

LEAD-FREE TERMINAL PERFORMANCE

PRODUCTS: SMT TANTALUM ELECTROLYTIC CAPACITORS

NTC-T & NTP SERIES



REF: LEAD-FREE TERMINALS (100% TIN; 100% Sn)

NOTICE: AS OF FEBRUARY 01, 2003 100% TIN PLATED TERMINALS WILL BECOME THE STANDARD TERMINAL FINISH AVAILABLE ON NTC-T & NTP SERIES PRODUCTS

NIC P/N: NTC -T xxxxxxxxxxxF & NTPxxxxxxxxxF

- CURRENT "F" CODE (100% TIN; 100% Sn FINISH) WILL BECOME STANDARD FINISH AS OF FEBRUARY 01, 2003
- AS OF DATE CODE "0306", LEAD-FREE "F" PART NUMBER DESIGNATOR WILL BE DISCONTINUED

OBJECTIVE:

COMPARISON OF SOLDER WETTING RATES AND SOLDER JOINT INTERGRITY – RELIABILITY OF LEAD-FREE TERMINAL (100% TIN) AS COMPARED TO DISCONTINUED TIN-LEAD (Sn/Pb; 90/10) FINISH TERMINALS

TESTING:

- SOLDER WETTING RATES
- SOLDER JOINT PERFORMANCE
- TIN WHISKER GROWTH TEST

FINDINGS:

- WHEN USED IN LEAD-FREE (Sn-Au-Cu) AND TIN-LEAD (Sn-Pb) SOLDERING OPERATIONS, 100% TIN (Sn) PLATED TERMINALS EXHIBITED BETTER SOLDER WETTING RATES AS COMPARED TO Sn-Bi & Sn-Ag (ALTERNATE LEAD-FREE) TERMINAL FINISHES (SEE PAGES 2 & 3)
- WHEN USED IN TIN-LEAD (Sn-Pb) SOLDERING OPERATIONS, 100% TIN (Sn) PLATED TERMINALS EXHIBITED SOLDER WETTING RATES COMPARABLE WITH TIN-LEAD (Sn/Pb) PLATED TERMINALS (SEE PAGES 2 & 3)
- SOLDER JOINTS OF 100% TIN (Sn) PLATED TERMINALS EXHIBITED VIRTUALLY NO CHANGE IN RESISTANCE TO SHEARING FORCE AFTER 500 THERMAL CYCLES OR AFTER 500 HOURS OF HIGH TEMPERATURE EXPOSURE. (SEE PAGES 4 ~8)
- 100% TIN (Sn) PLATED TERMINALS EXHIBITED VERY COMPARABLE SOLDER JOINT STRENGTH PERFORMANCE TO TIN-LEAD (Sn/Pb) PLATED TERMINALS (SEE PAGES 4 ~8)
- NO DIFFERENCE WAS OBSERVED IN TIN WHISKER GROWTH INCIDENCE OF 100% TIN (Sn) PLATED TERMINALS AS COMPARED TO TIN-LEAD (Sn/Pb) PLATED TERMINALS (SEE PAGES 9 ~ 11)

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Tin-Lead (Sn-Pb) Solder Wetting Speed Test

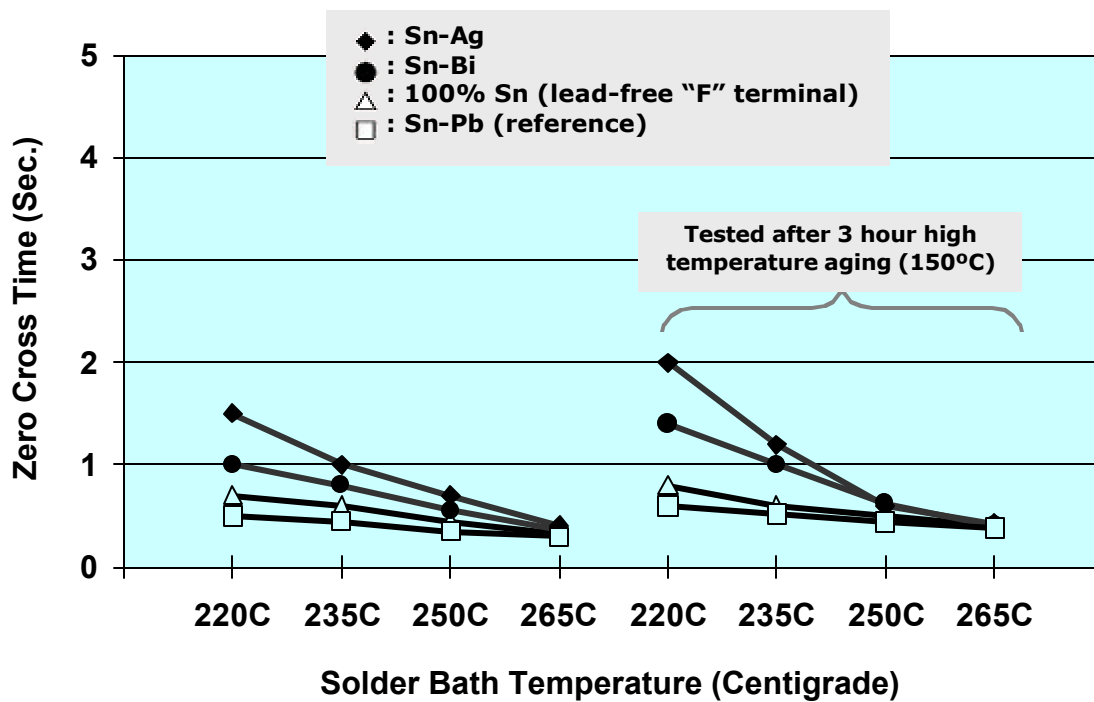
4-Terminal finishes evaluated:

Sn-Pb = Tin-Lead

Sn = 100% Tin

Sn-Bi = Tin - Bismuth

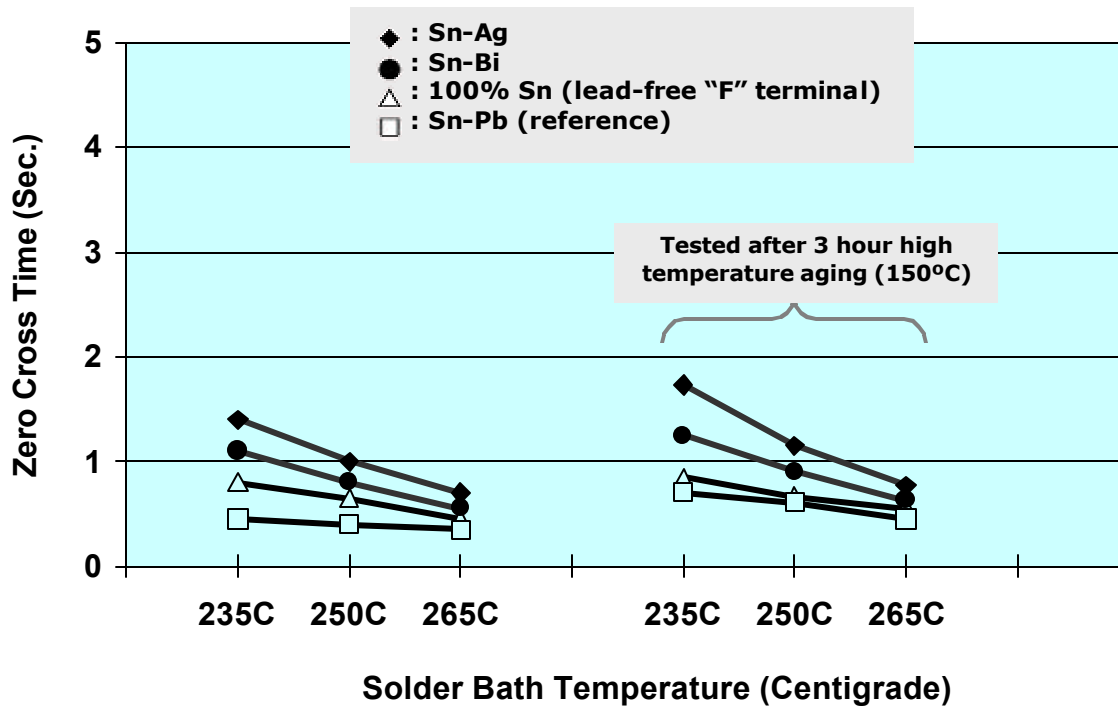
Sn-Ag = Tin - Silver



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Tin-Gold-Copper (Sn-Au-Cu) Solder Wetting Speed Test

4-Terminal finishes evaluated:
 Sn-Pb = Tin-Lead
 Sn = 100% Tin
 Sn-Bi = Tin - Bismuth
 Sn-Ag = Tin - Silver



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SOLDER JOINT STRENGTH COMPARISON

COMPONENT SOLDER JOINT (SHEAR) STRENGTH TESTED ON PCB ASSEMBLIES PRODUCED UNDER THE FOLLOWING CONDITIONS:

1. REFLOW SOLDERING (SINGLE PASS)
2. REFLOW SOLDERING (DOUBLE PASS)
3. REFLOW SOLDERING FOLLOWED BY FLOW (+250°C BATH)
4. REFLOW SOLDERING FOLLOWED BY FLOW (+270°C BATH)

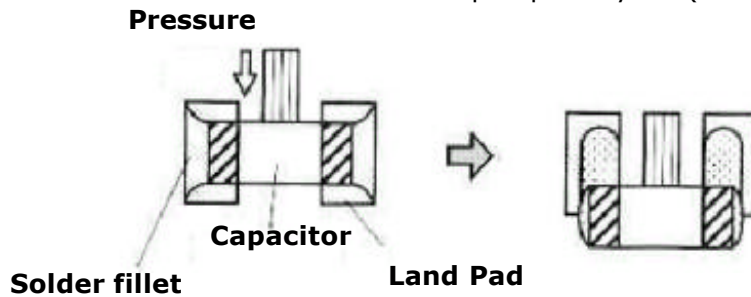
PCB ASSEMBLIES WERE THEN TEMPERATURE CONDITIONING PER THE FOLLOWING CONDITIONS:

1. THERMAL CYCLING: 500 CYCLES (-40°C ~ +125°C)
2. HIGH-TEMPERATURE EXPOSURE : 500 HOURS (+125°C)

SHEAR STRENGTH TEST

Shearing speed: 10mm / min.

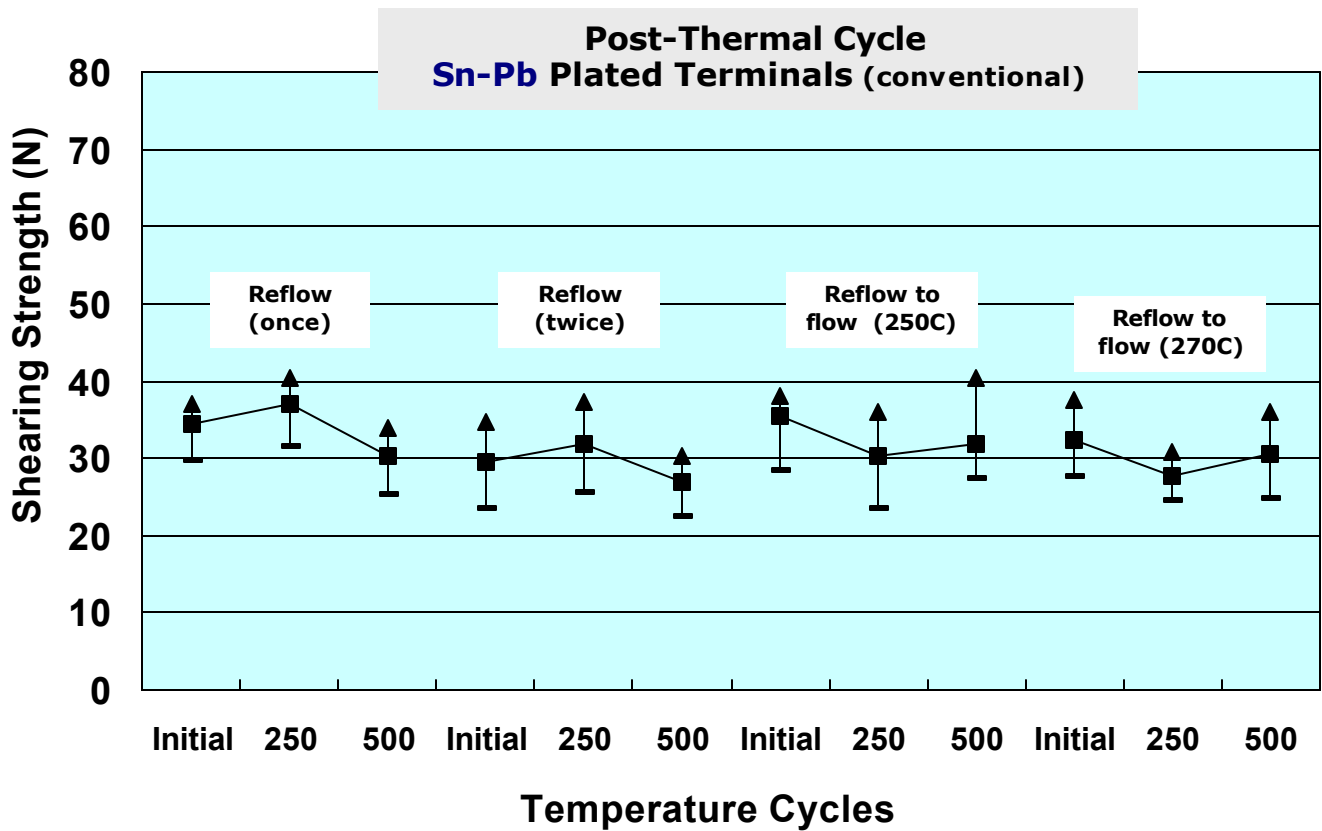
Sample quantity: 11(each condition)



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SOLDER JOINT STRENGTH COMPARISON

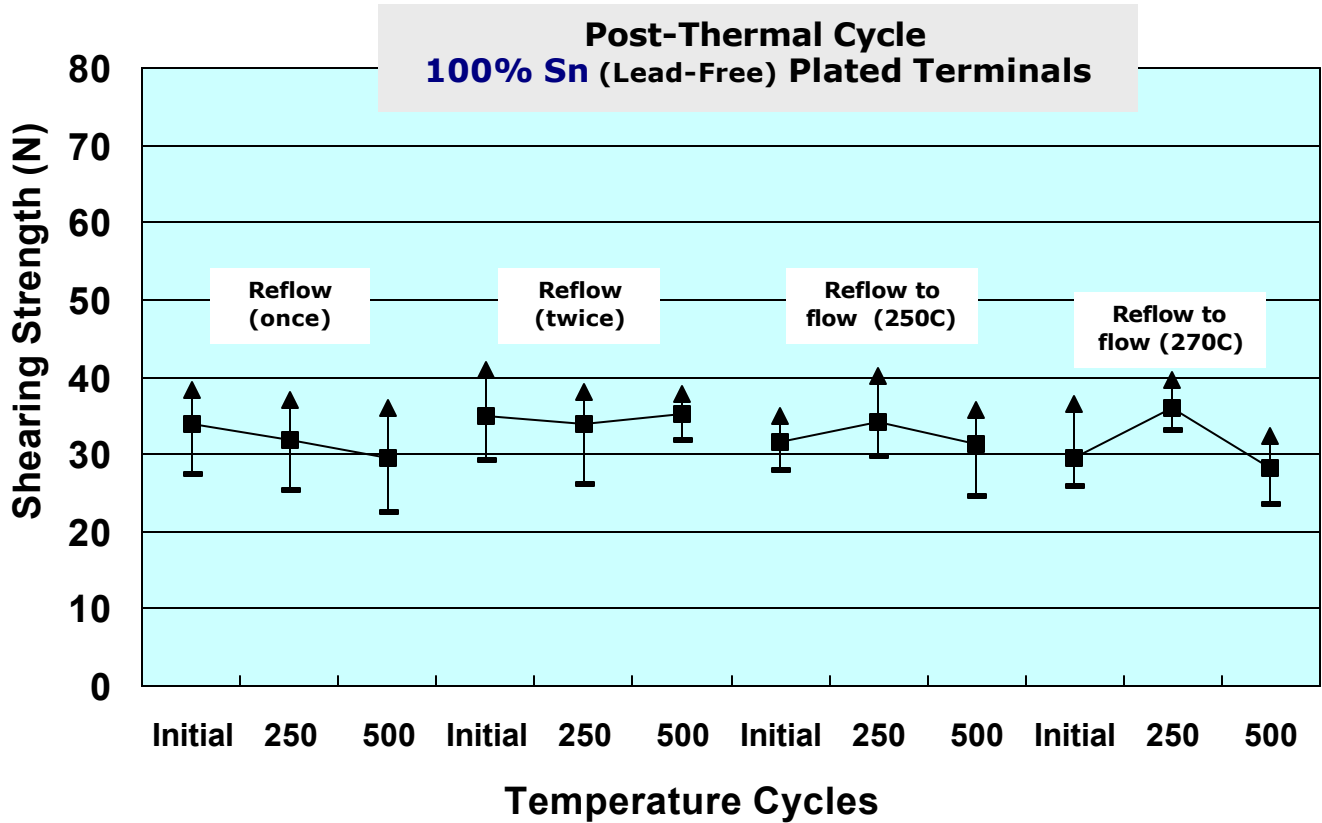
TYPICAL SHEAR STRENGTH



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SOLDER JOINT STRENGTH COMPARISON

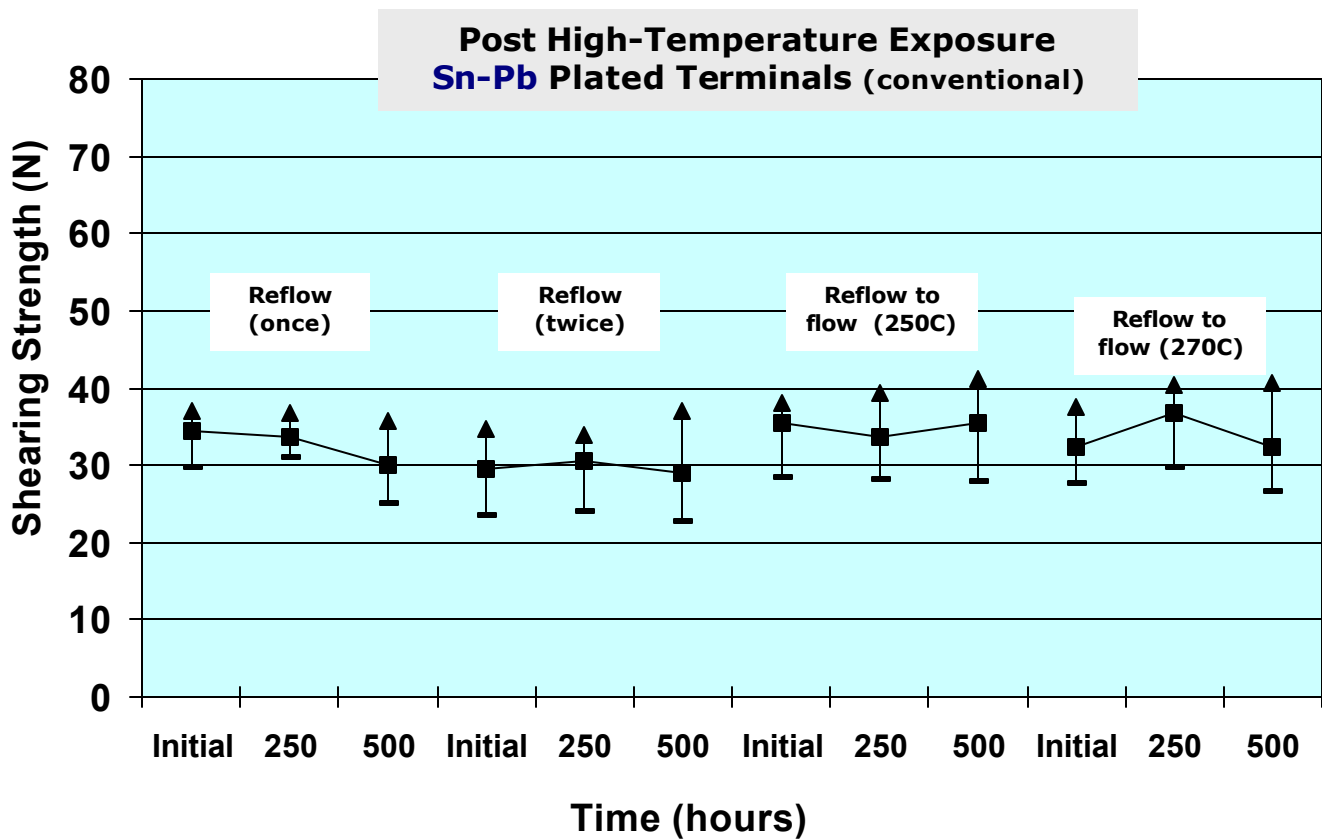
TYPICAL SHEAR STRENGTH



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SOLDER JOINT STRENGTH COMPARISON

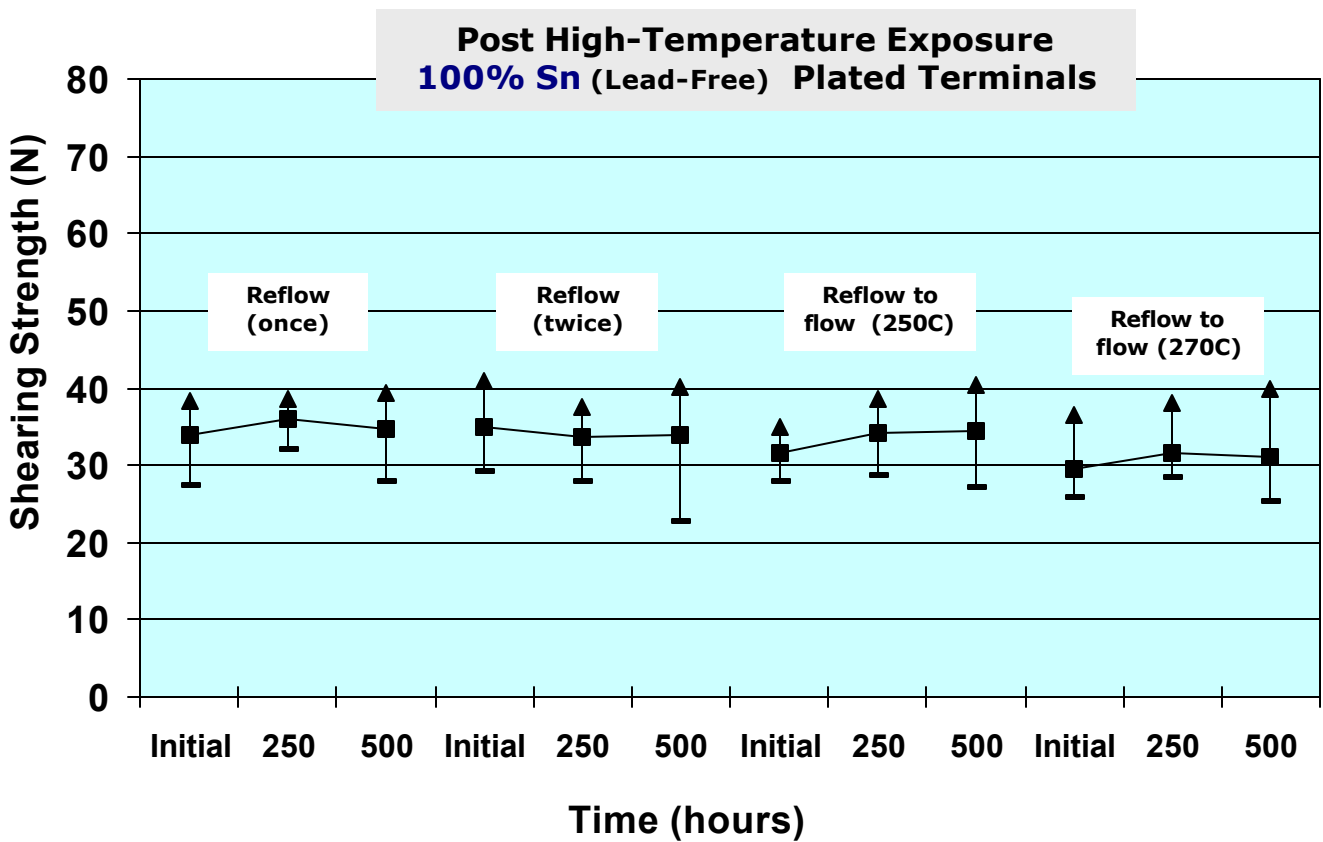
TYPICAL SHEAR STRENGTH



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TIN WHISKER GROWTH TEST

TEST CONDITIONS:

SAMPLES OF 100% TIN (Sn) PLATED TERMINALS WERE SERIALIZED – TESTED - COMPARED TO TIN-LEAD (Sn/Pb) PLATED TERMINALS

TEST METHOD:

- PCT (PRESSURE COOKER TEST)
 - 120 HOURS AT 2 ATMOSPHERES (29.4 PSI) AND +120°C
- TEMPERATURE CYCLE
 - 500 CYCLES (-40°C ~+125°C)

MEASUREMENTS:

- VISUAL INSPECTION
- SEM ANALYSIS (1000 ~ 2500X)
 - MEASUREMENT OF TIN WHISKER GROWTH

FINDINGS:

INCIDENT OF TIN WHISKER GROWTH ON 100% Sn PLATED TERMINALS IS COMPARABLE TO GROWTH OBSERVED ON Sn/Pb PLATED TERMINALS

TERMINAL TYPE	TEMPERATURE CYCLE TEST		PRESSURE COOKER TEST	
	VISUAL	SEM	VISUAL	SEM
Sn-Pb	GOOD	FAIR	GOOD	FAIR
100% Sn	GOOD	FAIR	GOOD	FAIR

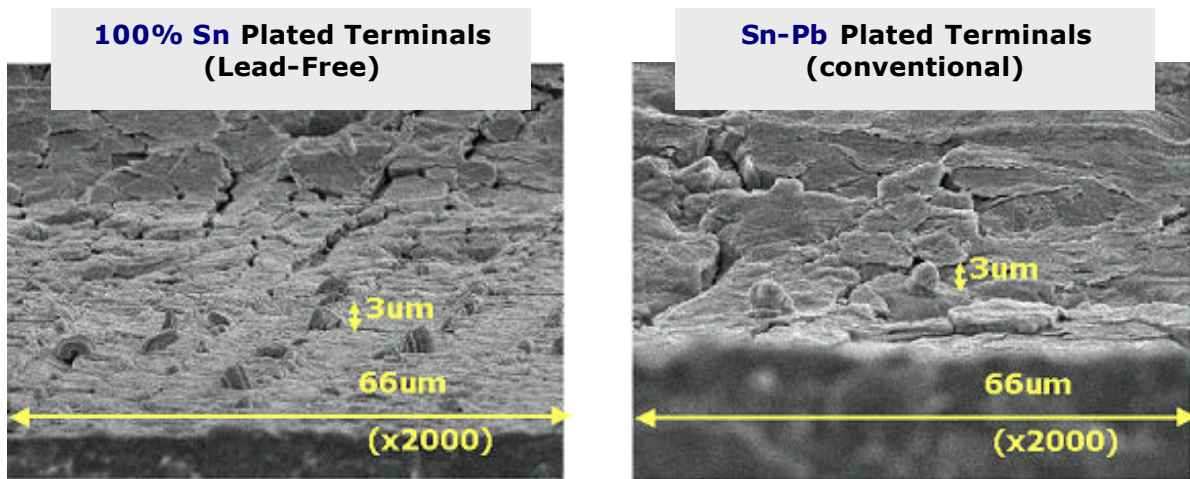
CRITERIA:

GOOD = NO WHISKER GROWTH
 FAIR = LESS THAN 10um GROWTH

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TIN WHISKER GROWTH TEST

SEM AFTER THERMAL CYCLING
TEMPERATURE CYCLE, 500 CYCLES (-40°C ~+125°C)



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SOLDER JOINT STRENGTH COMPARISON

SEM AFTER PCT (PRESSURE COOKER TEST)
120 HOURS AT 2 ATMOSPHERES (29.4 PSI) AND +120°C

