reject
Damaged part - Reject
Component mounting - Reject
Incorrect component - Reject
Reversed polarity - Reject
Solder in bend radii – “Reject"
Poor wetting/reflow stress lines - Reject
Vertical mounted axial lead component - Accept
Poor solder flow through plated through hole - Reject
Glass body component not sleeved - Reject
Rosin - Reject
Excessive lead length, damaged trace - Reject
Improper component mounting - Reject
Insufficient solder - Reject
Correct lead bend radius - Accept
Distance from weld bead to bend - Reject
Component not centered - Reject
Scratches on pads - Reject
Component mounting - Reject
Solder in bend radius, minimum - Accept
Lead length, insufficient - Reject
Broken, damaged part - Reject
Pit, void - Reject
Large component obscures termination of another
Part - Reject
Maximum solder (stud) - Accept
Improper lead clinched - Reject
Exposed copper - Reject
Preferred clinched lead - Accept
Excessive solder, lead not discernible - Reject
Poor wetting and exposed copper - Reject
Pits, grainy - Reject
Vertical component mounting - Accept
Optimum lead protrusion, stud mount - Accept
Excessive lead spring back - Reject
Solder fillet - Accept