Project Number:	Tracking Code: TC0840-PTF-2006		
Requested by: David Fletcher	Date: 9/30/2008	Product Rev: E	
Part #: PTF-130-01-S-D	Lot #: 1	Tech: Caleb Strickland & Troy Cook	Eng: Troy Cook
Part description: PTF			Qty to test: 60
Test Start: 09/30/2008	Test Completed: 11/12/2008		

ENGAGEMENT FORCE & CURRENT RATINGS OF ASSEMBLIES AND CONTACTS MATED WITH VARIOUS PLATING AND HOLE DIAMETERS

PART DESCRIPTION

PTF-130-01-S-D

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to IS0 10012-l and ANSI/NCSL 2540-1, as applicable.

SCOPE

To perform the following tests: Same procedure as used in: Perform engagement/separation test on various hole diameters and plating. All electical testing is based on data results from TC0417--0423.

APPLICABLE DOCUMENTS

Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the parts to be used for LLCR and DWV/IR testing were cleaned according to TLWI-0001.
4) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
5) The automated procedure is used with aqueous compatible soldering materials.
6) Parts not intended for testing LLCR and DWV/IR are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.

FLOWCHARTS

	Perform Engagement on the pins		
TEST STEP	**GROUP A** **10 Contacts (min)** **Engagement** **Sn/Pb Board** **.031 DIA PTH**	**GROUP B** **10 Contacts (min)** **Engagement** **Au Immersion Board** **.031 DIA PTH**	**GROUP C** **10 Contacts (min)** **Engagement** **Ag Immersion Board** **.031 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

	Only perform Engagement on the full part #		
TEST STEP	**GROUP A1** **5 Connectors (min)** **Engagement** **Sn/Pb Board** **.031 DIA PTH**	**GROUP B1** **5 Connectors (min)** **Engagement** **Au Immersion Board** **.031 DIA PTH**	**GROUP C1** **5 Connectors (min)** **Engagement** **Ag Immersion Board** **.031 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

Engagement/Separation= EIA-364-37, Method B (approved mating component)

	Perform Engagement on the pins		
TEST STEP	**GROUP A** **10 Contacts (min)** **Engagement** **Sn/Pb Board** **.032 DIA PTH**	**GROUP B** **10 Contacts (min)** **Engagement** **Au Immersion Board** **.032 DIA PTH**	**GROUP C** **10 Contacts (min)** **Engagement** **Ag Immersion Board** **.032 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

	Only perform Engagement on the full part #		
TEST STEP	**GROUP A1** **5 Connectors (min)** **Engagement** **Sn/Pb Board** **.032 DIA PTH**	**GROUP B1** **5 Connectors (min)** **Engagement** **Au Immersion Board** **.032 DIA PTH**	**GROUP C1** **5 Connectors (min)** **Engagement** **Ag Immersion Board** **.032 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

Engagement/Separation= EIA-364-37, Method B (approved mating component)

FLOWCHARTS Continued

	Perform Engagement on the pins		
TEST STEP	**GROUP A** **10 Contacts (min)** **Engagement** **Sn/Pb Board** **.033 DIA PTH**	**GROUP B** **10 Contacts (min)** **Engagement** **Au Immersion Board** **.033 DIA PTH**	**GROUP C** **10 Contacts (min)** **Engagement** **Ag Immersion Board** **.033 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

	Only perform Engagement on the full part #		
TEST STEP	**GROUP A1** **5 Connectors (min)** **Engagement** **Sn/Pb Board** **.033 DIA PTH**	**GROUP B1** **5 Connectors (min)** **Engagement** **Au Immersion Board** **.033 DIA PTH**	**GROUP C1** **5 Connectors (min)** **Engagement** **Ag Immersion Board** **.033 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

Engagement/Separation= EIA-364-37, Method B (approved mating component)

	Perform Engagement on the pins		
TEST STEP	**GROUP A** **10 Contacts (min)** **Engagement** **Sn/Pb Board** **.034 DIA PTH**	**GROUP B** **10 Contacts (min)** **Engagement** **Au Immersion Board** **.034 DIA PTH**	**GROUP C** **10 Contacts (min)** **Engagement** **Ag Immersion Board** **.034 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

	Only perform Engagement on the full part #		
TEST STEP	**GROUP A1** **5 Connectors (min)** **Engagement** **Sn/Pb Board** **.034 DIA PTH**	**GROUP B1** **5 Connectors (min)** **Engagement** **Au Immersion Board** **.034 DIA PTH**	**GROUP C1** **5 Connectors (min)** **Engagement** **Ag Immersion Board** **.034 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

Engagement/Separation= EIA-364-37, Method B (approved mating component)

FLOWCHARTS Continued

	Perform Engagement on the pins		
TEST STEP	**GROUP A** **10 Contacts (min)** **Engagement** **Sn/Pb Board** **.035 DIA PTH**	**GROUP B** **10 Contacts (min)** **Engagement** **Au Immersion Board** **.035 DIA PTH**	**GROUP C** **10 Contacts (min)** **Engagement** **Ag Immersion Board** **.035 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

	Only perform Engagement on the full part #		
TEST STEP	**GROUP A1** **5 Connectors (min)** **Engagement** **Sn/Pb Board** **.035 DIA PTH**	**GROUP B1** **5 Connectors (min)** **Engagement** **Au Immersion Board** **.035 DIA PTH**	**GROUP C1** **5 Connectors (min)** **Engagement** **Ag Immersion Board** **.035 DIA PTH**
01	Engagement	Engagement	Engagement
02	Data Review	Data Review	Data Review

Engagement/Separation= EIA-364-37, Method B (approved mating component)

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

ENGAGEMENT/SEPARATION (FOR CONTACTS TESTED IN THE HOUSING):

1) Reference document: EIA-364-37, *Contact Engagement and Separation Force Test Procedure for Electrical Connectors*.
2) Unless otherwise noted a minimum of twenty-five contacts shall be tested.
3) The insertion/withdrawal forces for each contact shall be repeated five times.
4) The connector housing shall be placed in a holding fixture that does not interfere with or otherwise influence the insertion of the probe into the contact.
5) Said holding fixture shall be mounted on a floating, adjustable, X-Y table on the base of the Dillon TC^2, computer controlled test stand with a deflection measurement system resolution of 5.0 μm (0.0002").
6) The probe shall be attached to a load cell providing a typical accuracy of ± 0.2%.
7) The deflection rate shall be 5 mm (0.2")/minute nominal (not to exceed 2"/min).
8) The system shall utilize the TC^2 software in order to acquire and record the test data.
9) The acquired data shall be graphed with the deflection data on the X-axis and the force data on the Y-axis.

ENGAGEMENT/SEPARATION (FOR CONTACTS TESTED OUT OF THE HOUSING):

1) Reference document: EIA-364-37, *Contact Engagement and Separation Force Test Procedure for Electrical Connectors*.
2) Unless otherwise noted a minimum of twenty-five contacts shall be tested.
3) The insertion/withdrawal forces for each contact shall be repeated five times.
4) The contacts shall be tested in the loose state, *not* inserted in connector housing.
5) The contacts shall be prepared to allow access to the spring member at the same attitude and deflection level as would occur in actual use.
6) Said holding fixture shall be mounted on a floating, adjustable, X-Y table on the base of the Dillon TC^2, computer controlled test stand with a deflection measurement system resolution of 5.0 μm (0.0002").
7) The probe shall be attached to a load cell providing a typical accuracy of ± 0.2%.
8) The deflection rate shall be 5 mm (0.2")/minute nominal (not to exceed 2"/min).
9) The system shall utilize the TC^2 software in order to acquire and record the test data.
10) The acquired data shall be graphed with the deflection data on the X-axis and the force data on the Y-axis.

TEMPERATURE RISE (Current Carrying Capacity, CCC):

1) EIA-364-70, *Temperature Rise versus Current Test Procedure for Electrical Connectors and Sockets*.
2) When current passes through a contact, the temperature of the contact increases as a result of I^2R (resistive) heating.
3) The number of contacts being investigated plays a significant part in power dissipation and therefore temperature rise.
4) The size of the temperature probe can affect the measured temperature.
5) Copper traces on PC boards will contribute to temperature rise:
    a. Self heating (resistive)
    b. Reduction in heat sink capacity affecting the heated contacts
6) A de-rating curve, usually 20%, is calculated.
7) Calculated de-rated currents at three temperature points are reported:
    a. Ambient
    b. 85^{o} C
    c. 95^{o} C
    d. 115^{o} C
8) Typically, neighboring contacts (in close proximity to maximize heat build up) are energized.

9) The thermocouple (or temperature measuring probe) will be positioned at a location to sense the maximum temperature in the vicinity of the heat generation area.
10) A computer program, *TR 803.exe*, ensures accurate stability for data acquisition.
11) Hook-up wire cross section is larger than the cross section of any connector leads/PC board traces, jumpers, etc.
12) Hook-up wire length is longer than the minimum specified in the referencing standard.

RESULTS

Temperature Rise, CCC at 20% de-rating
Tin PCB with 0.031" holes

- **At 95°C, relative to 125°C----------3.1 A with 6 contacts powered in a clustered configuration**

Temperature Rise, CCC at 20% de-rating
Gold PCB with 0.033" holes

- **At 95°C, relative to 125°C----------3.0 A with 6 contacts powered in a clustered configuration**

Temperature Rise, CCC at 20% de-rating
Silver PCB with 0.033" holes

- **At 95°C, relative to 125°C----------2.9 A with 6 contacts powered in a clustered configuration**

Engagement Force: Assembly

- **Au Immersion**
  - **.031"**
    - **Min ---------- 339.5 Lbs**
    - **Max---------- 359.3 Lbs**
  - **.032"**
    - **Min ---------- 294.5 Lbs**
    - **Max---------- 318.6 Lbs**
  - **.033"**
    - **Min ---------- 219.8 Lbs**
    - **Max---------- 253.8 Lbs**
  - **.034"**
    - **Min ---------- 183.5 Lbs**
    - **Max---------- 219.8 Lbs**
  - **.035"**
    - **Min ---------- 130.8 Lbs**
    - **Max---------- 153.8 Lbs**
- **Ag Immersion**
  - **.031"**
    - **Min ---------- 375.4 Lbs**
    - **Max---------- 406.5 Lbs**
  - **.032"**
    - **Min ---------- 335.1 Lbs**
    - **Max---------- 346.1 Lbs**
  - **.033"**
    - **Min ---------- 270.3 Lbs**
    - **Max---------- 291.2 Lbs**
  - **.034"**
    - **Min ---------- 215.4 Lbs**
    - **Max---------- 246.1 Lbs**
  - **.035"**
    - **Min ---------- 136.3 Lbs**
    - **Max---------- 198.9 Lbs**
- **Sn Immersion**
  - **.031"**
    - **Min ---------- 327.4 Lbs**
    - **Max---------- 372.5 Lbs**
  - **.032"**
    - **Min ---------- 305.4 Lbs**
    - **Max---------- 369.2 Lbs**

- **.033”**
  - **Min ---------- 276.9 Lbs**
  - **Max---------- 331.8 Lbs**
- **.035”**
  - **Min ----------91.2 Lbs**
  - **Max---------- 194.5 Lbs**

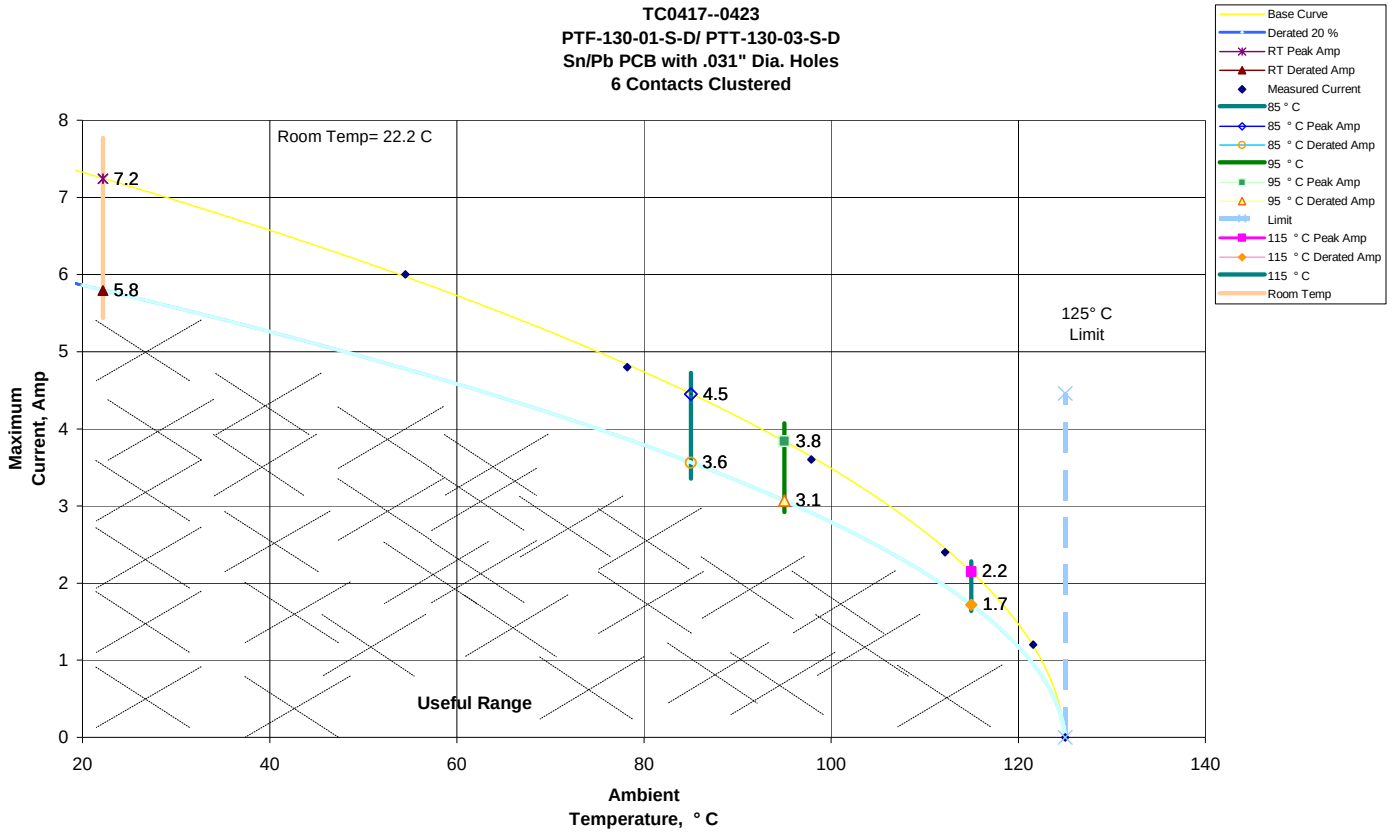
Engagement Force: Contact

- **Au Immersion**
  - **.031”**
    - **Min ---------- 5.47 Lbs**
    - **Max---------- 6.35 Lbs**
  - **.032”**
    - **Min ---------- 4.39 Lbs**
    - **Max---------- 5.95 Lbs**
  - **.033”**
    - **Min ---------- 3.90 Lbs**
    - **Max---------- 4.64 Lbs**
  - **.034”**
    - **Min ---------- 3.46 Lbs**
    - **Max---------- 4.10 Lbs**
  - **.035”**
    - **Min ---------- 2.83 Lbs**
    - **Max---------- 3.37 Lbs**
- **Ag Immersion**
  - **.031”**
    - **Min ---------- 5.42 Lbs**
    - **Max---------- 7.03 Lbs**
  - **.032”**
    - **Min ---------- 5.05 Lbs**
    - **Max---------- 6.00 Lbs**
  - **.033”**
    - **Min ---------- 4.59 Lbs**
    - **Max---------- 5.71 Lbs**
  - **.034”**
    - **Min ---------- 3.81 Lbs**
    - **Max---------- 4.44 Lbs**
  - **.035”**
    - **Min ---------- 2.63 Lbs**
    - **Max---------- 3.37 Lbs**
- **Sn Immersion**
  - **.031”**
    - **Min ---------- 6.74 Lbs**
    - **Max---------- 8.15 Lbs**
  - **.032”**
    - **Min ---------- 6.20 Lbs**
    - **Max---------- 7.42 Lbs**
  - **.033”**
    - **Min ---------- 5.14 Lbs**
    - **Max---------- 6.54 Lbs**
  - **.035”**
    - **Min ---------- 1.85 Lbs**
    - **Max---------- 4.39 Lbs**

DATA SUMMARIES

TEMPERATURE RISE (Current Carrying Capacity, CCC):
Tin PCB, 0.031" Diameter Holes

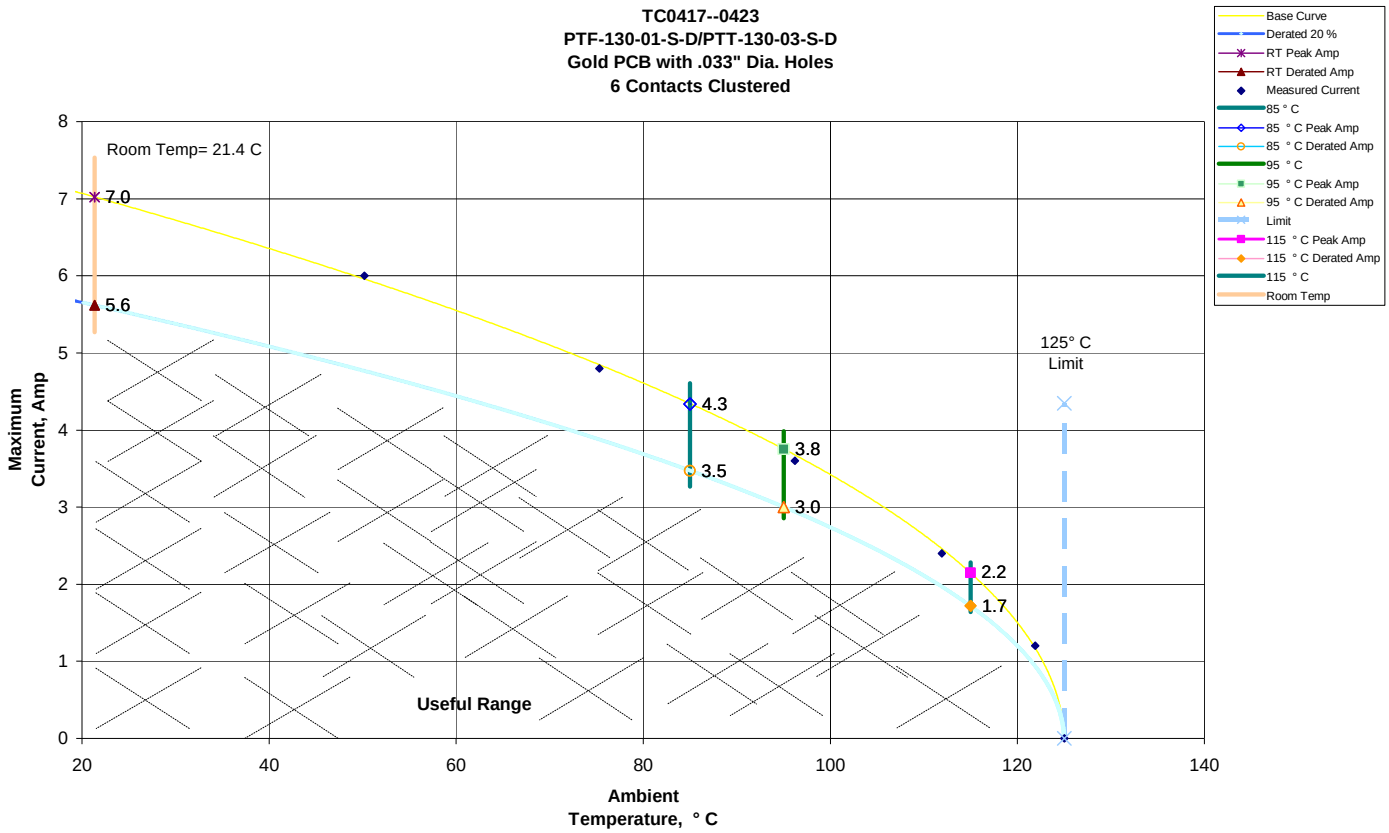
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the MAXIMUM temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes apart, differ less than 1° C (computer controlled data acquisition).
4) Adjacent contacts were powered:
    a. Six adjacent conductors/contacts powered in a 2 X 3 configuration



DATA SUMMARIES Continued

TEMPERATURE RISE (Current Carrying Capacity, CCC):
Gold PCB, 0.033” Diameter Holes

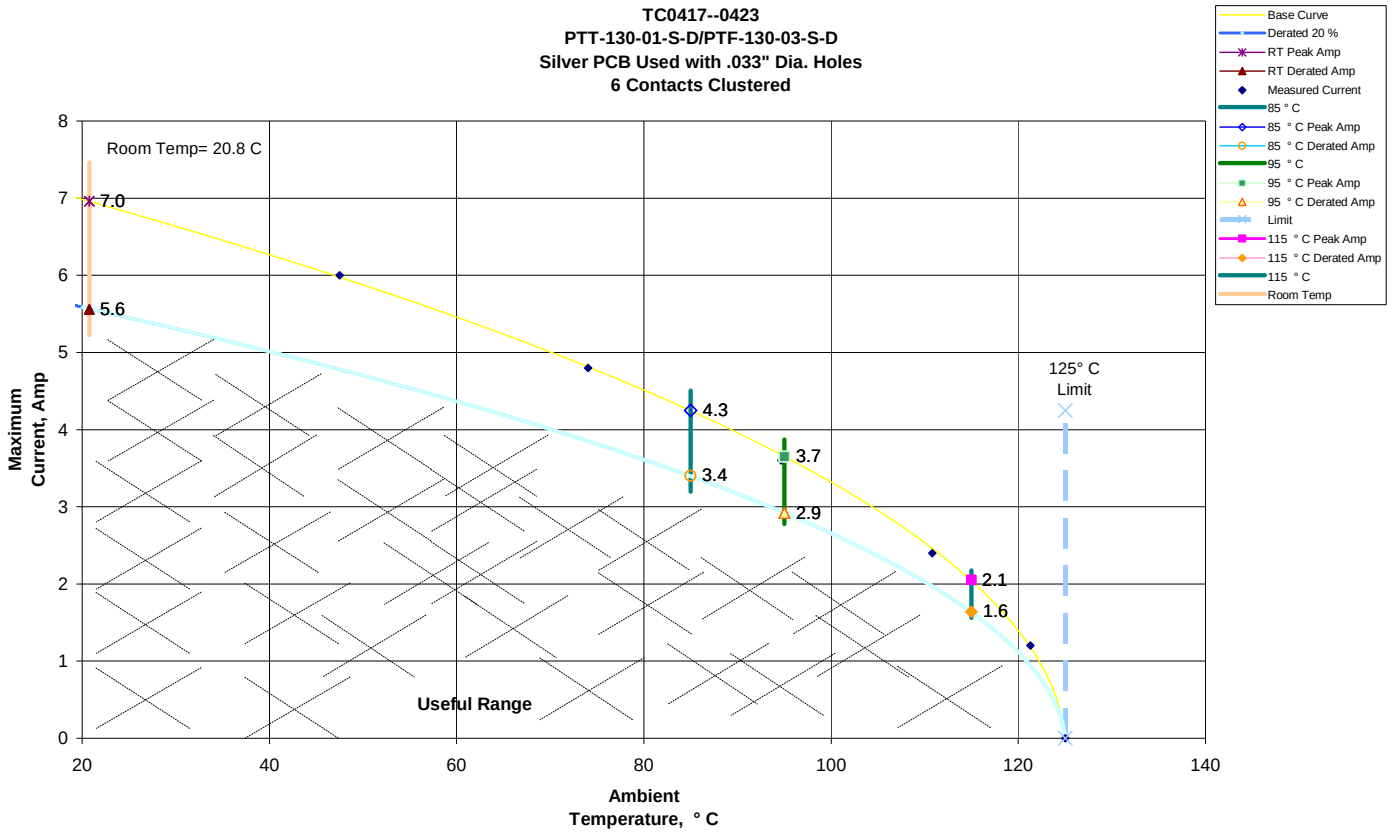
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the MAXIMUM temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes apart, differ less than 1° C (computer controlled data acquisition).
4) Adjacent contacts were powered:
    a. Six adjacent conductors/contacts powered in a 2 X 3 configuration



DATA SUMMARIES Continued

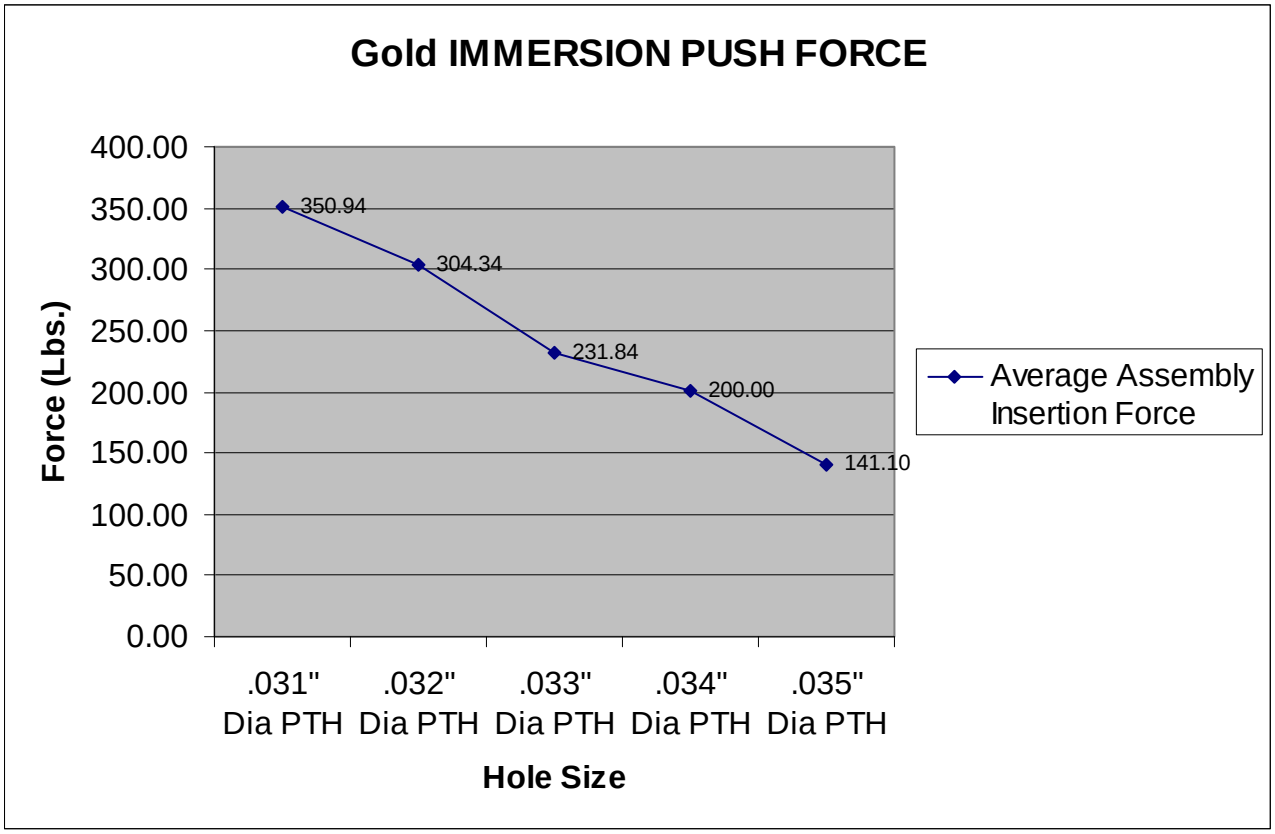
TEMPERATURE RISE (Current Carrying Capacity, CCC):
Silver PCB, 0.033” Diameter Holes

1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the MAXIMUM temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes apart, differ less than 1° C (computer controlled data acquisition).
4) Adjacent contacts were powered:
    a. Six adjacent conductors/contacts powered in a 2 X 3 configuration

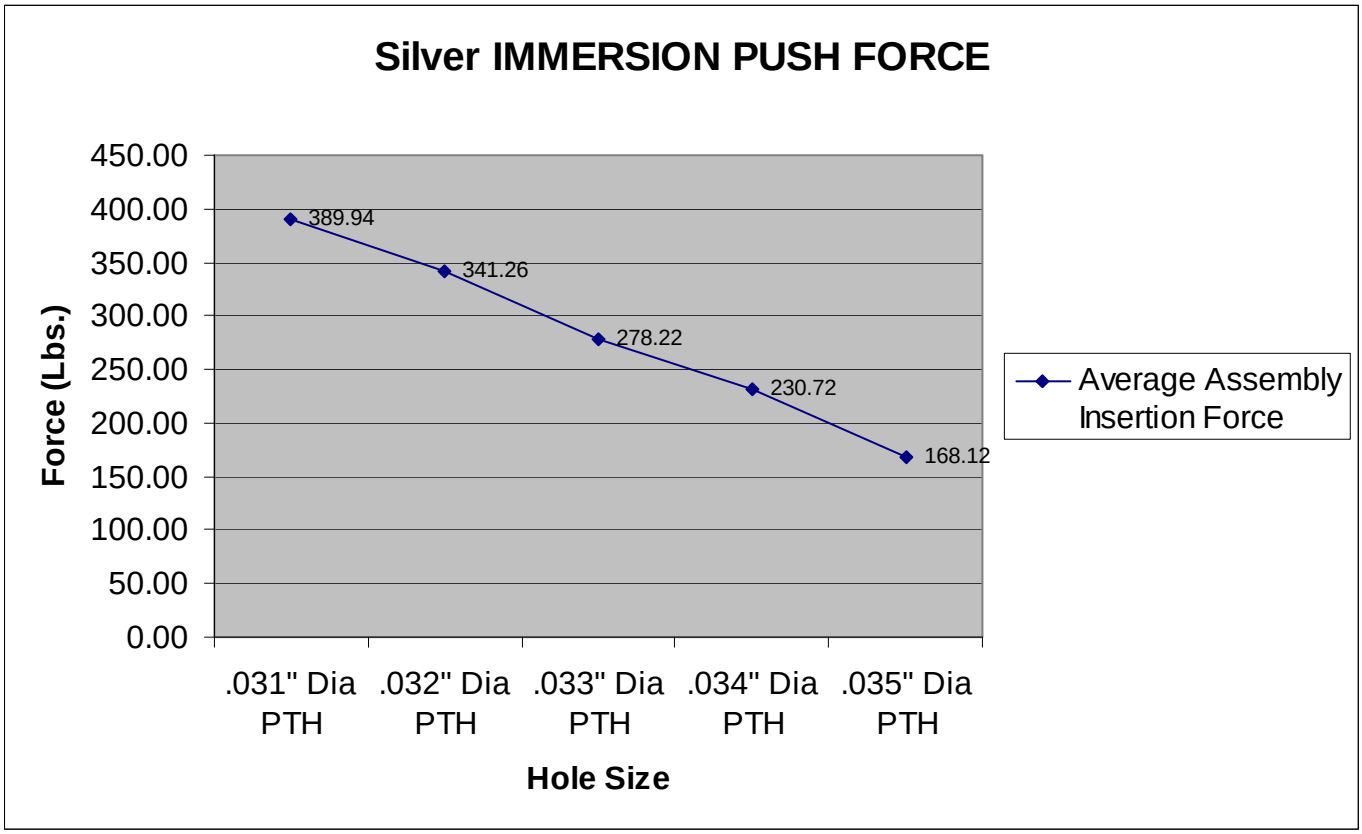


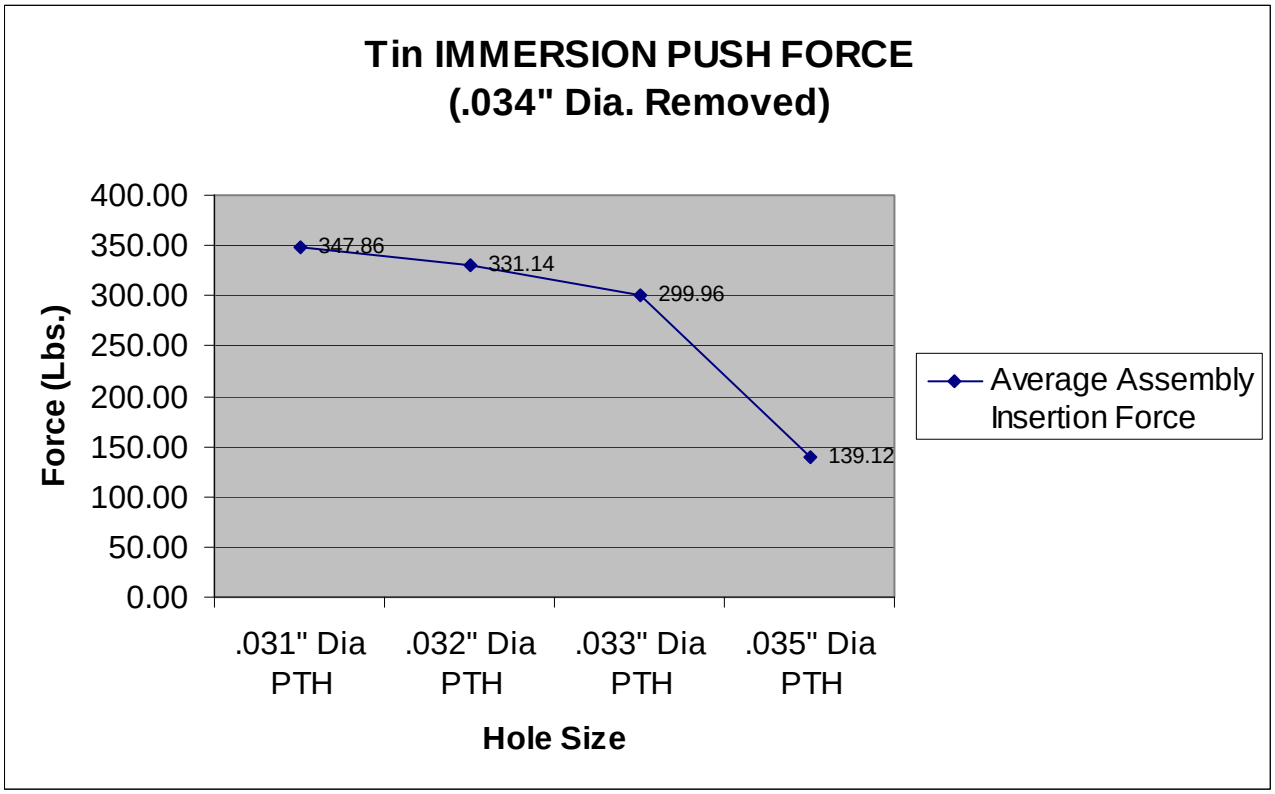
DATA SUMMARIES Continued

ENGAGEMENT/SEPARATION (FOR CONTACTS TESTED IN THE HOUSING):



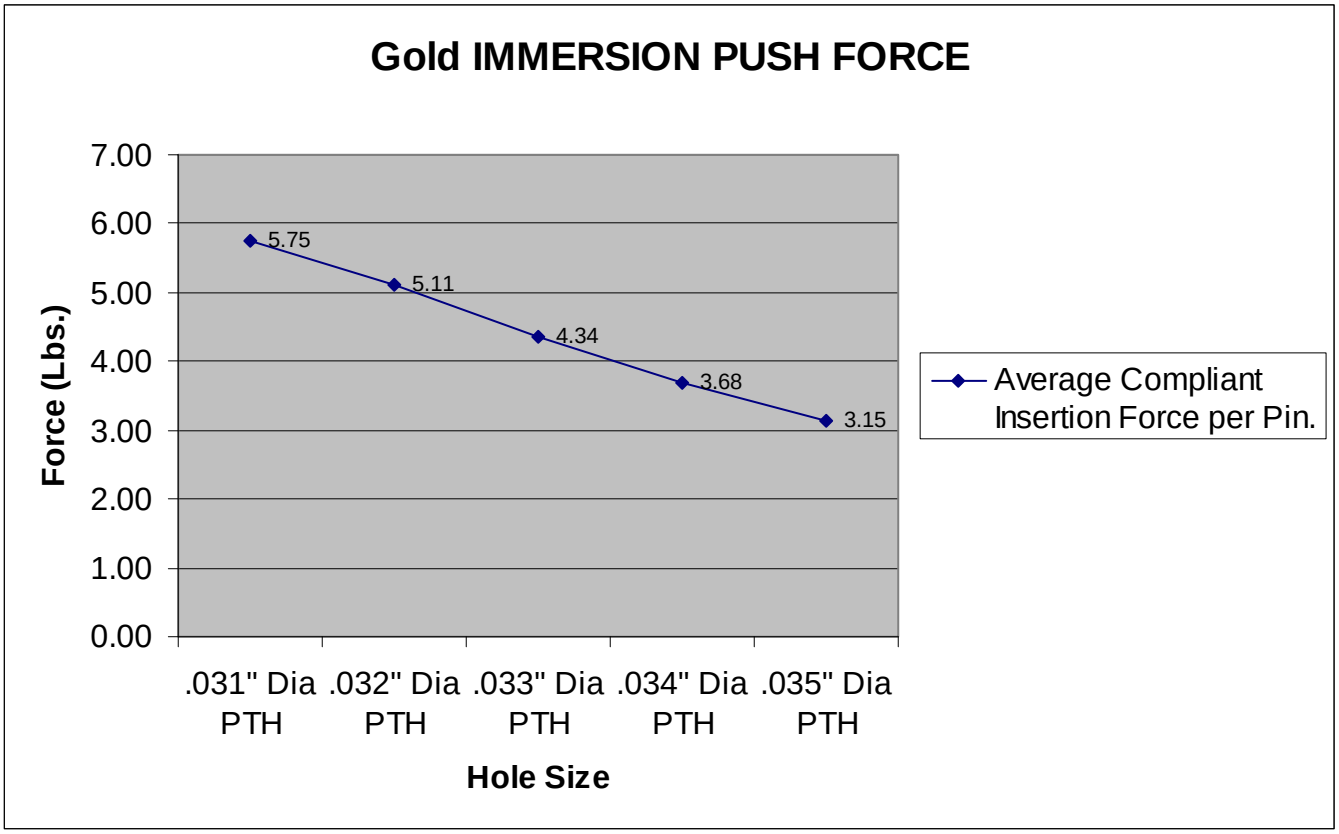
DATA SUMMARIES



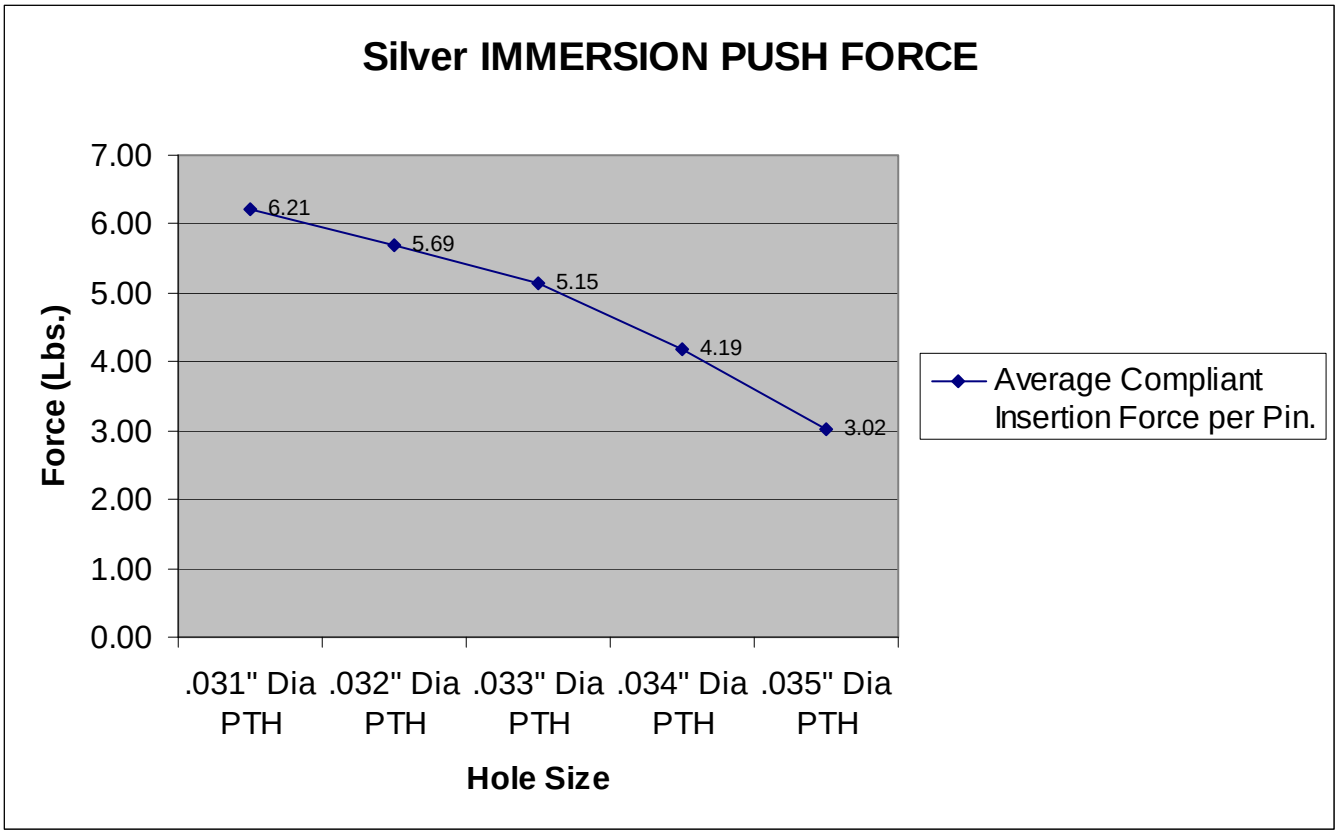


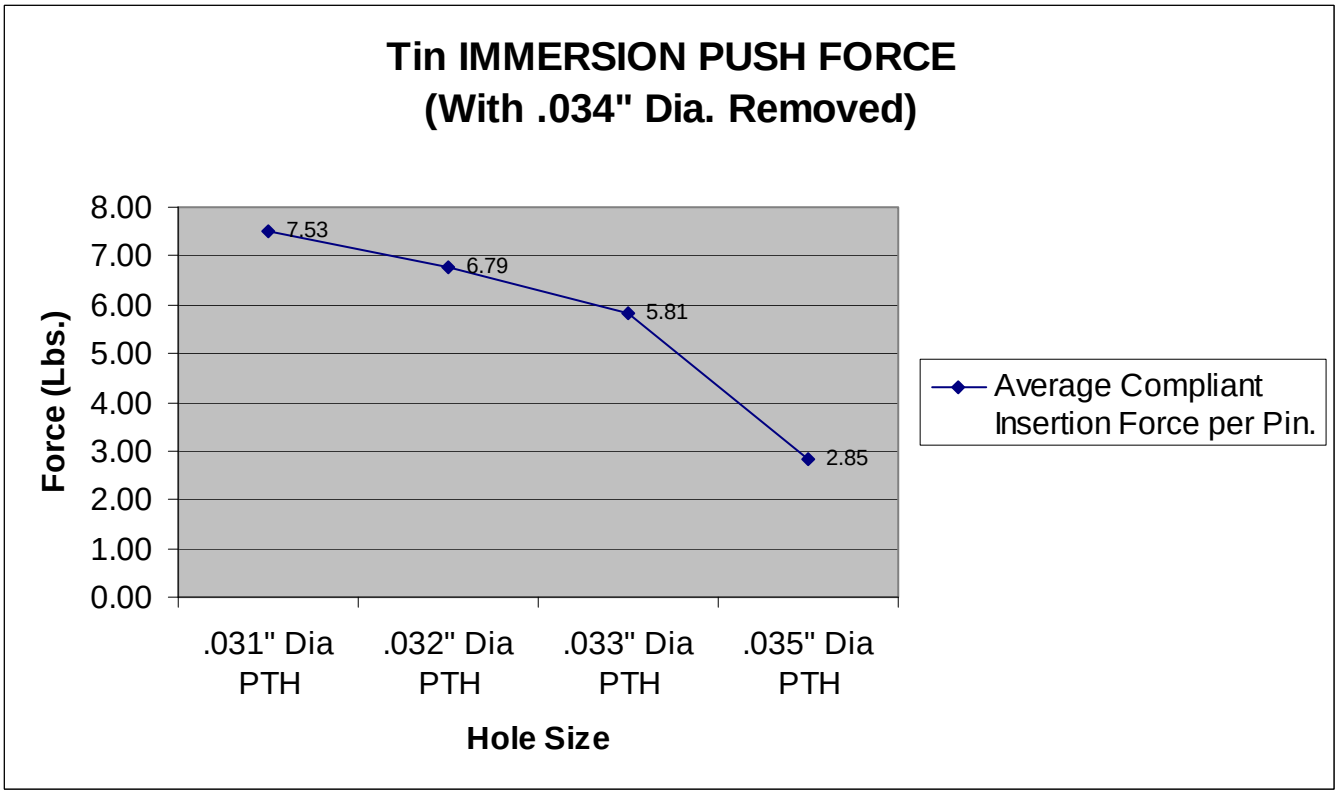
DATA SUMMARIES Continued

ENGAGEMENT/SEPARATION (FOR CONTACTS TESTED OUT OF THE HOUSING):



DATA SUMMARIES Continued





DATA

ENGAGEMENT/SEPARATION (FOR CONTACTS TESTED IN THE HOUSING):

AU IMMERSION DATA									
.031" Diameter		.032" Diameter		.033" Diameter		.034" Diameter		.035" Diameter	
Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)
1	354.90	1	295.60	1	223.10	1	185.70	1	141.80
2	339.50	2	307.60	2	225.20	2	197.80	2	153.80
3	343.90	3	318.60	3	219.80	3	183.50	3	130.80
4	357.10	4	305.40	4	237.30	4	219.80	4	142.80
5	359.30	5	294.50	5	253.80	5	213.20	5	136.30

AG IMMERSION DATA									
.031" Diameter		.032" Diameter		.033" Diameter		.034" Diameter		.035" Diameter	
Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)
1	406.50	1	346.10	1	291.20	1	236.20	1	136.30
2	375.40	2	335.10	2	270.30	2	224.10	2	198.90
3	390.00	3	341.70	3	279.10	3	231.80	3	164.80
4	391.10	4	338.40	4	273.60	4	246.10	4	180.20
5	386.70	5	345.00	5	276.90	5	215.40	5	160.40

AG IMMERSION DATA							
.031" Diameter		.032" Diameter		.033" Diameter		.035" Diameter	
Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)
1	372.50	1	305.40	1	328.50	1	120.90
2	327.40	2	338.40	2	281.30	2	115.40
3	353.80	3	325.20	3	281.30	3	173.60
4	357.10	4	369.20	4	276.90	4	91.20
5	328.50	5	317.50	5	331.80	5	194.50

DATA Continued

ENGAGEMENT/SEPARATION (FOR CONTACTS TESTED OUTSIDE THE HOUSING):

AU IMMERSION DATA

.031" Diameter		.032" Diameter		.033" Diameter		.034" Diameter		.035" Diameter	
Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)
1	5.81	1	4.44	1	3.90	1	3.76	1	3.17
2	5.61	2	5.86	2	4.54	2	3.61	2	3.37
3	5.71	3	4.83	3	4.44	3	3.71	3	3.17
4	5.47	4	4.39	4	4.25	4	3.46	4	3.17
5	5.47	5	5.56	5	4.39	5	3.56	5	3.32
6	5.47	6	5.95	6	3.90	6	3.56	6	3.12
7	5.86	7	5.37	7	4.34	7	3.46	7	2.83
8	5.76	8	4.59	8	4.39	8	3.81	8	3.27
9	5.95	9	5.08	9	4.64	9	4.10	9	2.93
10	6.35	10	5.03	10	4.64	10	3.81	10	3.12

AG IMMERSION DATA

.031" Diameter		.032" Diameter		.033" Diameter		.034" Diameter		.035" Diameter	
Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)
1	6.35	1	5.61	1	5.52	1	4.29	1	3.03
2	5.42	2	5.95	2	4.98	2	4.00	2	3.12
3	7.03	3	5.56	3	5.12	3	4.34	3	2.63
4	6.93	4	5.61	4	5.12	4	4.25	4	2.98
5	5.47	5	5.05	5	5.71	5	4.34	5	2.68
6	5.95	6	5.52	6	5.32	6	4.20	6	3.07
7	6.00	7	5.81	7	4.73	7	4.00	7	3.12
8	5.95	8	5.81	8	4.59	8	3.81	8	3.12
9	6.78	9	6.00	9	5.08	9	4.44	9	3.37
10	6.21	10	6.00	10	5.32	10	4.25	10	3.03

AG IMMERSION DATA

.031" Diameter		.032" Diameter		.033" Diameter		.035" Diameter	
Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)	Sample #	Force (lbs)
1	7.86	1	6.20	1	5.76	1	4.39
2	7.47	2	7.18	2	5.22	2	1.95
3	7.79	3	6.78	3	5.14	3	2.34
4	6.74	4	7.08	4	6.25	4	3.51
5	7.16	5	7.22	5	5.81	5	3.55
6	7.87	6	7.42	6	6.20	6	3.55
7	7.52	7	6.25	7	5.56	7	1.85
8	7.71	8	6.74	8	6.54	8	2.98
9	6.98	9	6.30	9	5.81	9	2.29
10	8.15	10	6.69	10	5.80	10	2.05

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-03
Description: Dillon Quantrol TC2 Test Stand
Manufacturer: Dillon Quantrol
Model: TC2
Serial #: 02-1033-03
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Displacement: +/- 5 micrometers.
… Last Cal: 5/18/07, Next Cal: 5/18/08

Equipment #: LC-2500N-2
Description: 2500 N icell load cell for Dillon Test Stand
Manufacturer: Mecmesin (Dillon/Quantrol)
Model: ILC
Serial #: 08-0020-02
Accuracy: .10% of Capacity
… Last Cal: 02/15/2008, Next Cal: 02/15/2009

Equipment #: Null
Description:
Manufacturer:
Model:
Serial #:
Accuracy:
… Last Cal: , Next Cal: