Compliant Terminal Technology Summary Test Report

Engineering Report
ER04100

October 5th, 2004
Revision A

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Overview:

This report summarizes the results of tests conducted by personnel of Contech Research, Incorporated of Attleboro, MA to characterize the performance of compliant terminal technology developed by Autosplice, Inc. The independent laboratory is accredited by A2LA (the American Association for Laboratory Accreditation) and specializes in interconnection technology. All equipment and measuring instruments used during these tests were calibrated and are traceable to NIST according to ISO 10012-1 and ANSI/NCSL Z540-1, as applicable.

Except as noted, all tests were conducted in accordance with the appropriate sections of SAE/USCAR-2, Revision 4. As these tests focused on the electrical interface between the terminal pin and the plated through hole (PTH) in the printed circuit board (PCB) some procedures were adjusted as described herein. EIA Publication 364, SAE J1127, SAE J1125, USCAR-23 and IEC5 were consulted in preparing the following test plan.

Compliant Terminal Specifications:

Mechanical:

- Plating: .000030-.000080" [0.00076-0.00200] Tin or Tin-Lead over .000050-.000100" [0.00127-0.00254] Nickel.
- Hole Deformation: .002" [0.05] max radial deformation.
- Insertion/Withdrawal Forces: .025" [0.64] Insertion Force max. 22.0 lbs. Retention Force Min. 4.5 lbs. .031" [0.81] Insertion Force max. 40.0 lbs. Retention Force Min. 5.5 lbs.

Electrical:

- Contact Resistance: 10 mΩ Max.
- Current rating: .025x.025 [0.64x0.64] = 7.5 Amps
  .025x.039 [0.64x1.00] = 10.0 Amps
  .031x.059 [0.81x1.50] = 12.5 Amps
  .031x.110 [0.81x2.80] = 15.0 Amps
  .031x.236 [0.81x6.00] = 25.0 Amps

Environmental:

- Operating Temp: -40°C to +125°C (SAE/USCAR Class III)
- Vibration and Mechanical Shock: 1.8G random axis, and 10 millisecond 35G, 3 axis.
- Thermal Shock: 100 cycles from -40°C to +125°C.
- Temperature/Humidity: 40 cycles from -40°C to +125°C @ 95% RH.
- High Temperature Exposure: +125°C for 1008 hours.
- Mixed Flowing Gas Exposure: H_2S @ 500ppb and SO_2 at 100ppb at a temperature of 25°C and a relative humidity of 75% for a period of 10 days.

Test Plan:

SAE/USCAR-2, Revision 4:

- Current Carrying Capacity (with temperature rise) - section 5.3.3
- Current Cycling – section 5.3.4
- Vibration and Mechanical Shock - section 5.4.6
- Thermal Shock – section 5.6.1
- Thermal Cycling with Humidity – section 5.6.2
- High Temperature Life Tests (1008 hours exposure) – section 5.6.3

EIA publication 364:

- Plated Through Hole Conditioning and Integrity
- Micro sectioning of the PTH for analysis
- Insertion/Retention Forces

IEC 60352-5:

- Exposure to Corrosive, Mixed Flowing Gases-procedure 65

* All terminals were tested to SAE/USCAR standards with electrical test performed to EIA.
* .025x.025 [0.64x0.64] brass C26000 soldered pins were used as a benchmark for all tests.

Test Conditions:

The SAE/USCAR-2 protocol uses the change in resistance across the electrical junction as the means to quantify the amount of degradation exhibited by a given sample. As these tests are focused on the interconnection between the terminal under test and the PTH, the resistance across this junction was measured. Two methods were employed to do this:

- **Compliant Pin Interface Resistance (CPIR)**
  - Resistance measurements are made and recorded in accordance with EIA 364 - procedure 23, using a Keithly Model 580 4-wire ohmmeter with test current of 100mA and an open circuit voltage of 20mV. Measurements are made before and after the completion of testing.

- **Contact Resistance (CR)**
  - Resistance is determined by measuring the milli-volt drop across the junction while the full rated current flows through the circuit. Dividing the milli-volt drop by the applied current results in the contact resistance.
  - This method allows measurement to be made and recorded during testing and is particularly useful during tests of long duration.

To facilitate the testing, custom PCBs were fabricated having discreet plated through holes for the attachment of test leads and the terminal under test. These PCBs were 0.062” thick using standard FR-4 substrates with 5oz copper cladding on the exterior sides and ½ oz copper traces on the internal layer in accordance to standard IPC practices.

Drilled and Finished Plated Through Hole requirements for PCB's tested.

Tables 1-1 and 1-2 identify the drilled and finished hole diameters used in these test PCBs. Note that the hole diameters are in inches. Additionally, the PCBs were colored coded by the type of plating used on that board. Orange identified Copper, Blue for HASL and Yellow for Gold.

Hole Size	Drilled Hole	HASL (SnPb) Finished PTH	OSP (Cu) Finished PTH	ENIG (Au) Finished PTH
Minimum	0.0420 (1.07)	.037 (0.94)	.037 (0.94)	.038 (0.96)
Nominal	0.0453 (1.15)	.040 (1.02)	.040 (1.02)	.040 (1.02)
Maximum	0.0472 (1.20)	.043 (1.09)	.043 (1.09)	.042 (1.07)

Table 1-1
0.64mm Thick Terminals

Hole Size	Drilled Hole	HASL (SnPb) Finished PTH	OSP (Cu) Finished PTH	ENIG (Au) Finished PTH
Minimum	0.0612 (1.30)	.0555 (1.41)	.0555 (1.41)	.056 (1.42)
Nominal	0.0635 (1.36)	.0585 (1.49)	.0585 (1.49)	.058 (1.47)
Maximum	0.0651 (1.40)	.0615 (1.56)	.0615 (1.56)	.060 (1.52)

Table 1-2
0.81mm Thick Terminals

PCB tested

Figure 1 illustrates the layout of the test PCB. Separate versions of the PCBs were made having PTH diameters sized as appropriate for the terminal under test. Each PCB bore an identification code, etched into the foil pattern, to insure that the PCB was matched to the proper terminal under test during assembly.

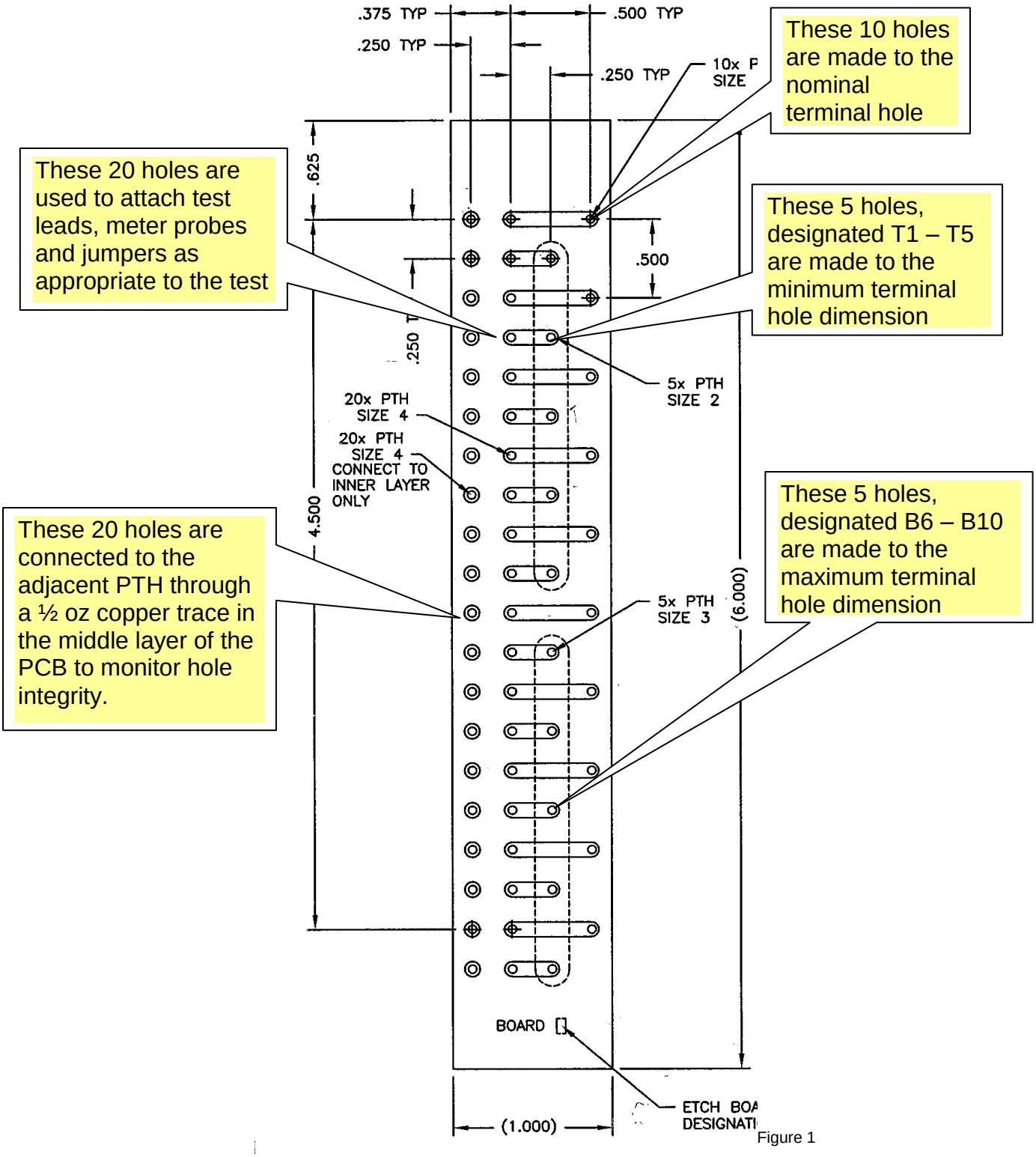


Figure 1

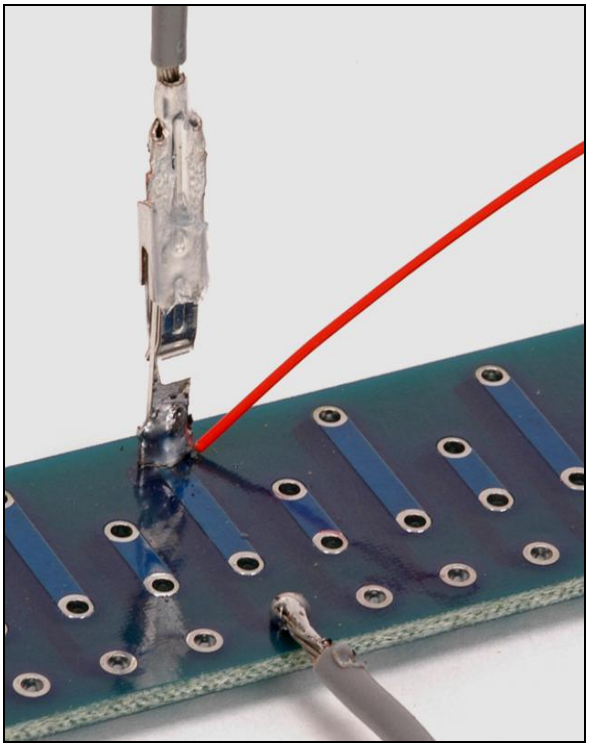
Figure 1

Current Carrying Capacity (Current Rating):

SAE/USCAR-2 - Revision 4 - Section 5.3.3
EIA Publication 364 - Procedure 70

The ability of a terminal to carry current is largely dependant on its temperature rise in response to current flow through it. It is therefore important to accurately measure the temperature rise throughout the duration of the test.

This illustration at right, describes the method by which, temperature rise was monitored. A type J thermocouple was attached at the junction of the compliant pin and the annular ring on the PCB. A thermally conductive epoxy was used to hold the thermocouple in place.

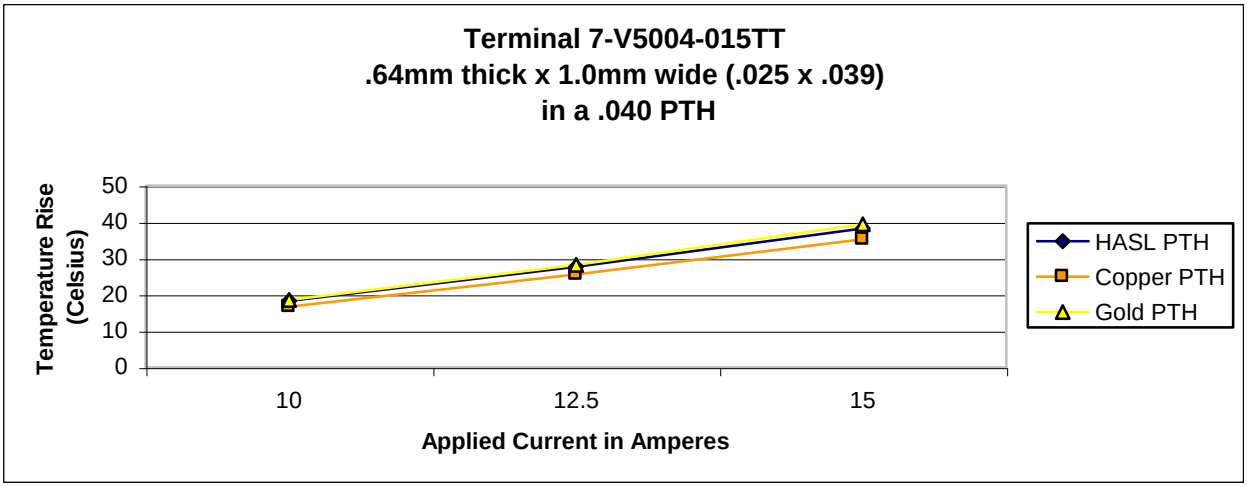


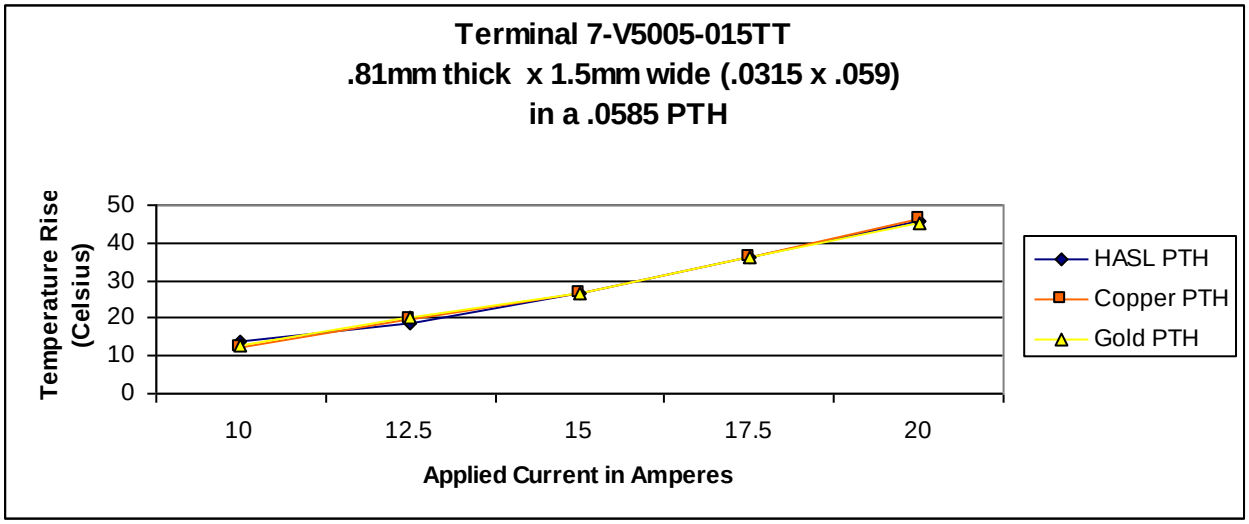
The following samples were mounted to a non-conducting surface and placed in a draft free enclosure. Initially, 50% of the expected maximum current is applied to the terminal under test and allowed to stabilize. The temperature rise of the terminal under test is recorded alongside of the applied current. The current is then increased by 10%, allowed to stabilize and another set of measurements is taken. This process is repeated until the temperature of the terminal under test exceeds 55°C.

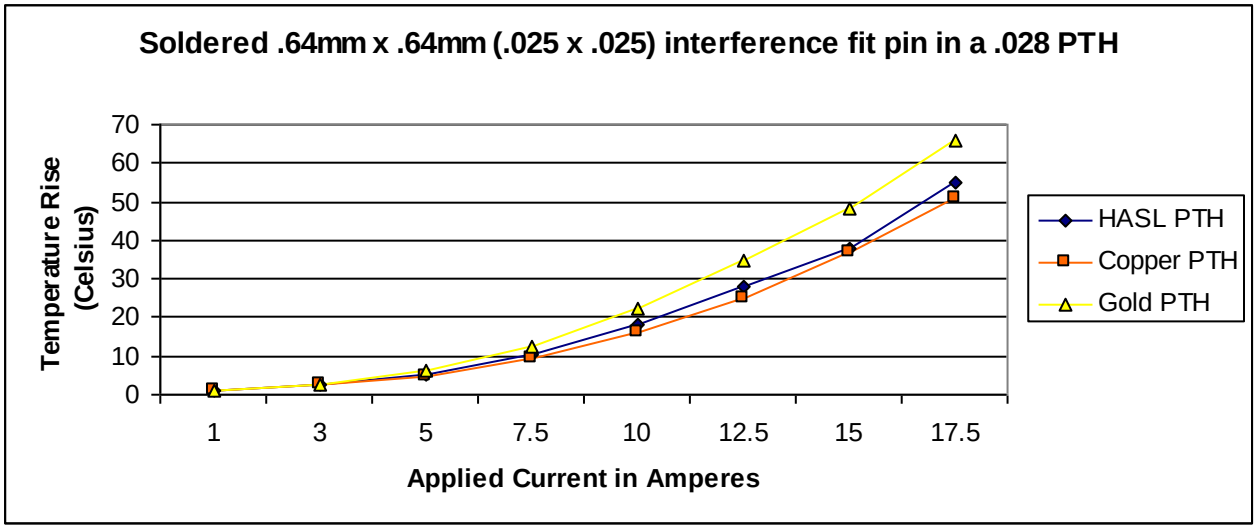
1) Compliant Terminal 7-V5004-015TT, .64 thick x 1mm wide (.025” x .039”)
2) Compliant Terminal 7-V5005-015TT, .81 thick x 1.5mm wide (.0315” x .059”)
3) .64 x .64mm (.025” x .025”) brass C26000 soldered pin (used as a benchmark for all tests)**.**

CPIR for each sample was measured and recorded before and after testing. SAE/USCAR acceptance criteria requires CPIR measurements to not exceed 20.0 mΩ for 0.64mm terminals, 10.0 mΩ for 1.5mm terminals and 1.5 mΩ for 6.0mm terminals. ***None of the samples tested exceeded the CPIR limits, in fact no sample experienced a change in resistance >1mΩ.***

Temperature Rise in Response to Applied Current







High Temperature Life Tests:

SAE/USCAR-2, Revision 4 -Section 5.6.3

The following terminals were subjected to1008 hours of operation at 125°C (USCAR Class 3) at the current indicated below. ***Examination of all samples following completion of the exposure found no evidence of physical damage and none exhibited a change in CPIR exceeding 1 mΩ.***

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.83 mΩ	<2.90 mΩ	<2.86mΩ
ΔContact Resistance (post test)	0.00 mΩ	+0.33 mΩ	+0.22 mΩ
CPIR (pre test)	<1.76 mΩ	<2.75 mΩ	<2.70 mΩ
ΔCPIR (post test)	+0.19 mΩ	+0.33 mΩ	+0.35 mΩ
1.0 x 0.64mm Compliant Pin @ 10.0 Amperes Autosplice Number: 7-V5004-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.43 mΩ	<2.57 mΩ	<2.67 mΩ
ΔContact Resistance (post test)	+0.05 mΩ	+0.02 mΩ	+0.03 mΩ
CPIR (pre test)	<1.44 mΩ	<2.30 mΩ	<2.41 mΩ
ΔCPIR (post test)	+0.03 mΩ	+0.08 mΩ	+ 0.11 mΩ
1.5 x 0.81mm Compliant Pin @ 12.5 Amperes Autosplice Number: 7-V5005-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.68 mΩ	<2.27 mΩ	< 2.03 mΩ
ΔContact Resistance (post test)	+0.04 mΩ	+ 0.14 mΩ	+0.07 mΩ
CPIR (pre test)	<1.51 mΩ	<1.97 mΩ	<1.67 mΩ
ΔCPIR (post test)	+0.04 mΩ	+ 0.03 mΩ	+0.02 mΩ
6.0 x 0.81mm Compliant Pin @ 25.0 Amperes Autosplice Number: 7-V5008-015TT			

Thermal Shock Tests:

SAE/USCAR-2 - Revision 4 - Section 5.7.1

The following terminals were subjected to 100 cycles of thermal shock. Each cycle consisted of soaking the samples for 30 minutes at 125°C and within 30 seconds max, taking the samples to -40°C, allowing them to soak at that temperature for 30 minutes. ***Examination following completion of the exposure found no evidence of physical damage and none of the samples exhibited a change in CPIR exceeding 1 mΩ.***

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.89 mΩ	<2.87 mΩ	<2.87 mΩ
ΔContact Resistance (post test)	+0.10 mΩ	+0.18 mΩ	+0.11 mΩ
CPIR (pre test)	<1.79 mΩ	<2.74 mΩ	<2.70 mΩ
ΔCPIR (post test)	+0.09 mΩ	+0.11mΩ	+0.15 mΩ
Condition of PTH	No Damage	No Damage	No Damage
1.0 x 0.64mm Compliant Pin @ 10.0 Amperes Autosplice Number: 7-V5004-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.74 mΩ	<2.74 mΩ	<2.71 mΩ
ΔContact Resistance (post test)	+0.07 mΩ	+0.08 mΩ	+0.06 mΩ
CPIR (pre test)	<1.58 mΩ	<2.59 mΩ	<2.53 mΩ
ΔCPIR (post test)	+0.05 mΩ	+0.06mΩ	+0.08 mΩ
Condition of PTH	No Damage	No Damage	No Damage
1.5 x 0.81mm Compliant Pin @ 12.5 Amperes Autosplice Number: 7-V5005-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.69 mΩ	<2.27 mΩ	<2.27 mΩ
Δ Contact Resistance (post test)	+029 mΩ	+0.09 mΩ	-0.03 mΩ
CPIR (pre test)	<1.55 mΩ	<2.05 mΩ	<1.93 mΩ
Δ CPIR (post test)	+0.04 mΩ	+0.06mΩ	+0.03 mΩ
Condition of PTH	No Damage	No Damage	No Damage
6.0 x 0.81mm Compliant Pin @ 25.0 Amperes Autosplice Number: 7-V5008-015TT			

Thermal Cycling with Humidity:

SAE/USCAR-2 – Revision 4 - Section 5.6.2

The following terminals were inserted into PCBs and subjected to 40 temperature/humidity cycles. Each cycle requires 8 hours to complete and followed the following profile:

1. Start cycle at -40°C (Relative Humidity uncontrolled)
2. Ramp to 87.5°C @ 80-95% (Relative Humidity over 30 minutes)
3. Dwell 87.5°C @ 80-95% (Relative Humidity for 4 hours)
4. Ramp to 125°C over 30 minutes (maximum transition time)
5. Dell at 125°C (Relative Humidity uncontrolled) for 1.5 hours
6. Ramp from 125°C to –40°C within 1 hour
7. Dwell at -40°C (Relative Humidity uncontrolled) for 30 minutes.

Examination of the samples following completion of the exposure found no evidence of physical damage. None of the samples exhibited a change in CPIR that exceeded 1 mΩ.

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.86 mΩ	<2.91 mΩ	<2.89 mΩ
ΔContact Resistance (post test)	+0.02 mΩ	+0.38 mΩ	+0.16 mΩ
CPIR (pre test)	<1.86 mΩ	<2.83 mΩ	<2.77 mΩ
ΔCPIR (post test)	+0.07 mΩ	+0.32 mΩ	+0.21 mΩ
1.0 x 0.64mm Compliant Pin @ 10.0 Amperes Autosplice Number: 7-V5004-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.49 mΩ	<2.44 mΩ	<2.35 mΩ
ΔContact Resistance (post test)	+0.36 mΩ	+0.26 mΩ	+0.43 mΩ
CPIR (pre test)	<1.57 mΩ	<2.49 mΩ	<2.56 mΩ
ΔCPIR (post test)	+0.04 mΩ	+0.02 mΩ	+0.01 mΩ
1.5 x 0.81mm Compliant Pin @ 12.5 Amperes Autosplice Number: 7-V5005-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.68 mΩ	<2.68 mΩ	<2.05 mΩ
ΔContact Resistance (post test)	+0.08 mΩ	+0.20 mΩ	+0.29 mΩ
CPIR (pre test)	<1.57 mΩ	<2.38 mΩ	<1.89 mΩ
ΔCPIR (post test)	+0.03 mΩ	+0.02 mΩ	-0.01 mΩ
6.0 x 0.81mm Compliant Pin @ 25.0 Amperes Autosplice Number: 7-V5008-015TT			

Mechanical Shock and Vibration Testing:

SAE/USCAR-2 – Revision 4 - Section 5.4.6

The following terminals were inserted into PCBs and exposed to shock and vibration as follows:

- 5 blows per direction per axis were applied for a total of 30 blows. Each blow measured 35 G's for 11 milliseconds, half sine in accordance with USCAR and EIA 364, test procedure 27.
- After completion of the shock exposure, random vibration tests were performed in accordance with USCAR and EIA 364, test procedure 28 for 8 hours duration per axis with a total of 3 axes.
- Samples were allowed to return to ambient conditions for 48 hours prior to variable measurements.

Examination of the samples following completion of the exposure found no evidence of physical damage. None of the samples exhibited a change in CPIR that exceeded 1 mΩ.

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.82 mΩ	<2.99 mΩ	<2.88 mΩ
ΔContact Resistance (post test)	+0.09mΩ	+0.16 mΩ	+0.07 mΩ
CPIR (pre test)	<1.78 mΩ	<2.86 mΩ	<2.74 mΩ
ΔCPIR (post test)	+0.07 mΩ	+0.09 mΩ	+0.89 mΩ
1.0 x 0.64mm Compliant Pin @ 10.0 Amperes Autosplice Number: 7-V5004-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.78 mΩ	<2.86 mΩ	<2.84 mΩ
ΔContact Resistance (post test)	+0.18 mΩ	+0.07 mΩ	+0.05 mΩ
CPIR (pre test)	<1.69 mΩ	<2.59 mΩ	<2.57 mΩ
ΔCPIR (post test)	+0.03 mΩ	+0.01 mΩ	+0.02 mΩ
1.5 x 0.81mm Compliant Pin @ 12.5 Amperes Autosplice Number: 7-V5005-015TT			

	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.65 mΩ	<2.18 mΩ	<1.88 mΩ
ΔContact Resistance (post test)	+0.10mΩ	+0.12 mΩ	+0.24 mΩ
CPIR (pre test)	<1.56 mΩ	<1.99 mΩ	<1.76 mΩ
ΔCPIR (post test)	+0.02 mΩ	+0.02 mΩ	+0.05 mΩ
6.0 x 0.81mm Compliant Pin @ 25.0 Amperes Autosplice Number: 7-V5008-015TT			

Current Cycling Tests:

SAE/USCAR -2 – Revision 4 – Section 5.3.4

This is an accelerated age test that approximates 10 years of use. The cycles stress the samples through expansion and contraction, while the high temperature portion of the cycle promote oxidation, inter-metallic growth and stress relaxation. Sample terminals were inserted into PCBs and subjected to current cycling for 1008 hours total duration. Each cycle consisted of being energized to the current level listed below, for 45 minutes, followed by 15 minutes de-energized. Temperature rise was measured 30 minutes into the "energized" portion of the cycle.

Examination of the samples following completion of the exposure, found no evidence of physical damage and none of the samples exhibited a change in CPIR that exceeded 1 mΩ.

	HASL PCB	Cu PCB	Au PCB	Observation
Contact Resistance (pre test)	<1.97 mΩ	<1.73 mΩ	<1.79 mΩ	No Damage
CPIR (pre test)	<1.65 mΩ	<1.57mΩ	<1.71mΩ	No Damage
Current Cycling: 5 Cycles	24.6°C	24.6°C	24.6°C	No Damage
250 Cycles	24.8°C	24.8°C	24.8°C	No Damage
500 Cycles	24.5°C	24.5°C	24.5°C	No Damage
750 Cycles	26.1°C	26.1°C	26.1°C	No Damage
1014 Cycles	24.1°C	24.1°C	24.1°C	No Damage
Δ CPIR (post test)	+0.29 mΩ	+0.24 mΩ	+0.22 mΩ	No Damage
Δ Contact Resistance (post test)	+0.07mΩ	+0.24 mΩ	+0.17 mΩ	No Damage
0.64 x 0.64mm Compliant Pin @ 7.5 Amperes Autosplice Number: 7-V5007-015TT				

	HASL PCB	Cu PCB	Au PCB	Observation
Contact Resistance (pre test)	<1.72 mΩ	<2.46 mΩ	<2.29 mΩ	No Damage
CPIR (pre test)	<1.41 mΩ	<1.48mΩ	<1.58mΩ	No Damage
Current Cycling: 5 Cycles	18.3 °C	18.7 °C	16.8 °C	No Damage
250 Cycles	19.5 °C	21.5 °C	19.2 °C	No Damage
500 Cycles	19.4 °C	21.7 °C	18.8 °C	No Damage
750 Cycles	19.6 °C	21.7 °C	19.0 °C	No Damage
1014 Cycles	19.6 °C	21.8 °C	18.9 °C	No Damage
Δ CPIR (post test)	+0.29 mΩ	+0.24 mΩ	+0.22 mΩ	No Damage
Δ Contact Resistance (post test)	+0.07mΩ	+0.24 mΩ	+0.17 mΩ	No Damage
1.5 x 0.81mm Compliant Pin @ 12.5 Amperes Autosplice Number: 7-V5005-015TT				

	HASL PCB	Cu PCB	Au PCB	Observation
Contact Resistance (pre test)	<1.41mΩ	<1.64mΩ	<1.47mΩ	No Damage
CPIR (pre test)	N/A	N/A	N/A	No Damage
Current Cycling: 5 Cycles	19.4 °C	22.4 °C	20.6 °C	No Damage
250 Cycles	22.7 °C	27.1 °C	22.4 °C	No Damage
500 Cycles	22.7 °C	26.9 °C	21.9 °C	No Damage
750 Cycles	22.3 °C	26.7 °C	23.1 °C	No Damage
1014 Cycles	21.9 °C	24.8 °C	20.5 °C	No Damage
Δ CPIR (post test)	N/A	N/A	N/A	No Damage
Δ Contact Resistance (post test)	+0.20mΩ	+0.17mΩ	+0.19 mΩ	No Damage
0.64 x 0.64mm Soldered Pin 28%IACS @ 7.5 Amperes Autosplice Number8-251205000000TT				

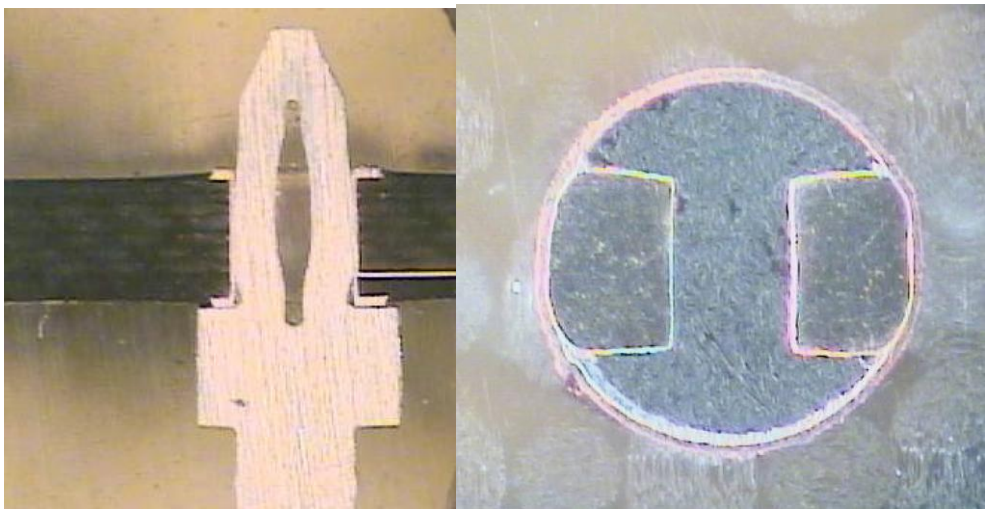
Plated Through Hole Integrity:

EIA Publication 364

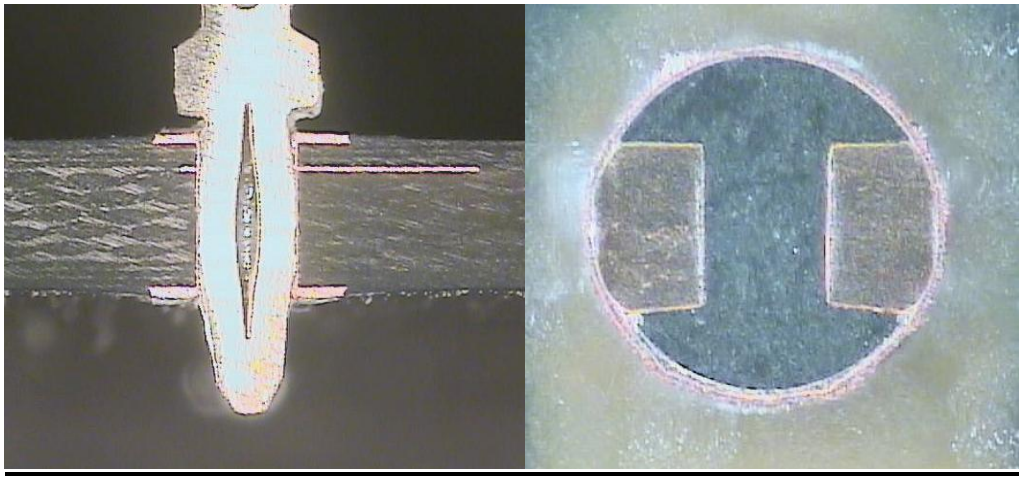
Using the “minimum” holes on the HASL PCBs having the 5oz copper traces on the outer surfaces and a center trace of ½ oz copper, 4 samples each of the following terminals were inserted and extracted into PCBs. Upon the third insertion the terminals were left in place for examination. Below are cross sections of terminals examined in the horizontal and vertical plane.

1.0 x 0.64mm	Compliant	7-V5004-015TT
1.5 x 0.81mm	Compliant	7-V5005-015TT

.81 thick Compliant Sections



.64 thick Compliant Sections

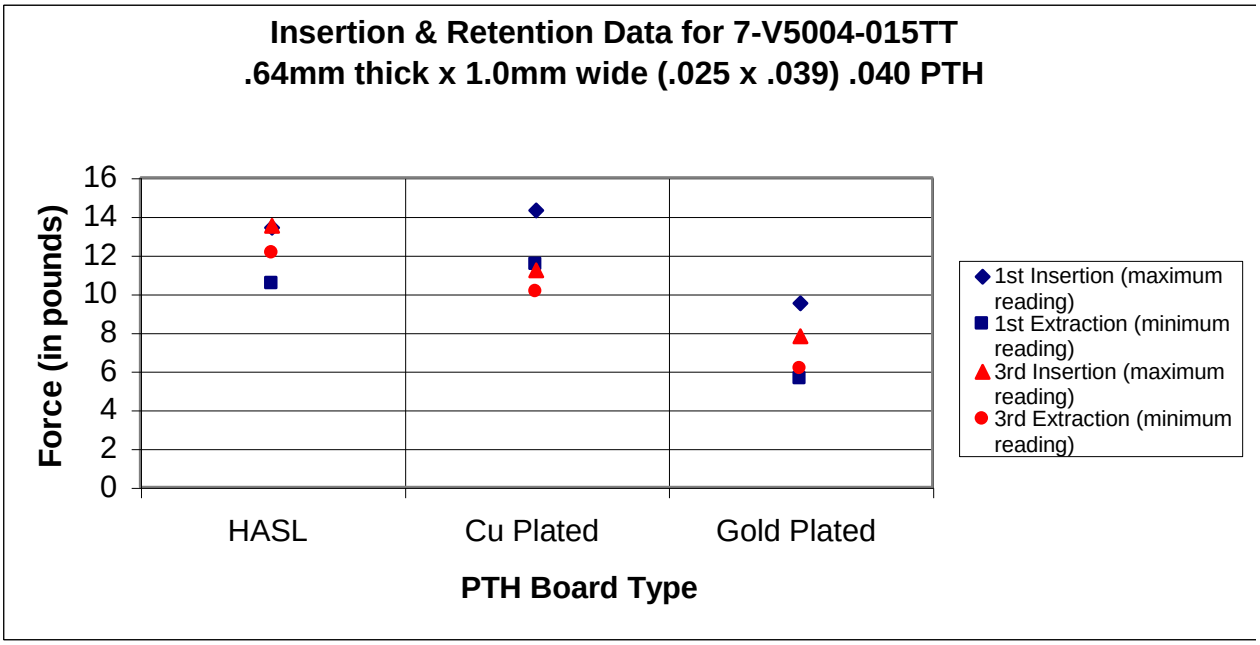


The examination found no evidence of physical damage. Hole deformation did not exceed a radius of 0.0015 – 0.002" radius (measured from the drilled hole) and copper plating was in evidence between the drilled holes and compliant pins.

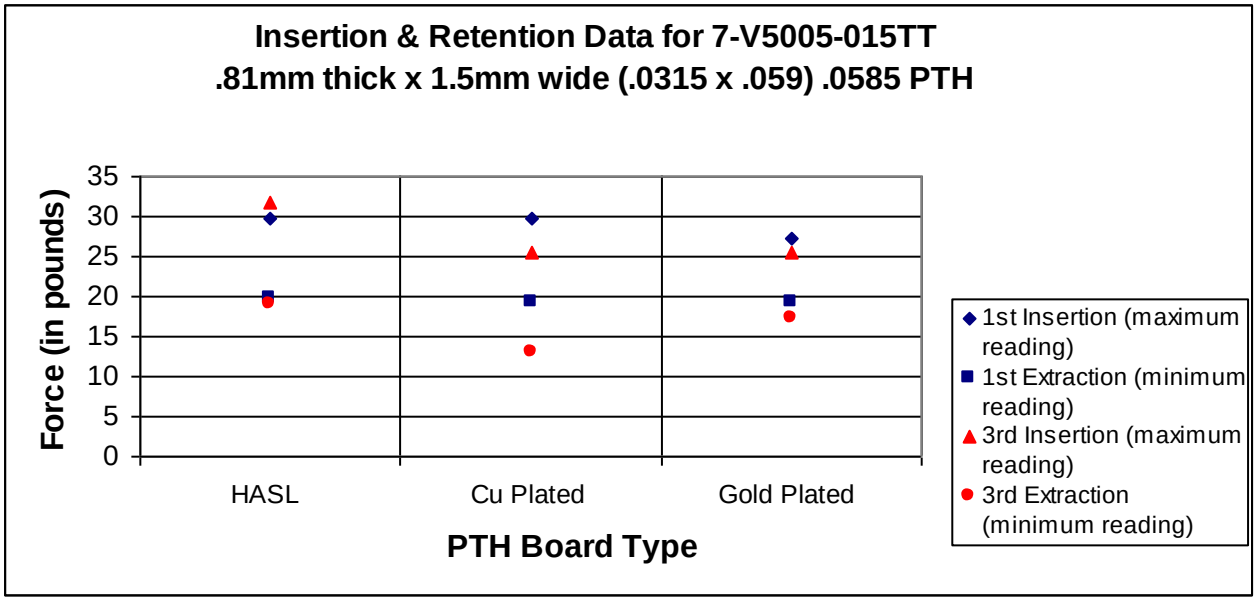
Terminal Insertion and Retention Data:

EIA Publication 364

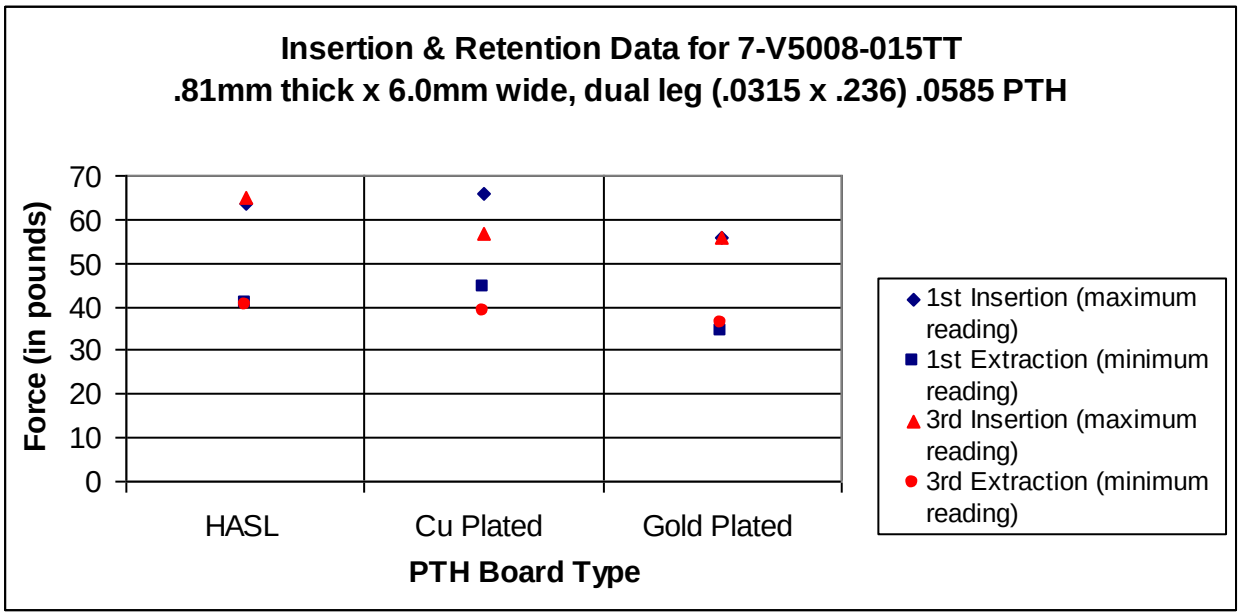
Pins were inserted in PCBs having HASL, Copper and Gold plating for the following tests. CPIR and Peak force data was recorded for *1st and 3rd terminal insertions and extractions*. Each PCB had plated through holes at maximum, minimum and nominal diameters in order to confirm operation over the full range of allowable PCB conditions.



	HASL	Cu Plated	Gold Plated
1st Insertion (maximum reading)	13.4 LBS	14.3 LBS	9.5 LBS
Initial CPIR (after 1st insertion)	<1.23 mΩ	<1.26 mΩ	<1.43 mΩ
1st Extraction (minimum reading)	10.5 LBS	11.5 LBS	5.6 LBS
Inspect Condition of PTH	- No Damage -		
3rd Insertion (maximum reading)	13.5 LBS	11.2 LBS	7.8 LBS
Δ CPIR (change after 3rd insertion)	-0.01 mΩ	-0.04 mΩ	+0.04 mΩ
3rd Extraction (minimum reading)	12.1 LBS	10.1 LBS	6.1 LBS
.64 x 1mm Compliant Pin	Autosplice Part Number: 7-V5004-015TT		



	HASL	Cu Plated	Gold Plated
1st Insertion (maximum reading)	29.7 LBS	29.8 LBS	27.3 LBS
Initial CPIR (after 1st insertion)	<1.18 mΩ	<1.03 mΩ	<1.04 mΩ
1st Extraction (minimum reading)	19.8 LBS	19.2 LBS	19.3 LBS
Inspect Condition of PTH	- No Damage -		
3rd Insertion (maximum reading)	31.7 LBS	25.5 LBS	25.6 LBS
Δ CPIR (change after 3rd insertion)	+0.02 mΩ	+0.00 mΩ	+0.01 mΩ
3rd Extraction (minimum reading)	18.9 LBS	12.9 LBS	17.3 LBS
.81 x 1.5mm Compliant Pin	Autosplice Part Number: 7-V5005-015TT		



	HASL	Cu Plated	Gold Plated
1st Insertion (maximum reading)	63.6 LBS	66 LBS	55.9 LBS
Initial CPIR (after 1st insertion)	<1.23 mΩ	<1.12 mΩ	<1.33 mΩ
1st Extraction (minimum reading)	40.8 LBS	44.5 LBS	34.1 LBS
Inspect Condition of PTH	- No Damage -		
3rd Insertion (maximum reading)	65.0 LBS	56.7 LBS	55.9 LBS
Δ CPIR (change after 3rd insertion)	+0.00 mΩ	+0.02 mΩ	+0.00 mΩ
3rd Extraction (minimum reading)	40.4 LBS	38.9 LBS	36 LBS
6.0 x 0.81mm Compliant Pin	Autosplice Part Number: 7-V5008-015TT		

Exposure to Corrosive, Mixed Flowing Gases:

IEC 60352-5

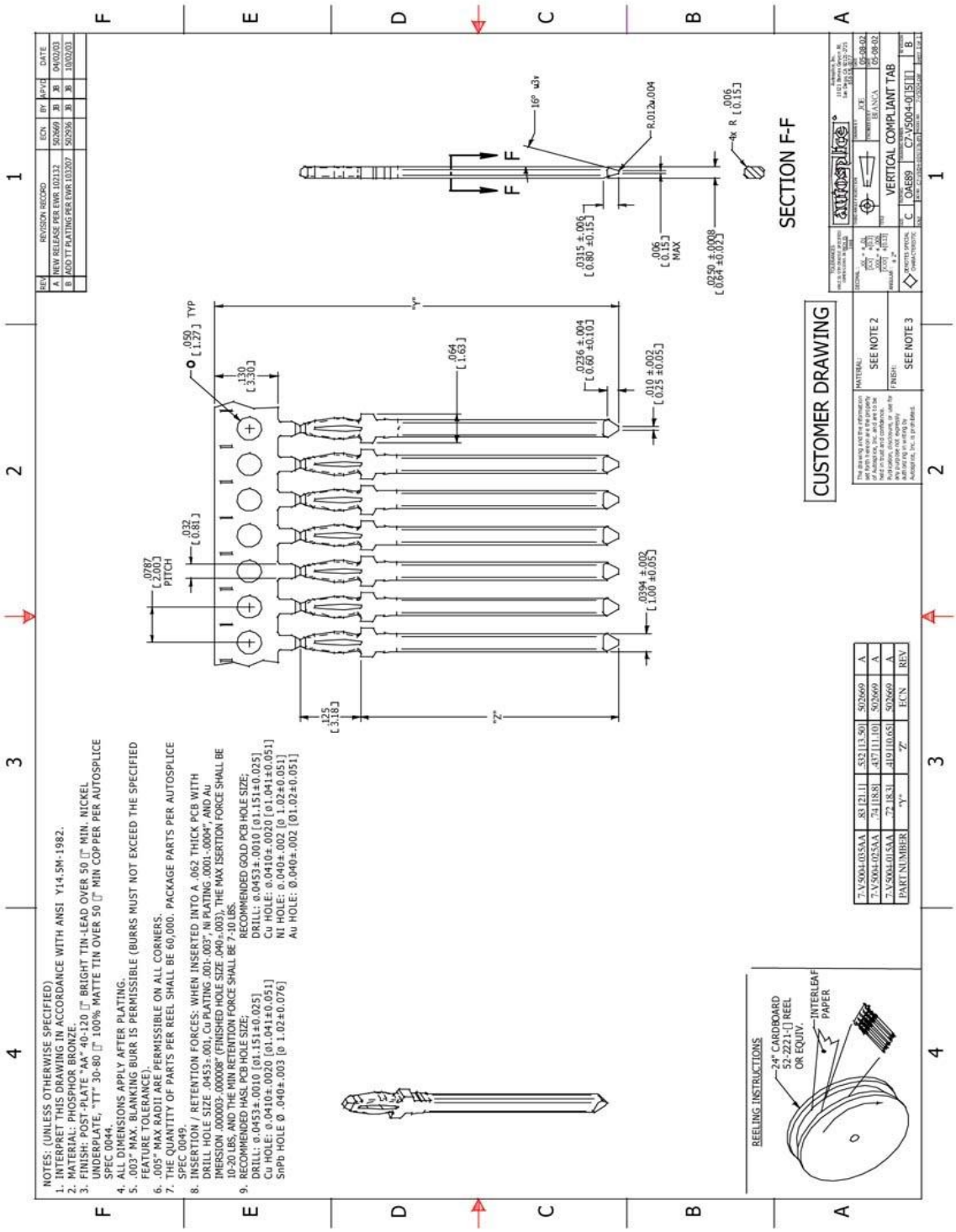
Failure to maintain a gas-tight interface between the compliant pin and the plated-through-hole can lead to degradation of the connection and the performance of that circuit over time.

The following samples were exposed to a mixture of H_2S @ 500ppb and SO_2 at 100ppb at a temperature of 25°C and a relative humidity of 75% for a period of 10 days. Samples that do not achieve a gas-tight connection between the compliant pin and the PTH will allow corrosion and/or oxides to form which can be detected by a change in the CPIR. Changes that exceed 5mΩ where considered a failure. **No *sample experienced a change in resistance >1mΩ.***

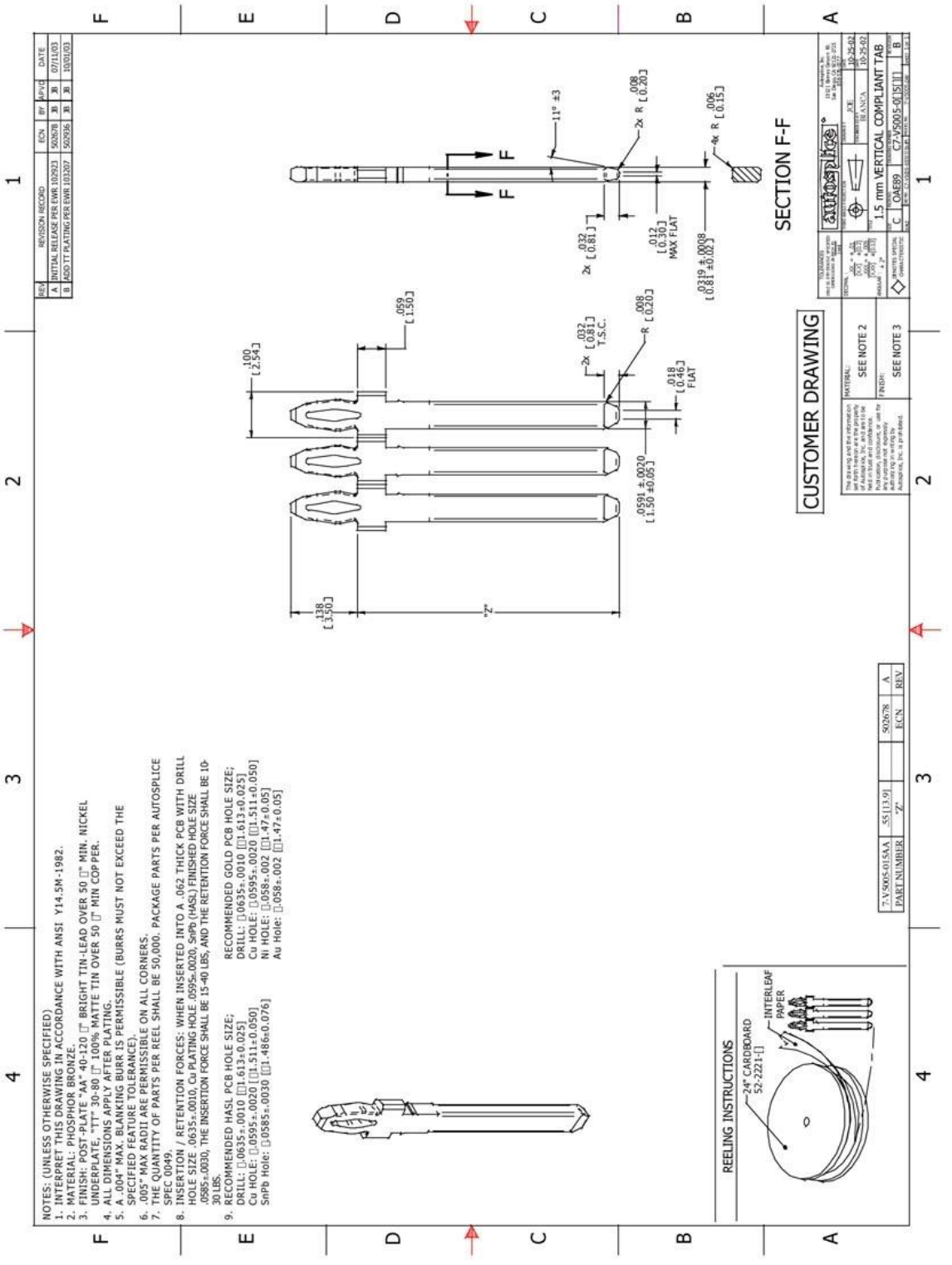
	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.61 mΩ	<1.86 mΩ	<1.98 mΩ
ΔContact Resistance (post test)	+0.07 mΩ	+0.23 mΩ	+0.09 mΩ
CPIR (pre test)	<1.62 mΩ	<1.81 mΩ	<1.79 mΩ
ΔCPIR (post test)	-0.03 mΩ	-0.03 mΩ	-0.03 mΩ
0.64 x 0.64mm Compliant Pin @ 10 Amperes	Autosplice Number: 7-V5007-015TT		

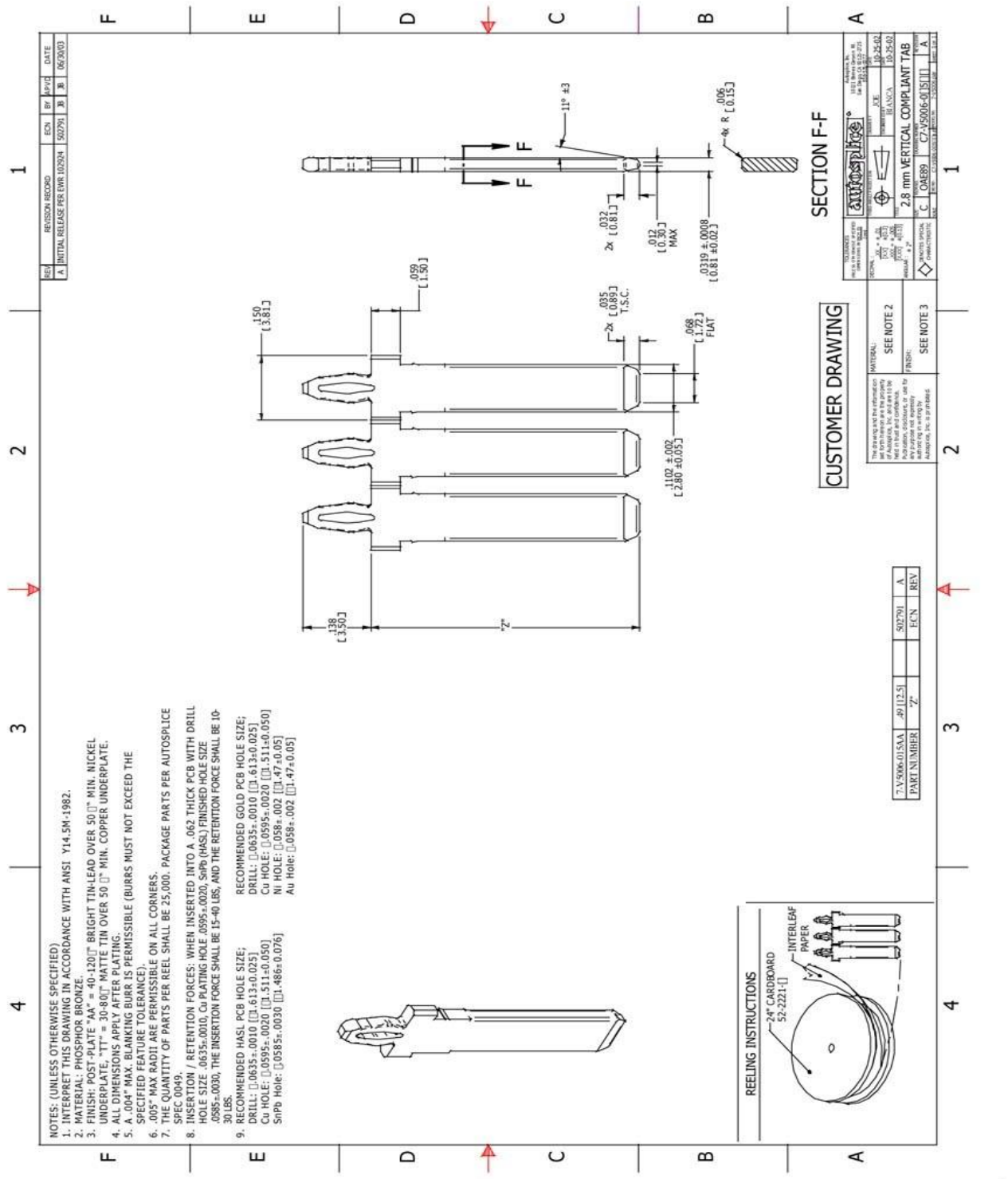
	HASL	Cu Plated	Gold Plated
Contact Resistance (pre test)	<1.57 mΩ	<1.42 mΩ	<1.63 mΩ
ΔContact Resistance (post test)	+0.13 mΩ	+0.23 mΩ	+0.19 mΩ
CPIR (pre test)	<1.47 mΩ	<1.59 mΩ	<1.53 mΩ
ΔCPIR (post test)	+0.01 mΩ	+0.05 mΩ	+0.06 mΩ
1.5 x 0.81mm Compliant Pin @ 12.5 Amperes	Autosplice Number: 7-V5005-015TT		

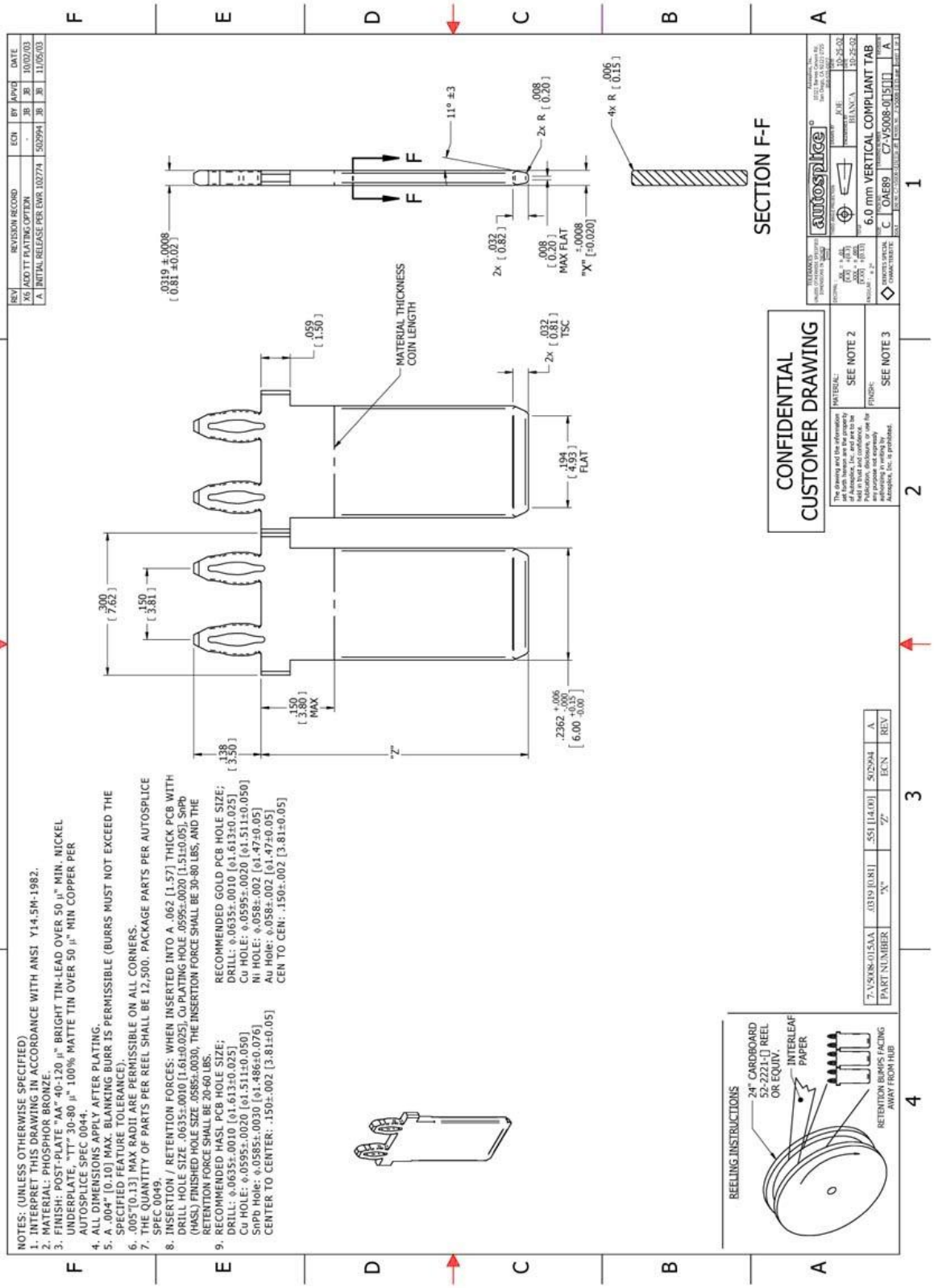
Appendix 1 Compliant Terminals Tested



C7-V5004-015TT


CUSTOMER DRAWING
SECTION F-F
REELING INSTRUCTIONS
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INTERPRET THIS DRAWING IN ACCORDANCE WITH ANSI Y14.5M-1982.
2. MATERIAL: PHOSPHOR BRONZE.
3. FINISH: POST-PLATE "AA" 40-120 □" BRIGHT TIN-LEAD OVER 50 □" MIN. NICKEL UNDERPLATE, "TT" 30-80 □" 100% MATTE TIN OVER 50 □" MIN COP PER.
4. ALL DIMENSIONS APPLY AFTER PLATING.
5. A .004" MAX. BLANKING BURR IS PERMISSIBLE (BURRS MUST NOT EXCEED THE SPECIFIED FEATURE TOLERANCE).
6. .005" MAX RADII ARE PERMISSIBLE ON ALL CORNERS.
7. THE QUANTITY OF PARTS PER REEL SHALL BE 50,000. PACKAGE PARTS PER AUTOSPLICE SPEC 0049.
8. INSERTION / RETENTION FORCES: WHEN INSERTED INTO A .062 THICK PCB WITH DRILL HOLE SIZE .0635±.0010, Cu PLATING HOLE .0595±.0020, SnPb (HASL) FINISHED HOLE SIZE .0585±.0030, THE INSERTION FORCE SHALL BE 15-40 LBS, AND THE RETENTION FORCE SHALL BE 10-30 LBS.
9. RECOMMENDED HASL PCB HOLE SIZE; DRILL: □.0635±.0010 [□1.613±0.025] Cu HOLE: □.0595±.0020 [□1.511±0.050] SnPb Hole: □.0585±.0030 [□1.486±0.076]
RECOMMENDED GOLD PCB HOLE SIZE; DRILL: □.0635±.0010 [□1.613±0.025] Cu HOLE: □.0595±.0020 [□1.511±0.050] Ni HOLE: □.058±.002 [□1.47±0.05] Au Hole: □.0585±.002 [□1.47±0.05]
REV | REVISION RECORD | ECN | BY | APVD | DATE
A | INITIAL RELEASE PER EWR 102923 | 502678 | JB | JB | 07/11/03
B | ADD TT PLATING PER EWR 103207 | 502936 | JB | JB | 10/01/03
7-V-5005-015AA | .55[13.9] | | 502678 | A
PART NUMBER | "Z" | | ECN | REV
24" CARDBOARD 52-2221-[]
INTERLEAF PAPER
1.5 mm VERTICAL COMPLIANT TAB
C7-V5005-0[S][T]
C | OAE89
SEE NOTE 2
SEE NOTE 3
"Z"
.059 [1.50]
.100 [2.54]
.138 [3.50]
.0591 ±.0020 [1.50 ±0.05]
.018 [0.46] FLAT
.012 [0.30] MAX FLAT
.0319 ±.0008 [0.81 ±0.02]
.032 [0.81] T.S.C.
.008 [0.20] R
.006 [0.15] R
11° ±3


CUSTOMER DRAWING
SECTION F-F
2.8 mm VERTICAL COMPLIANT TAB
C7-V5006-015AA
REELING INSTRUCTIONS
24" CARDBOARD
52-2221-[]
INTERLEAF PAPER
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INTERPRET THIS DRAWING IN ACCORDANCE WITH ANSI Y14.5M-1982.
2. MATERIAL: PHOSPHOR BRONZE.
3. FINISH: POST-PLATE "AA" = 40-120[]" BRIGHT TIN-LEAD OVER 50 []" MIN. NICKEL UNDERPLATE. "TT" = 30-80[]" MATTE TIN OVER 50 []" MIN. COPPER UNDERPLATE.
4. ALL DIMENSIONS APPLY AFTER PLATING.
5. A .004" MAX. BLANKING BURR IS PERMISSIBLE (BURRS MUST NOT EXCEED THE SPECIFIED FEATURE TOLERANCE).
6. .005" MAX RADII ARE PERMISSIBLE ON ALL CORNERS.
7. THE QUANTITY OF PARTS PER REEL SHALL BE 25,000. PACKAGE PARTS PER AUTOSPLICE SPEC 0049.
8. INSERTION / RETENTION FORCES: WHEN INSERTED INTO A .062 THICK PCB WITH DRILL HOLE SIZE .0635±.0010, Cu PLATING HOLE .0595±.0020, SnPb (HASL) FINISHED HOLE SIZE .0585±.0030, THE INSERTION FORCE SHALL BE 15-40 LBS, AND THE RETENTION FORCE SHALL BE 10-30 LBS.
9. RECOMMENDED HASL PCB HOLE SIZE; DRILL: []0635±.0010 [[]1.613±0.025] Cu HOLE: []0595±.0020 [[]1.511±0.050] SnPb Hole: []0585±.0030 [[]1.486±0.076]
RECOMMENDED GOLD PCB HOLE SIZE; DRILL: []0635±.0010 [[]1.613±0.025] Cu HOLE: []0595±.0020 [[]1.511±0.050] NI HOLE: []058±.002 [[]1.47±0.05] Au Hole: []058±.002 [[]1.47±0.05]
REV A INITIAL RELEASE PER EWR 102924 ECN 502791 BY JB APVD JB DATE 06/30/03
C7-V5006-015AA .89 [22.5] 502791 A
PART NUMBER "Z" ECN REV
SEE NOTE 2
SEE NOTE 3
.150 [3.81]
.059 [1.50]
.035 [0.89] T.S.C.
.068 [1.72] FLAT
.1102 ±.002 [2.80 ±0.05]
.138 [3.50]
"Z"
11° ±3
.032 [0.81]
.012 [0.30] MAX
.0319 ±.0008 [0.81 ±0.02]
4x R .006 [0.15]



C7-V5008-015TT