REVISION HISTORY		
REV	BY	DATE
P1	POC	10/24/2014

Glenair Advanced Band Termination System Slim Standard Band Testing

By: Preston Clover	Date: 10/14/2014	 Glendale, California
Checked: Cece Chen	Date: 10/24/2014	
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Title: Glenair Advanced Band Termination System Slim Standard Band Testing	Document Number: GT-14-75	Revision: P1

Singer Laboratories

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Test Report **Laboratory Report No. GT-14-75**

Test Item(s)/Lab No(s): GT-14-75

Submitted by: Preston Clover

Date: 10/24/2014

Test Results Approved by: Cece Chen, Quality Representative, 10/24/2014.

Purpose:

To test the Slim Standard Band in parallel with the Standard Band, in order to compare their performance characteristics in Shell-to-Shell Conductivity, Random Vibration, Thermal Shock, Temperature Life, and Cable Pull Out.

Important Reference Documents:

1. Qualification Test Plan “Slim Standard Comparison Testing”.
2. AS85049C, Connector Accessories, Electrical General Specification.
3. EIA-364-83, Shell to Shell and Shell to Bulkhead resistance test procedure for electrical connectors.
4. EIA-364-28E, Vibration test procedure for electrical connectors and sockets.
5. MIL-DTL-38999L, Connectors, electrical, circular, miniature, high density, quick disconnect (bayonet, threaded, and breech coupling), environmental resistant, removable crimp and hermetic solder contacts, general specification.

Test Criteria:

The units under test shall be considered to meet the specification requirements when they have successfully completed the following test criteria:

a) No physical damage or loosening of test samples when visually inspected.

b) Pass all shell-to-shell resistance testing before and after every major test category is completed.

Calibrated Test Equipment:

1. Dytran, Accelerometer, Model 3055B6, Serial # 19669
   Calibrated: 5-5-14.
   Calibration due: 5-5-15.
   Singer Labs # AC00001

2. Starrett Pocket Tape, Serial # 14184866
   Calibrated: 5-1-14.
   Calibration due: 5-1-15.
   Singer Labs # DM00001

3. Fluke, True RMS Multimeter Model 287, Serial # 23650184
   Calibrated: 12-3-13.
   Calibration due: 12-3-14.
   Singer Labs # EM00003

4. Fluke, True RMS Multimeter Model 287, Serial # 26060019
   Calibrated: 12-3-13.
   Calibration due: 12-3-14.
   Singer Labs # EM00004

5. Econ, Vibration Controller UCON VT-9002, Serial # 209997978
   Calibrated: 2-20-14.
   Calibration due: 2-19-15.
   Singer Labs # CE00004

6. Glenair, Slim Standard Band Termination Tool 601-109, Serial # 36124
   Calibrated: 8-15-14.
   Calibration due: 8-15-15.

7. Sun Electronic Systems Chamber, Serial # AA2907
   Calibrated: 10-30-13.
   Calibration due: 10-30-15.

8. Tenney Chamber, TJR, Serial # 0909000066-03
   Calibrated: 7-23-14.
   Calibration due: 7-23-15.

Calibration certificates for all equipment attached to this report.

Test Item Identification:

Qualification testing shall be performed on the test items identified in Table 1 in the sequence specified in Table 2 unless otherwise stated herein. Any deviations and/or requests for alternative sequence and/or groupings to the specified requirements shall be submitted in writing and approved by Engineering prior to incorporation. Unless otherwise specified one (1) each of the test items identified in Table 1 shall be used.

TABLE 1

(Test Item Identification)

Test Item Identification Numbers	Band Type	Shell Size	Description of Item Under Test	Test Item Qty.
001 to 004	Slim Standard	11	M85049/88-11N03 Connector with Armorlite Braid Part # 103-051-012	4
005 to 008	Slim Standard	17	M85049/88-17N03 Connector with Armorlite Braid Part # 103-051-016	4
009 to 012	Slim Standard	25	M85049/88-25N03 Connector with Armorlite Braid Part # 103-051-032	4
013 to 016	Slim Standard	11	M85049/88-11N03 Connector with Tin Plated Copper Braid Part # 100-001A-312	4
017 to 020	Slim Standard	17	M85049/88-17N03 Connector with Tin Plated Copper Braid Part # 100-001A-500	4
021 to 024	Slim Standard	25	M85049/88-25N03 Connector with Tin Plated Copper Braid Part # 100-001A-100	4
025 to 028	Standard	11	M85049/88-11N03 Connector with Armorlite Braid Part # 103-051-012	4
029 to 032	Standard	17	M85049/88-17N03 Connector with Armorlite Braid Part # 103-051-016	4
033 to 036	Standard	25	M85049/88-25N03 Connector with Armorlite Braid Part # 103-051-032	4
037 to 040	Standard	11	M85049/88-11N03 Connector with Tin Plated Copper Braid Part # 100-001A-312	4
041 to 044	Standard	17	M85049/88-17N03 Connector with Tin Plated Copper Braid Part # 100-001A-500	4
045 to 048	Standard	25	M85049/88-25N03 Connector with Tin Plated Copper Braid Part # 100-001A-100	4

TABLE 2

(Test Group Identification)

Test Group	Test Item Numbers
Test Group #1	001, 005, 009, 013, 017, 021, 025, 029, 033, 037, 041, 045
Test Group #3	002, 006, 010, 014, 018, 022, 026, 030, 034, 038, 042, 046
Test Group #3	003, 007, 011, 015, 019, 023, 027, 031, 035, 039, 043, 047
Test Group #4	004, 008, 012, 016, 020, 024, 028, 032, 036, 040, 044, 048

TABLE 3

(Order of Testing)

Test	Test Group #1	Test Group #2	Test Group #3	Test Group #4
Workmanship	X	X	X	X
Shell Conductivity (Mil-C-85049), Paragraph 4.6.3, EIA-364-83	X			
Random Vibration Mil-C-38999L, EIA-364-28	X			
Shell Conductivity	X	X		
Thermal Shock Mil-C-38999L, EIA-364-32		X		
Shell Conductivity		X	X	
Temperature Life Mil-C-38999L, Paragraphs 3.38.2 and 4.5.34.2			X	
Shell Conductivity			X	X
Cable Pull-Out AS85049/128D				X
Shell Conductivity				X

Test Methods:

1. **Workmanship:**

   The test articles will be free of defects detrimental to product performance when examined by the unaided eye. Photographs of each test article will be taken before and after Vibration Testing for comparison.

2. **Shell Conductivity:**

4.6.3 Shell Conductivity (see 3.5.2)

Shell conductivity shall be measured in accordance with EIA 364-83. The applied potential shall be 1.5 volts maximum. A resistance shall be inserted in the circuit to limit the current to 1.0 amperes ± 0.1 amperes. Measurements shall be made from a point on the overall cable shield (or individual wire shields, if applicable), located 1.0 inch ± 0.25 inch to the rear of the connector accessory, to the point on the backshell/fixture flange as specified in EIA 364-83.

3.5.2 Shell Conductivity

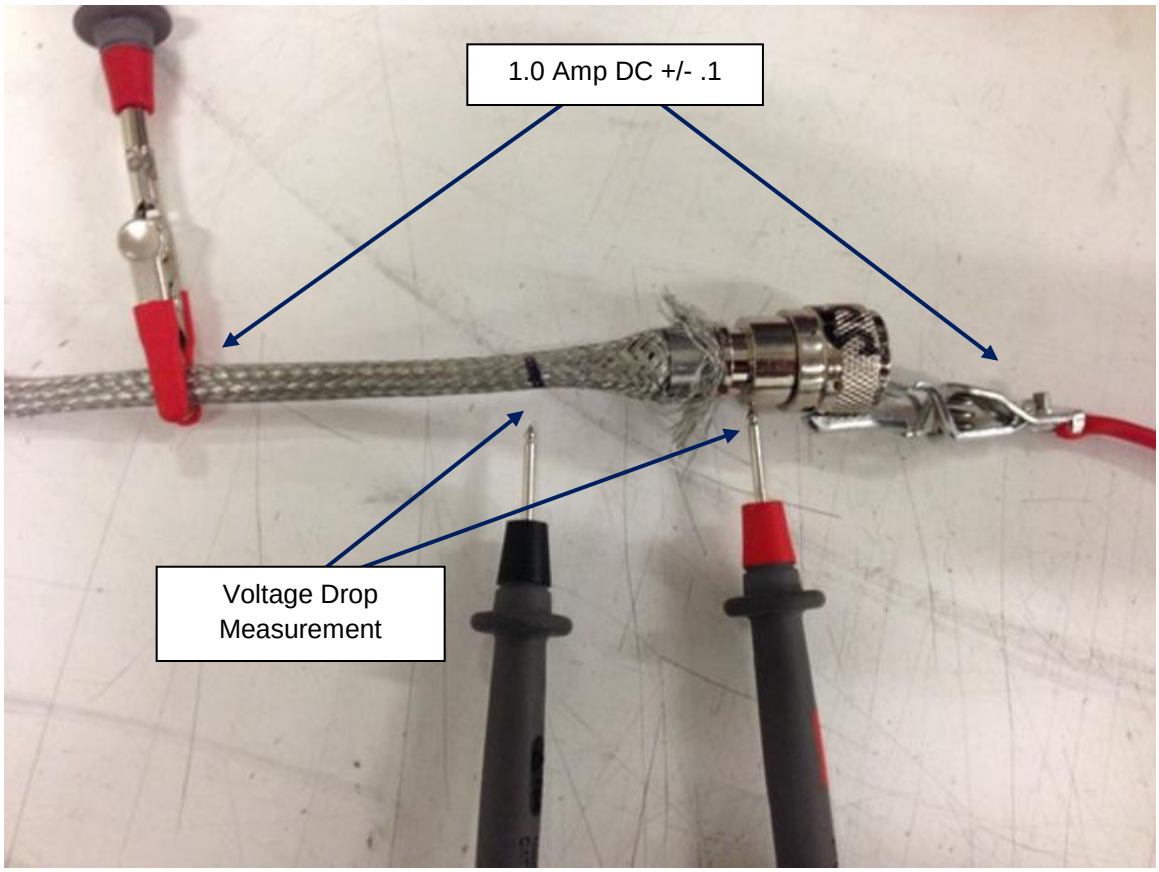
Category 1, 2, and 3 connector accessories that provide termination features for individual or overall EMI/RFI shielding shall be tested as specified in 4.6.3. The connector and connector accessory assembly shall be electrically conductive. The overall resistance shall not exceed 0.0025 ohms for aluminum and composite connector accessories and 0.0050 ohms for stainless steel connector accessories.

4 Test procedure

Unless otherwise specified, a test current of 1.0 +/- 0.1 ampere dc at 1.5 volts maximum shall be caused to pass through the mated connector or through the mated connector and the mounting surface (bulkhead). The test probe shall not puncture or otherwise damage the connector finish.

4.1 Shell-to-shell resistance

Unless otherwise specified, the voltage drop across the mated connector shall be measured from a point on the rear accessory thread on the plug to the mounting flange on the receptacle. On square flange receptacles the point of measurement shall be adjacent to the mounting hole. On single hole mount receptacles the point of measurement shall be adjacent to the o-ring on the front or mounting side of the flange.



3. <u>Random Vibration Testing:</u>

Random vibration testing is required for the included test samples. Excerpts from Mil-C-38999 and EIA-364-28E testing documents are below to describe the extent of the testing. Red boxes have been added to the excerpts in order to designate the levels and the exact profile that will be performed. Test articles shall be vibrated for 8 hours in each axis. Test articles will be at 175°C while under vibration.

3.3.2 Test conditions V, VI and VII (random excitation conditions)

The specimen shall be mounted as specified. The orientation of the specimen or direction of application of the applied vibration motion shall be specified in one or more directions. If the order of application of the different directions is critical, it also shall be specified. Any special test fixtures or jigs required to run the test shall be specified in sufficient detail to assure reproducibility of the input motion applied to the specimen. These details shall include the dimensions, the materials, temper, etc., as applicable.

1.3.1.3 Z-axis

The axis perpendicular to the fixture seating plane attached to the test table.

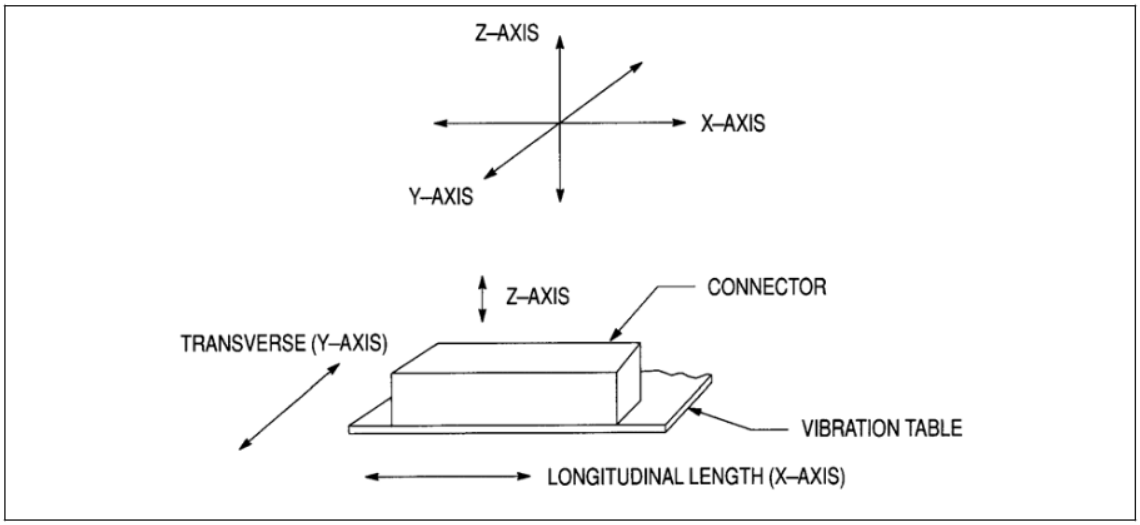


Figure 1 - Mounting axis definitions

Table 2 - Values for test condition V [1)]

Test condition letter	Power spectral density, g^2/Hz	Overall rms g
A	0.02	5.35
B	0.04	7.56
C	0.06	9.26
D	0.1	11.95
E	0.2	16.91
F	0.3	20.71
G	0.4	23.91
H	0.6	29.28
I	Superseded by Test condition letter J	
J	1.0	37.80
K	1.5	46.30

1) For duration of test: see 4.2.2.

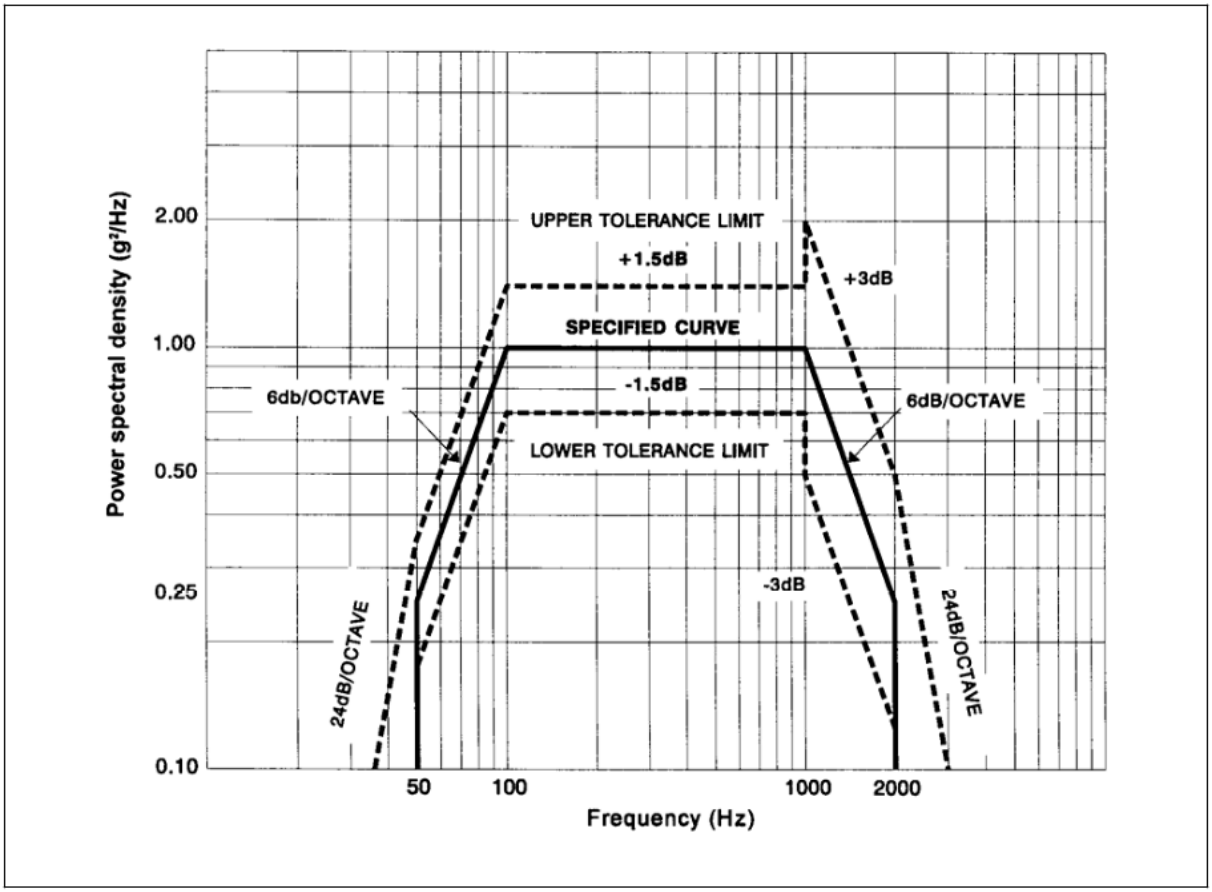


Figure 4 - Test condition V, random vibration test-curve envelope (see table 2).

4. Thermal Shock:

Once both cold and hot chambers have reached stabilized temperature, test articles will be placed in the cold chamber. The cold chamber shall be at -65°C and the hot chamber shall be at 200°C. A 1 hour soak time will be performed at each temperature for 5 cycles (totaling 10 hours of testing). At the end of each soak time, the test articles will be removed from the chamber and shell conductivity testing will be performed. Below is an excerpt from EIA-364-32F describing the requirements for testing.

4.6.16 Temperature Cycling (Finishes J, L, M, XC, YC, and ZC, see 3.5.14)

Connector accessories shall be subjected to the temperature cycling of EIA 364-32, method A, condition I, 5 cycles, except that steps 2 and 4 shall be of 2 minutes maximum duration. The temperature of step 1 shall be -65° +0, -5 °C and the temperature of step 3 shall be 175° +5, -0 °C for finish J, XC, YC and ZC and 200° +5, -0 °C for finish L and M.

5. Temperature Life

Test articles shall be placed in an environmental chamber for 1,000 hours at 200°C. Shell conductivity testing will be performed before and after temperature life testing. Temperature will be continuously monitored and a graph displaying temperature data shall be supplied with the final report.

3.38.2 High temperature exposure. Applicable to series III except the hermetics. When tested as specified in 4.5.34.2 for 1,000 hours, connectors shall perform satisfactorily and pass succeeding tests in the qualification test sequence.

4.5.34.2 High temperature exposure. Applicable to all classes of series III except hermetic connectors, see 3.38.2. Mated connectors shall be subjected to an ambient temperature of 175°C +3°C, -0°C for classes J, P, T, W, X and Z, and 200°C +3°C, -0°C for all other classes. The temperature shall be maintained for 1,000 hours.

6. Braid Retention:

Test articles shall be mounted on a fixture in an appropriate tensile tester for braid retention testing. The connector shall be mounted to the base of the tensile tester and the braid clamped on the opposite, actuated side of the tester. Measurements of band position shall be taken before and after to validate slippage of less than .025" has occurred during testing. Load and position data shall be recorded during testing and graphs will be recorded for each test sample in the final test report. Please see the excerpt below from AD85049/128 Rev. D for load and speed of testing.

3. BAND TERMINATION TEST (CONFIGURATION 6 & 8 ONLY): FOR EACH DASH NUMBER TO BE QUALIFIED, PERFORM THE FOLLOWING TESTS ON TWO BAND SPECIMENS FOR EACH ACCESSORY SHELL SIZE FOR A TOTAL OF SIX SPECIMENS. A 6-INCH BRAID SHALL BE CLAMPED BY EACH SPECIMEN TO THE ACCESSORY. THE BRAID SHALL BE TIN COATED COPPER IN ACCORDANCE WITH A-A-59569 WITH A 90% COVERAGE. TWO SPECIMENS EACH SHALL BE CLAMPED TO AN M85049/82-08*03, M85049/82-14*03, AND M85049/82-20*03 THE ACCESSORY RESPECTIVELY. THE BAND SHALL BE ASSEMBLED TO THE ACCESSORY WITH THE APPLICABLE BAND INSTALLATION TOOL IN ACCORDANCE WITH TABLE 2.

   a. BRAID RETENTION: WITH ACCESSORY SUITABLY ASSEMBLED WITH BRAID, PULL THE BRAID AT A RATE OF 1 INCH PER MINUTE TO A FORCE OF 50 POUNDS MINIMUM FOR BRAID .50 INCH AND UNDER AND 75 POUNDS MINIMUM FOR BRAID OVER .50 INCH. THE BRAID SHALL NOT PULL OUT. BAND SLIPPAGE SHALL NOT EXCEED .025 INCH WHEN MEASURED FROM A FIXED POINT ON THE ADAPTER. BRAID BREAKAGE DUE TO TENSILE LOAD WILL NOT BE VIEWED AS A FAILURE.

7. Braid Retention to Destruction:

Test articles shall be mounted on a fixture in an appropriate tensile tester for braid retention testing to destruction. The connector shall be mounted to the base of the tensile tester and the braid clamped on the opposing actuated side of the tester. The braid shall be pulled at 1 inch/minute until a significant failure with the braid or the band becomes apparent. Load and position data shall be recorded during testing and graphs will be recorded for each test sample in the final test report.

3. BAND TERMINATION TEST (CONFIGURATION 6 & 8 ONLY): FOR EACH DASH NUMBER TO BE QUALIFIED, PERFORM THE FOLLOWING TESTS ON TWO BAND SPECIMENS FOR EACH ACCESSORY SHELL SIZE FOR A TOTAL OF SIX SPECIMENS. A 6-INCH BRAID SHALL BE CLAMPED BY EACH SPECIMEN TO THE ACCESSORY. THE BRAID SHALL BE TIN COATED COPPER IN ACCORDANCE WITH A-A-59569 WITH A 90% COVERAGE. TWO SPECIMENS EACH SHALL BE CLAMPED TO AN M85049/82-08*03, M85049/82-14*03, AND M85049/82-20*03 THE ACCESSORY RESPECTIVELY. THE BAND SHALL BE ASSEMBLED TO THE ACCESSORY WITH THE APPLICABLE BAND INSTALLATION TOOL IN ACCORDANCE WITH TABLE 2.

   a. BRAID RETENTION: WITH ACCESSORY SUITABLY ASSEMBLED WITH BRAID, PULL THE BRAID AT A RATE OF 1 INCH PER MINUTE TO A FORCE OF 50 POUNDS MINIMUM FOR BRAID .50 INCH AND UNDER AND 75 POUNDS MINIMUM FOR BRAID OVER .50 INCH. THE BRAID SHALL NOT PULL OUT. BAND SLIPPAGE SHALL NOT EXCEED .025 INCH WHEN MEASURED FROM A FIXED POINT ON THE ADAPTER. BRAID BREAKAGE DUE TO TENSILE LOAD WILL NOT BE VIEWED AS A FAILURE.

Results:

1. Workmanship:

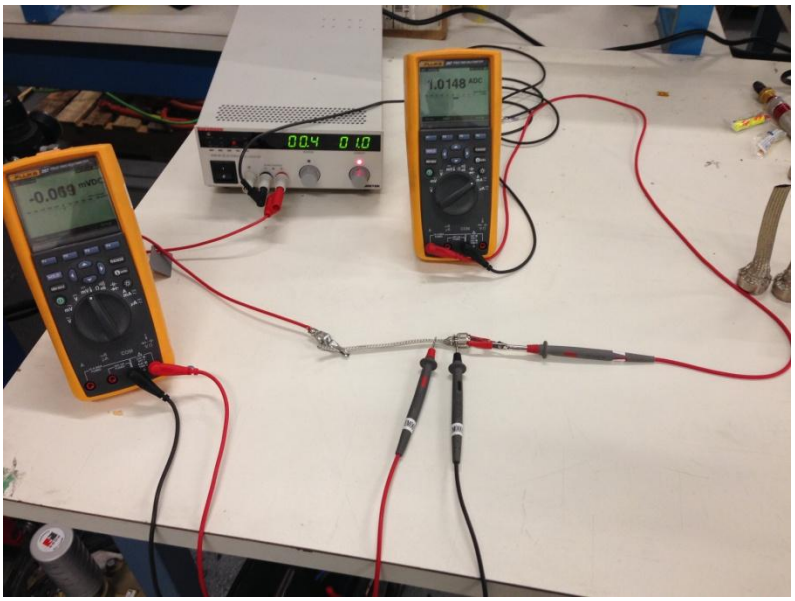
All samples were inspected visually. There was no evidence of poor workmanship. All plating was complete and there was no cracking. All initial samples were found to be in good condition.

2. Initial Shell Conductivity:

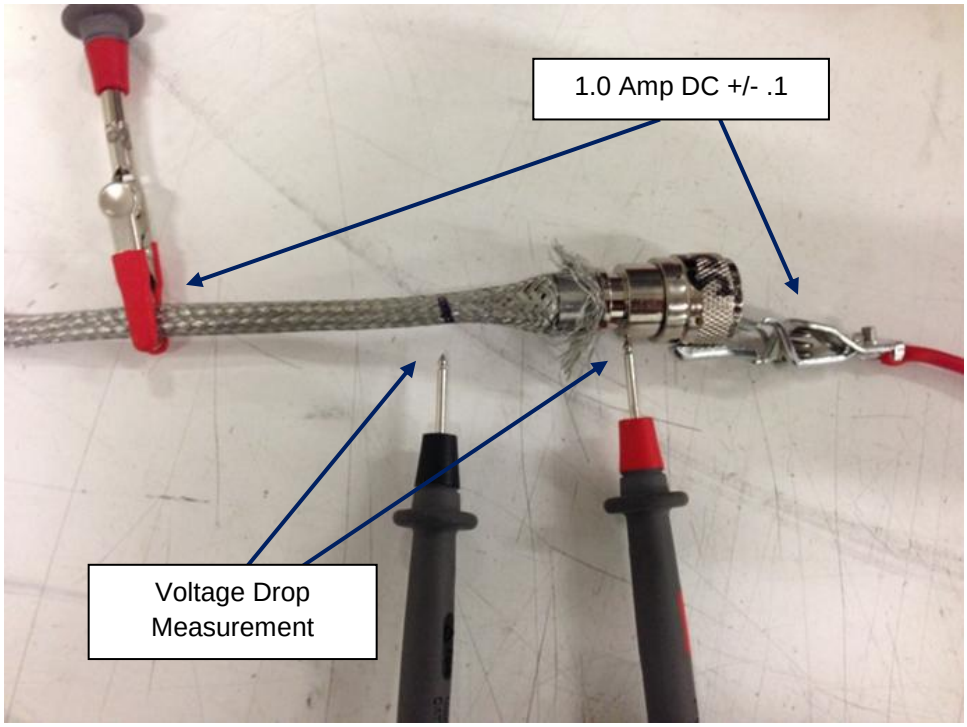
All samples were tested using the voltage drop method to get an initial resistance for each one of the samples.

Sample Number	Initial Resistance milliohms
001	1.870 mΩ
002	1.865 mΩ
003	1.632 mΩ
004	1.771 mΩ
005	1.377 mΩ
006	1.199 mΩ
007	1.365 mΩ
008	1.359 mΩ
009	0.504 mΩ
010	0.507 mΩ
011	0.478 mΩ
012	0.477 mΩ
013	0.174 mΩ
014	0.173 mΩ
015	0.161 mΩ
016	0.162 mΩ
017	0.109 mΩ
018	0.095 mΩ
019	0.096 mΩ
020	0.100 mΩ
021	0.086 mΩ
022	0.084 mΩ
023	0.082 mΩ
024	0.080 mΩ

Sample Number	Initial Resistance milliohms
025	1.541 mΩ
026	1.600 MΩ
027	1.619 mΩ
028	1.534 mΩ
029	1.350 mΩ
030	1.176 mΩ
031	1.260 mΩ
032	1.235 mΩ
033	0.471 mΩ
034	0.487 mΩ
035	0.449 mΩ
036	0.443 mΩ
037	0.185 mΩ
038	0.155 mΩ
039	0.159 mΩ
040	0.161 mΩ
041	0.114 mΩ
042	0.102 mΩ
043	0.105 mΩ
044	0.112 mΩ
045	0.085 mΩ
046	0.074 mΩ
047	0.084 mΩ
048	0.083 mΩ



Voltage drop resistance measurement test set up.



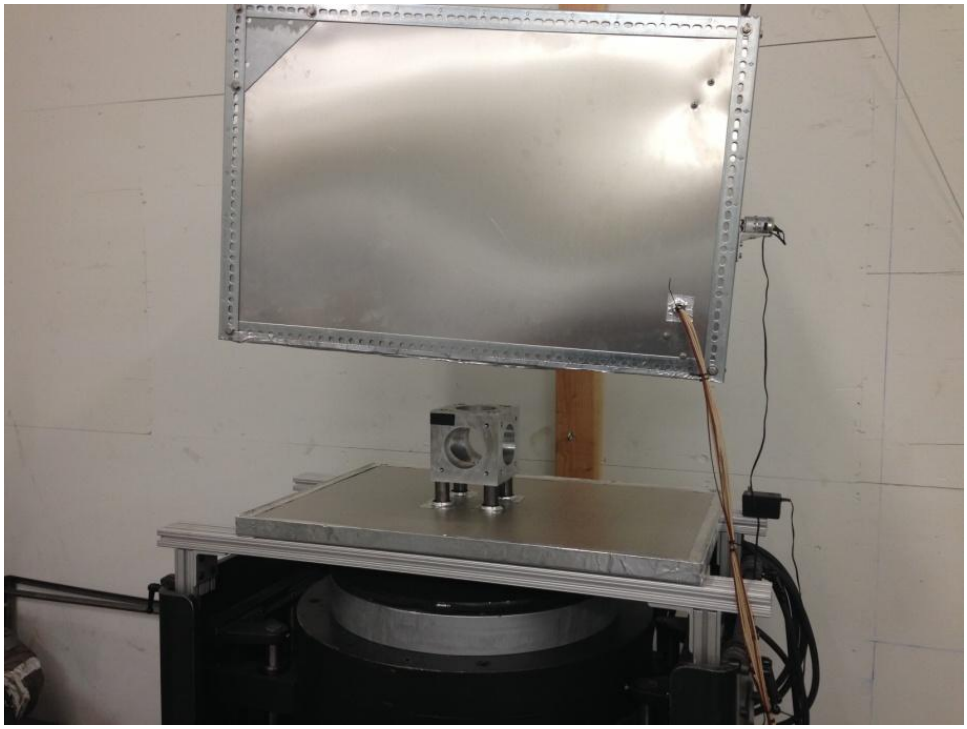
Initial voltage drop resistance measurement.

3. Random Vibration:

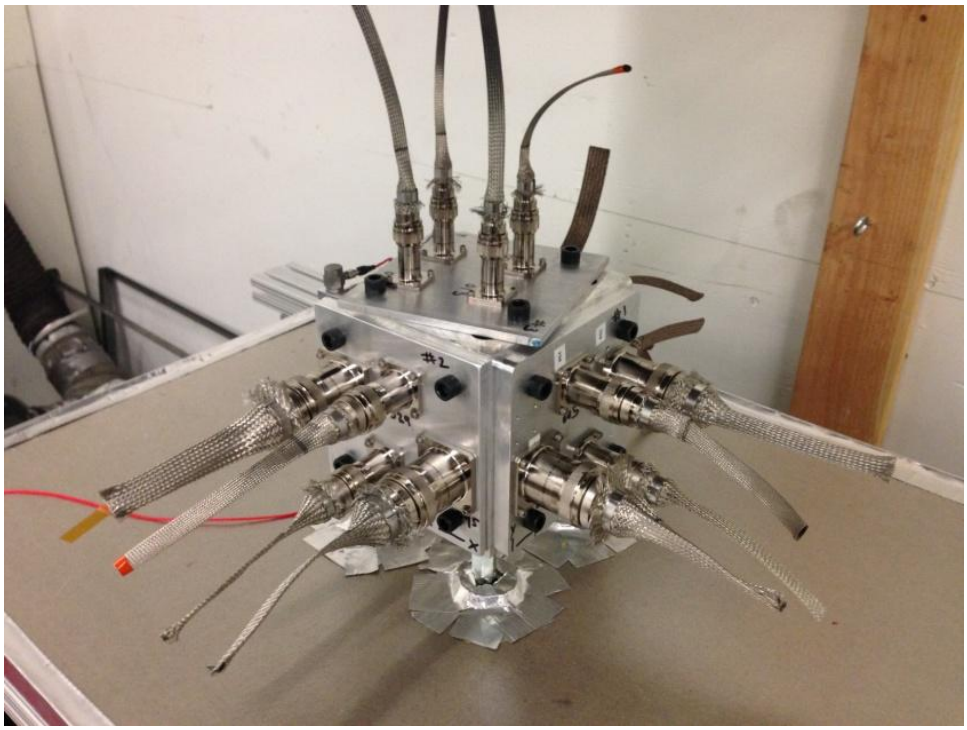
All test samples were inspected before and following every vibration session. There was no evidence of damage to any of the bands. No loosening, cracking or discoloration was noted.

Test Set Up:

All Samples were fastened to 0.5” thick aluminum fixture plates and then bolted to a vibration cube fixture. As requested by Glenair, the samples where vibrated at high temperature (175°C). Test group 1 underwent random vibration testing. Test Group 1 is comprised of the following sample numbers: 001, 005, 009, 013, 017, 021, 025, 029, 033, 037, 041, 045.



Test set up.



Test articles in place for testing.

Resistance measurements were taken before and after every vibration session. Please see the table below for those values.

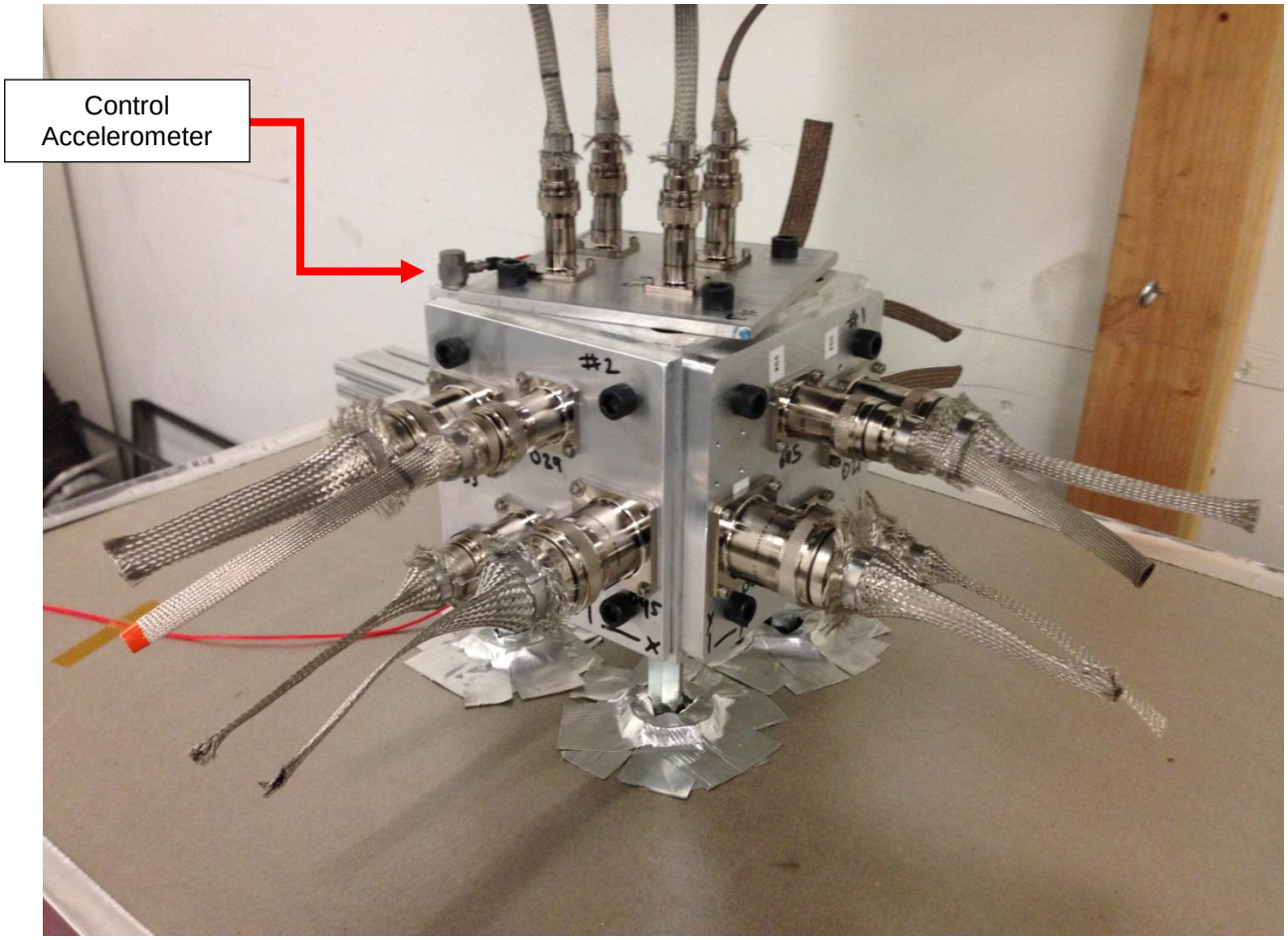
Sample #	Initial Resistance	Resistance Post Session 1	Resistance Post Session 2	Resistance Post Session 3
1	1.870 mΩ	1.907 mΩ	1.682 mΩ	1.590 mΩ
5	1.377 mΩ	1.655 mΩ	1.625 mΩ	1.865 mΩ
9	0.504 mΩ	0.606 mΩ	0.562 mΩ	0.695 mΩ
13	0.174 mΩ	0.410 mΩ	0.452 mΩ	0.469 mΩ
17	0.109 mΩ	0.256 mΩ	0.215 mΩ	0.628 mΩ
21	0.086 mΩ	0.255 mΩ	0.660 mΩ	0.418 mΩ
25	1.541 mΩ	1.701 mΩ	1.614 mΩ	2.350 mΩ
29	1.350 mΩ	1.417 mΩ	1.378 mΩ	1.385 mΩ
33	0.471 mΩ	0.539 mΩ	0.551 mΩ	0.464 mΩ
37	0.185 mΩ	0.305 mΩ	0.308 mΩ	0.284 mΩ
41	0.114 mΩ	0.201 mΩ	0.235 mΩ	0.483 mΩ
45	0.085 mΩ	0.168 mΩ	0.660 mΩ	0.630 mΩ

Random Vibration Testing Process:

Summary of Events

Time	Event
8/26/2014	
9:30 pm	All test samples are bolted to vibration cube on a single fixture plate attached to vibration cube. Initial resistance measurements conducted. Environmental chamber placed over vibration shaker and temperature ramp up initiated.
10:08 pm	Environmental chamber has reached temperature of 175°C. Vibration session 1 begins. Plate #3 in Z axis, Plate #2 in Y axis, Plate #1 in Y axis.
11:30 pm	Pause vibration testing for the night. Resume testing in the morning.
8/27/2014	
8:00 am	Begin the bring temperature up to 175°C.
8:30 am	Continue with random vibration. Plate #3 in Z axis, Plate #2 in Y axis, Plate #1 in Y axis.
3:05 pm	First session is complete. Remove all fixture plates and perform resistance testing. Reconfigure and bolt plates back to fixture cube.
4:00 pm	All samples bolted to fixture cube, start thermal chamber ramp up.
4:30 pm	Chamber stabilized at 175°C. Begin second session of random Vibration. Plate #1 in X, Plate #2 in Z and Plate #3 in Y.
4:31 pm	Control accelerometer found to be loose, remove chamber cover and fix issue.
4:40 pm	Put chamber cover back on; begin heating back up to 175°C.
4:58 pm	Temperature stabilized. Continue with session 2 random vibration testing.
12:58 pm	End Vibration Testing session 2. Remove all plates and perform resistance testing. End of testing for the day.
8/28/2014	
12:30 pm	Bolt on all fixture plates in final orientation. Close up chamber and begin heating up to 175°C.
1:01 pm	Temperature stabilized at 175°C; begin final session of random vibration. Plate #1 in Z, Plate #2 in X, Plate #3 in X.
9:01 pm	All random vibration testing complete. Samples removed and resistance tested.

Random Vibration, First 8 Hour Session



All twelve samples testing in the Z-Axis.

Figure 1: Random Vibration, Session 1, Hour 0

Figure 2: Random Vibration, Session 1, Hour 1

Figure 3: Random Vibration, Session 1, Hour 2

Figure 4: Random Vibration, Session 1, Hour 3

Figure 5: Random Vibration, Session 1, Hour 4

Figure 6: Random Vibration, Session 1, Hour 5

Figure 7: Random Vibration, Session 1, Hour 6

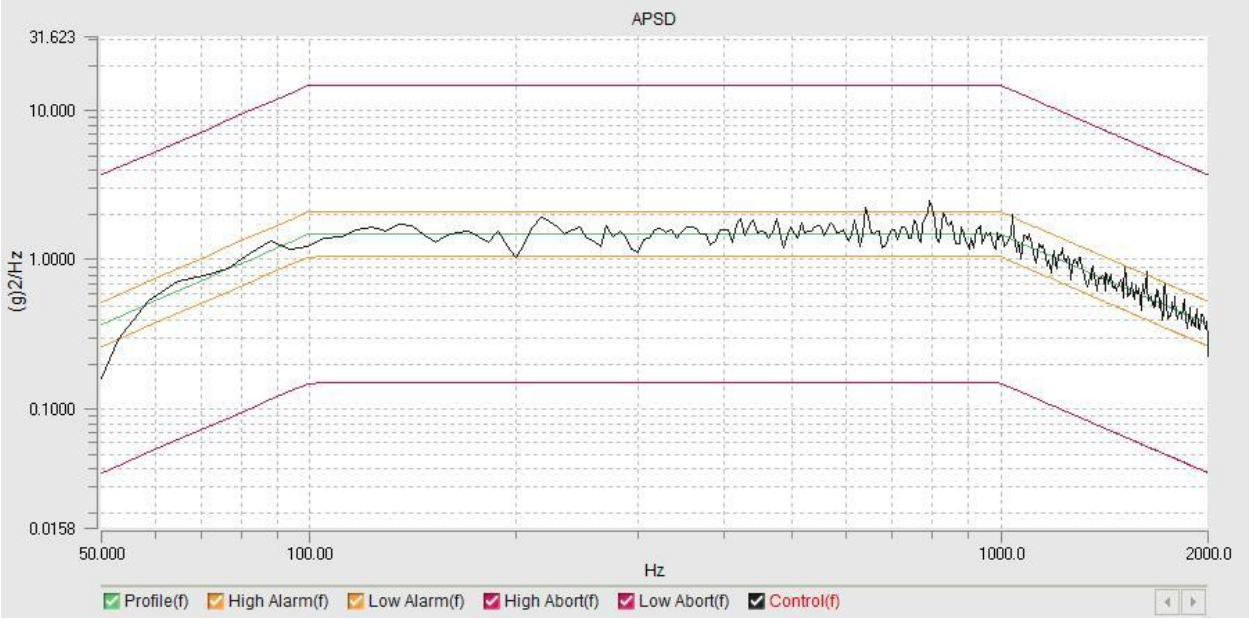
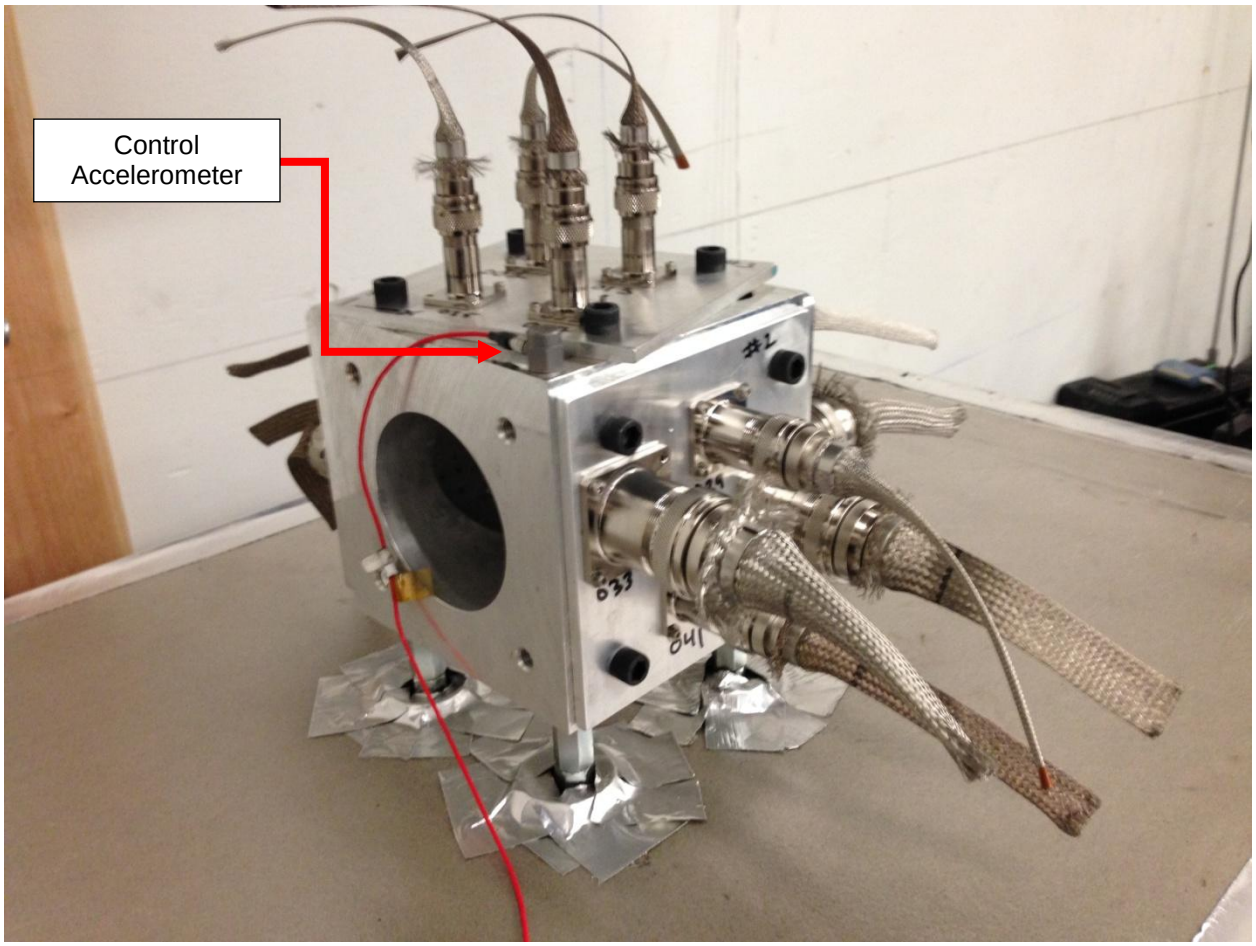


Figure 8: Random Vibration, Session 1, Hour 7

Figure 9: Random Vibration, Session 1, Hour 8

Random Vibration, Second 8 Hour Session



All Nano Band Vibration Samples in Y-Axis.

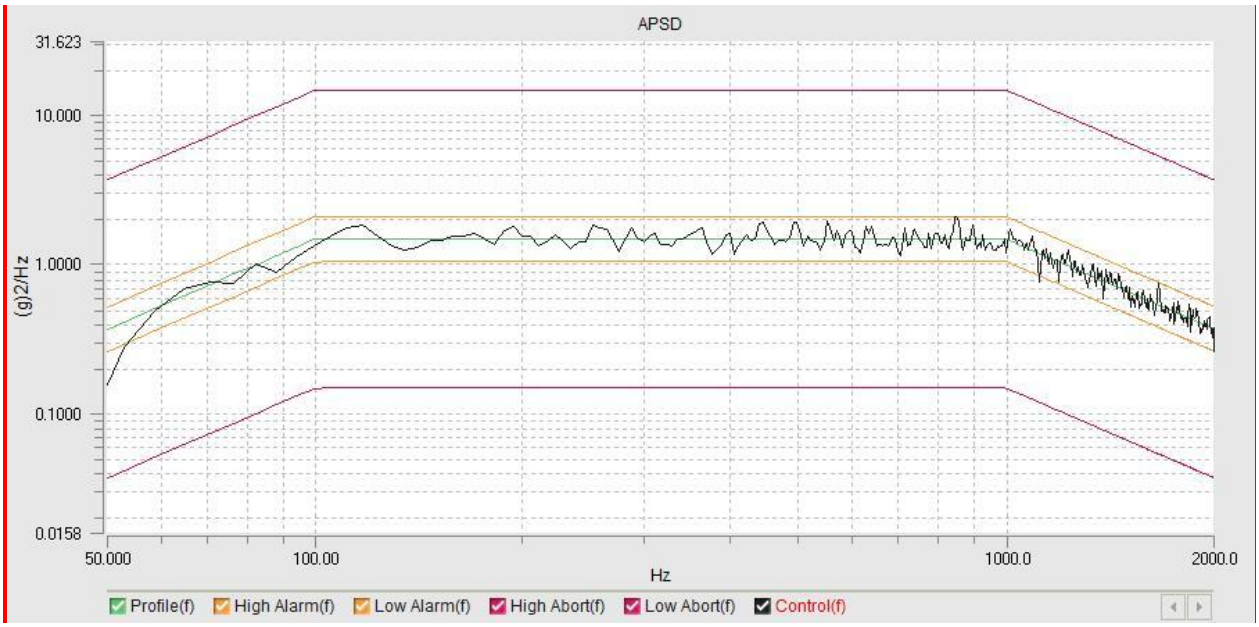


Figure 10: Random Vibration, Session 2, Hour 0

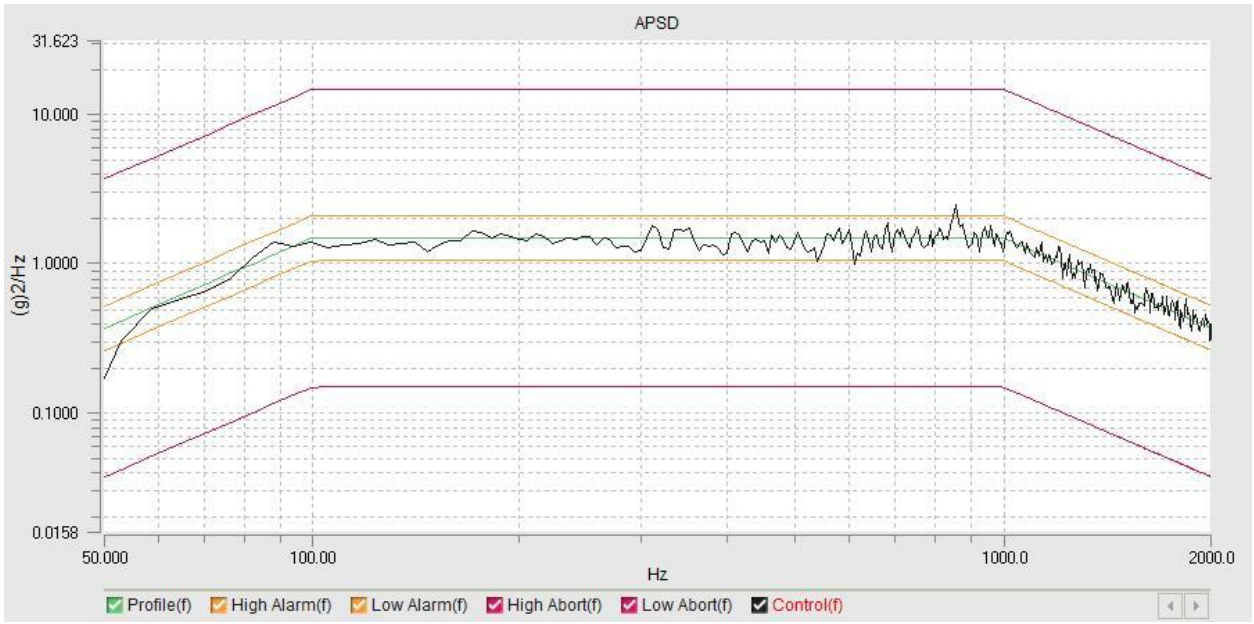


Figure 11: Random Vibration, Session 2, Hour 1

Figure 1210: Random Vibration, Session 2, Hour 2

Figure13: Random Vibration, Session 2, Hour 3

Figure 14: Random Vibration, Session 2, Hour 4

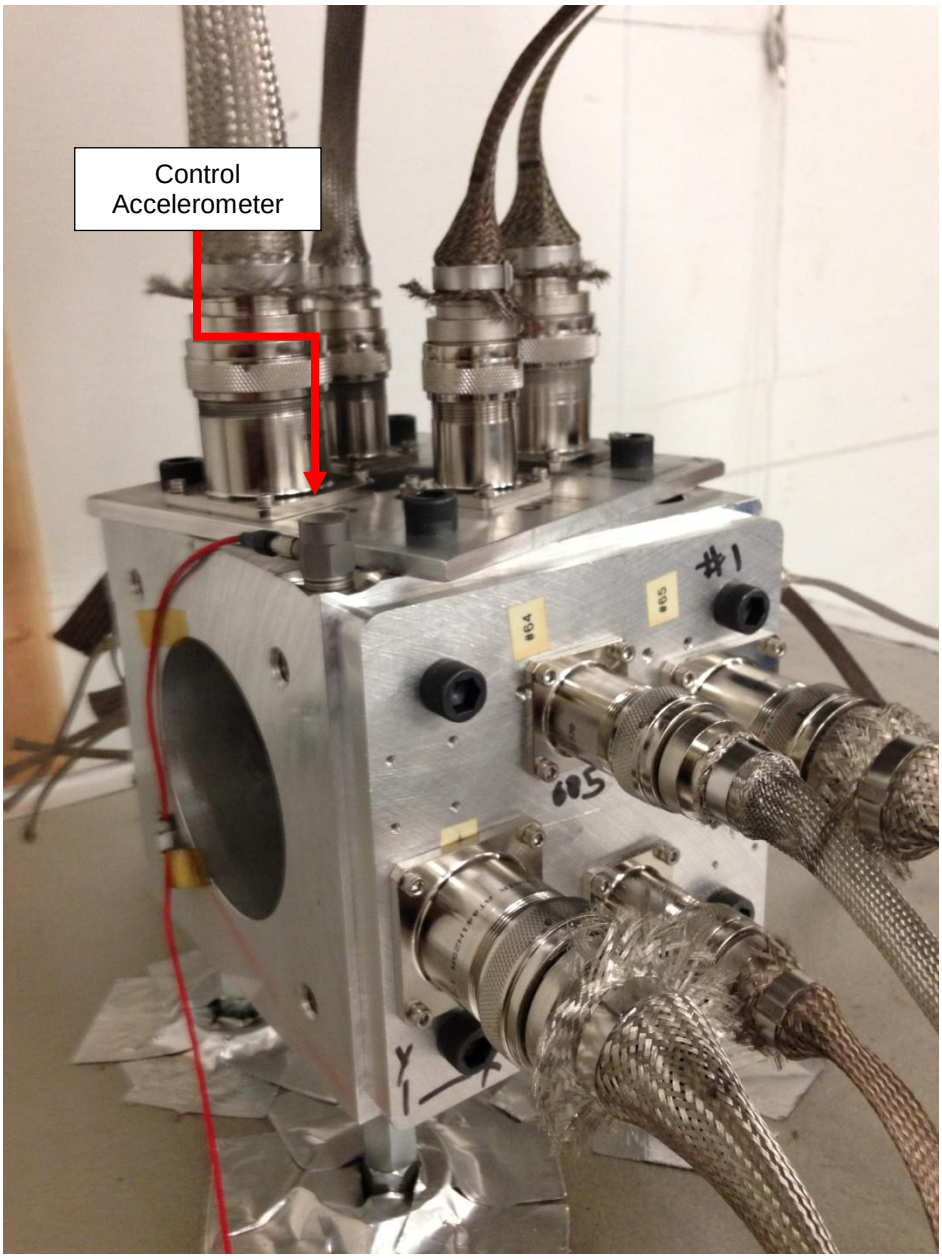
Figure 15: Random Vibration, Session 2, Hour 5

Figure 16: Random Vibration, Session 2, Hour 6

Figure 17: Random Vibration, Session 2, Hour 7

Figure 18: Random Vibration, Session 2, Hour 8

Random Vibration, Third 8 Hour Session



All Nano Band Vibration Samples in X-Axis.

Figure19: Random Vibration, Session 3, Hour 0

Figure 20: Random Vibration, Session 3, Hour 1

Figure 21: Random Vibration, Session 3, Hour 2

Figure 22: Random Vibration, Session 3, Hour 3

Figure 23: Random Vibration, Session 3, Hour 4

Figure 24: Random Vibration, Session 3, Hour 5

Figure 25: Random Vibration, Session 3, Hour 6

Figure 26: Random Vibration, Session 3, Hour 7

Figure 27: Random Vibration, Session 3, Hour 8

4. Thermal Shock:

Test Set Up:

Test samples in cold chamber.

Test samples in hot chamber.

Results:

All of the measurements displayed below are in milliohms and were measured using the voltage drop method. A resistance measurement was taken at each temperature extreme during the thermal shock testing. A 1 hour soak time was performed at each temperature extreme. 5 cycles were completed for a total of 10 hours of testing.

Sample #	Initial Resistance	-65°	200°	-65°	200°	-65°	200°	-65°	200°	-65°	200°
2	1.767	1.882	2.010	1.335	1.887	1.261	1.940	1.237	2.040	1.283	1.875
6	1.157	0.940	1.765	0.900	1.683	0.868	1.714	0.880	1.609	0.881	1.531
10	0.557	0.422	1.001	0.349	0.806	0.398	0.762	0.353	0.616	0.412	0.425
14	0.177	0.109	0.509	0.117	0.500	0.456	0.577	1.010	0.425	1.639	0.477
18	0.097	0.086	0.474	0.090	0.423	0.017	0.548	0.049	0.479	0.083	0.335
22	0.033	0.058	0.384	0.069	0.505	0.026	0.290	0.150	0.202	0.222	0.261
26	1.686	1.500	2.134	1.353	1.927	1.294	2.070	1.271	2.025	1.257	1.944
30	1.275	0.990	1.881	0.942	1.741	0.940	1.921	0.900	1.590	1.054	1.521
34	0.524	0.340	0.863	0.339	0.825	0.321	0.824	0.355	0.805	0.488	0.382
38	0.154	0.083	0.532	0.080	0.428	0.445	0.508	0.719	0.424	0.880	0.401
42	0.108	0.020	0.506	0.102	0.467	0.154	0.567	0.188	0.302	0.253	0.385
46	0.078	0.018	0.607	0.128	0.337	0.250	0.340	0.318	0.282	0.510	0.187

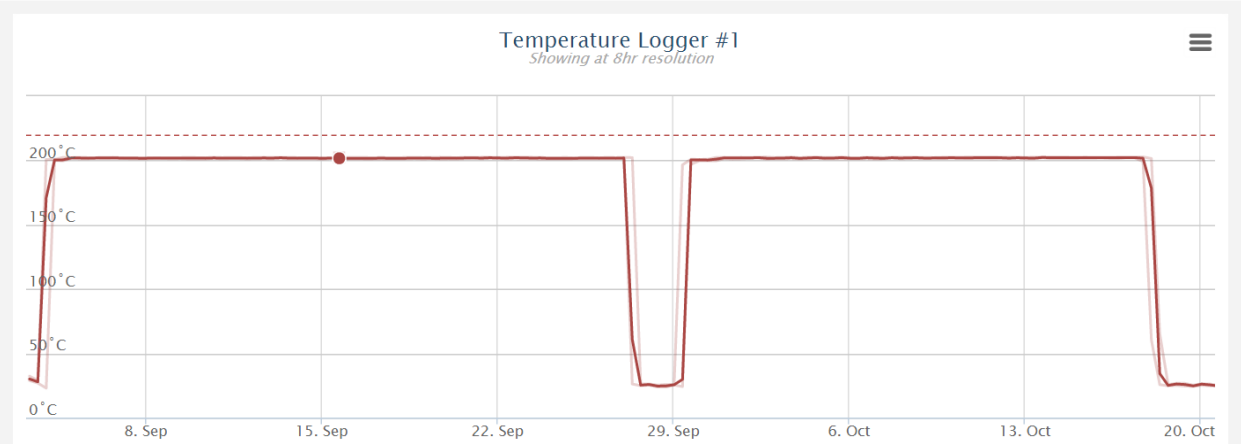
5. Temperature Life:

Test Set Up:

Samples in Temperature Life chamber.

Samples post Temperature Life testing.

Results:



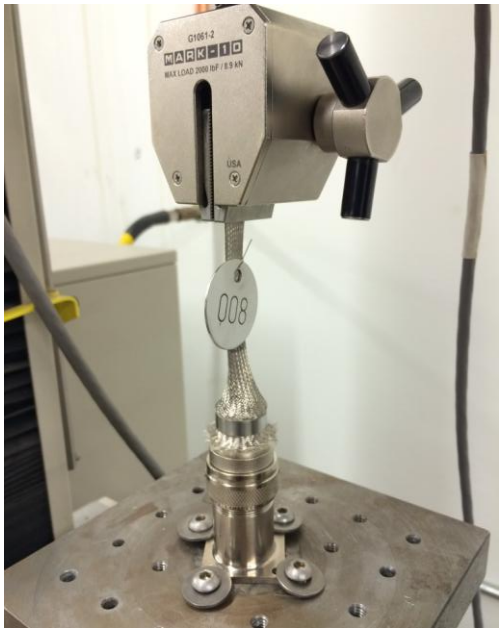
All samples were placed in a temperature controlled oven and subjected to 200°C for 1,000 hours. A resistance measurement was performed before and immediately after the temperature life test.

Sample #	Initial Resistance	Resistance Post Temperature Life
003	1.632 mΩ	1.326 mΩ
007	1.365 mΩ	1.493 mΩ
011	0.478 mΩ	0.680 mΩ
015	0.161 mΩ	0.486 mΩ
019	0.096 mΩ	0.308 mΩ
023	0.082 mΩ	0.823 mΩ
027	1.619 mΩ	1.706 mΩ
031	1.260 mΩ	1.559 mΩ
035	0.449 mΩ	0.737 mΩ
039	0.159 mΩ	0.236 mΩ
043	0.105 mΩ	0.556 mΩ
047	0.084 mΩ	0.752 mΩ

DEVIATION OF TESTING: *Due to a city wide power outtage, a loss of temperature was incurred during testing. Once this issue was discovered, the oven was ramped back up to 200°C and the final end time of the test was adjusted in order to compensate for the power outage. The samples still underwent a total of 1,000 hours of temperature life testing at 200°C.*

6. Braid Retention:

Test Set Up:

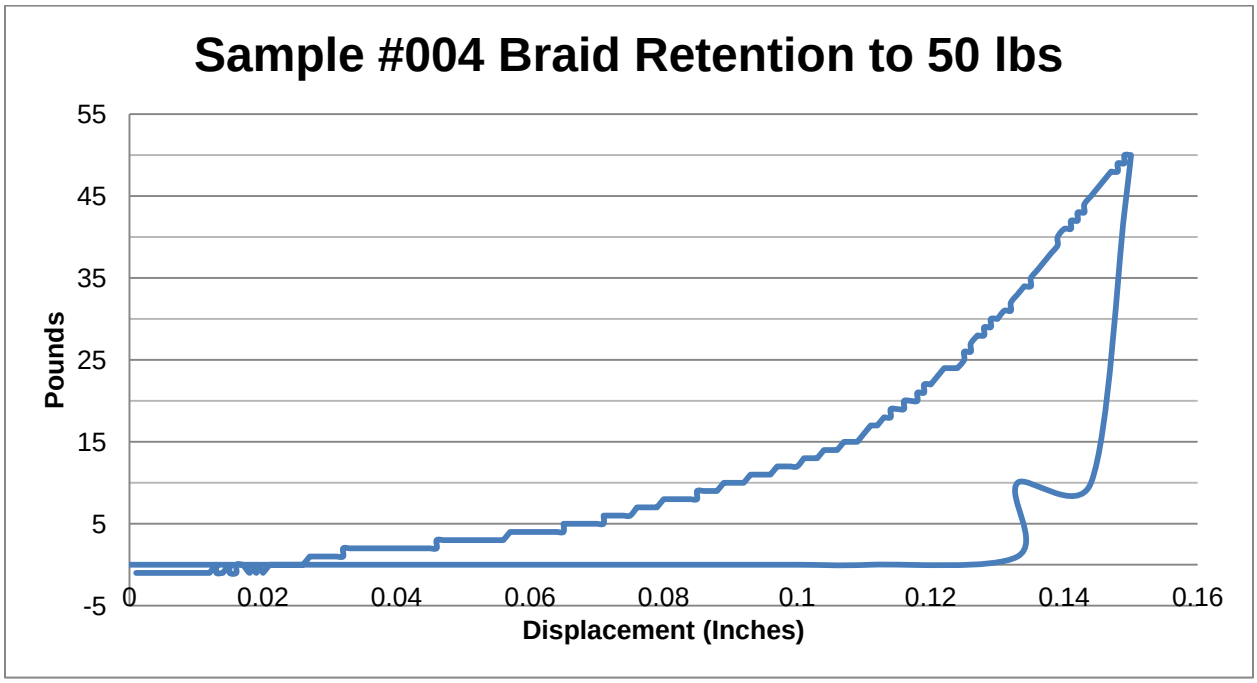


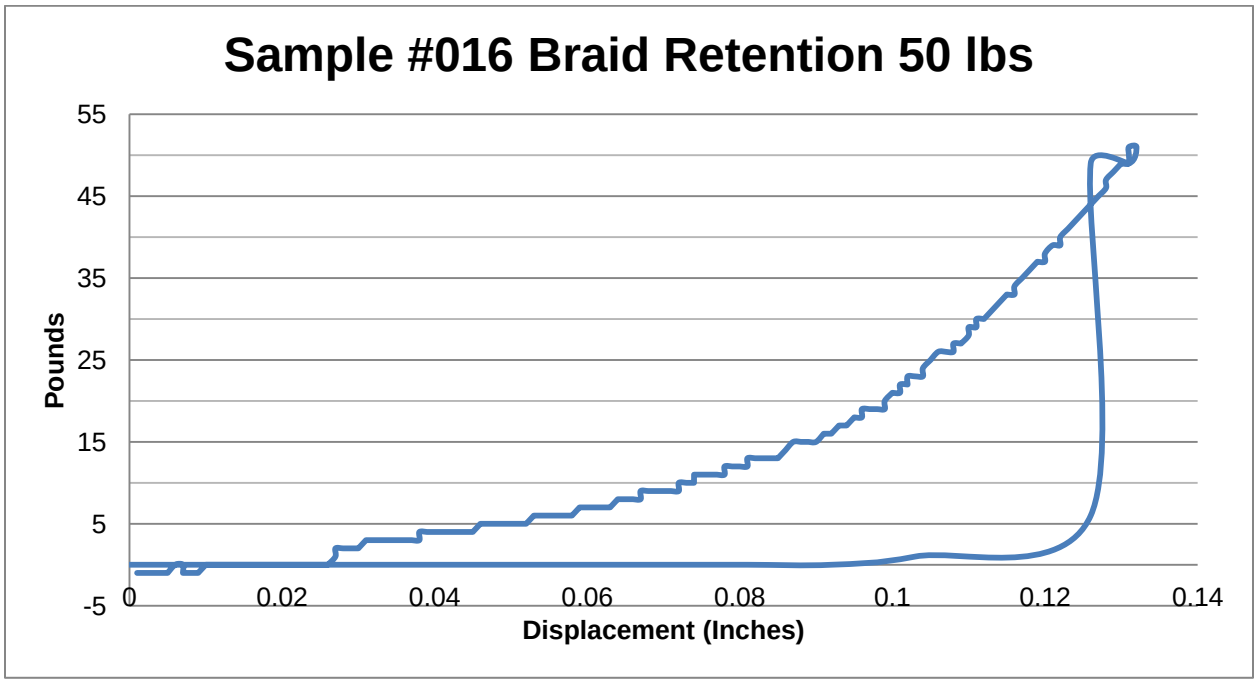
Braid Retention test set up.

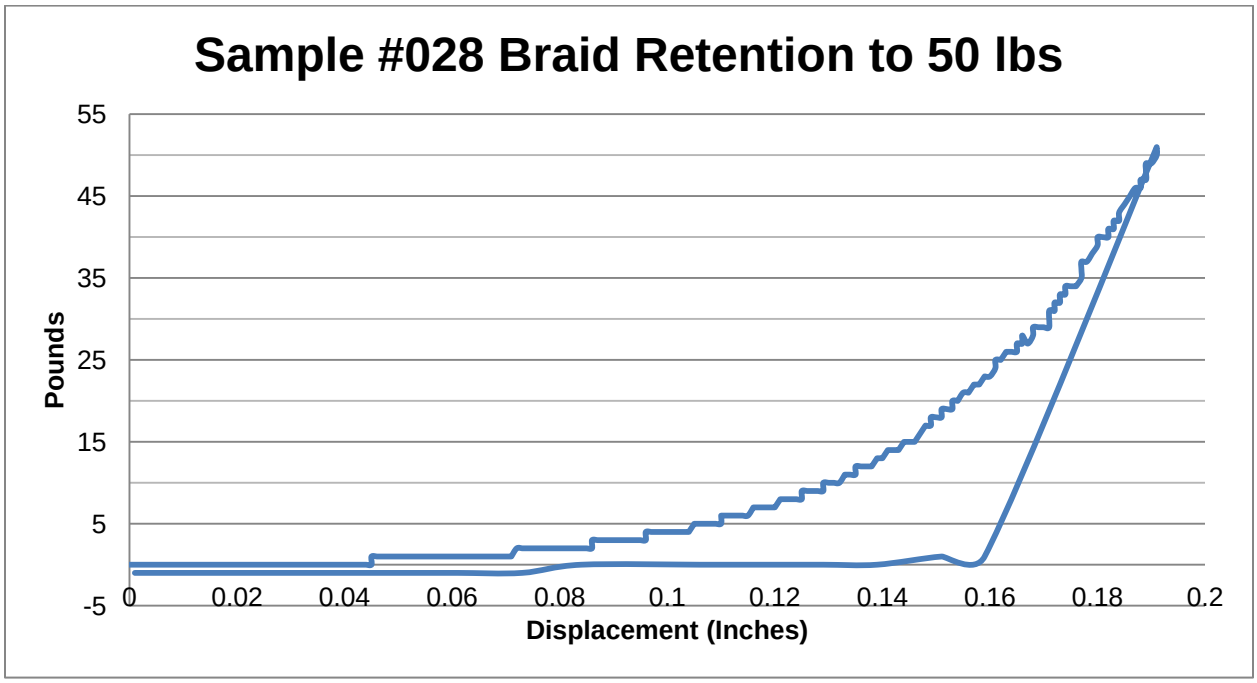
Results:

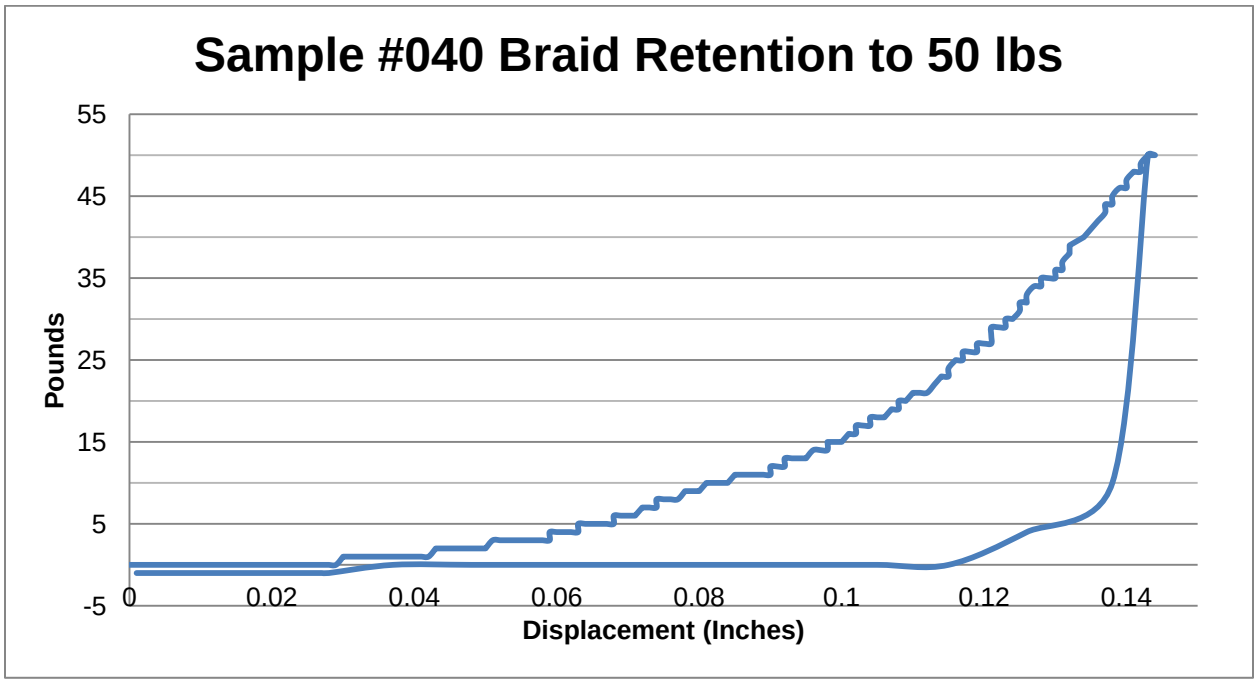
A resistance measurement was peformed before and immediately after the braid retention testing.

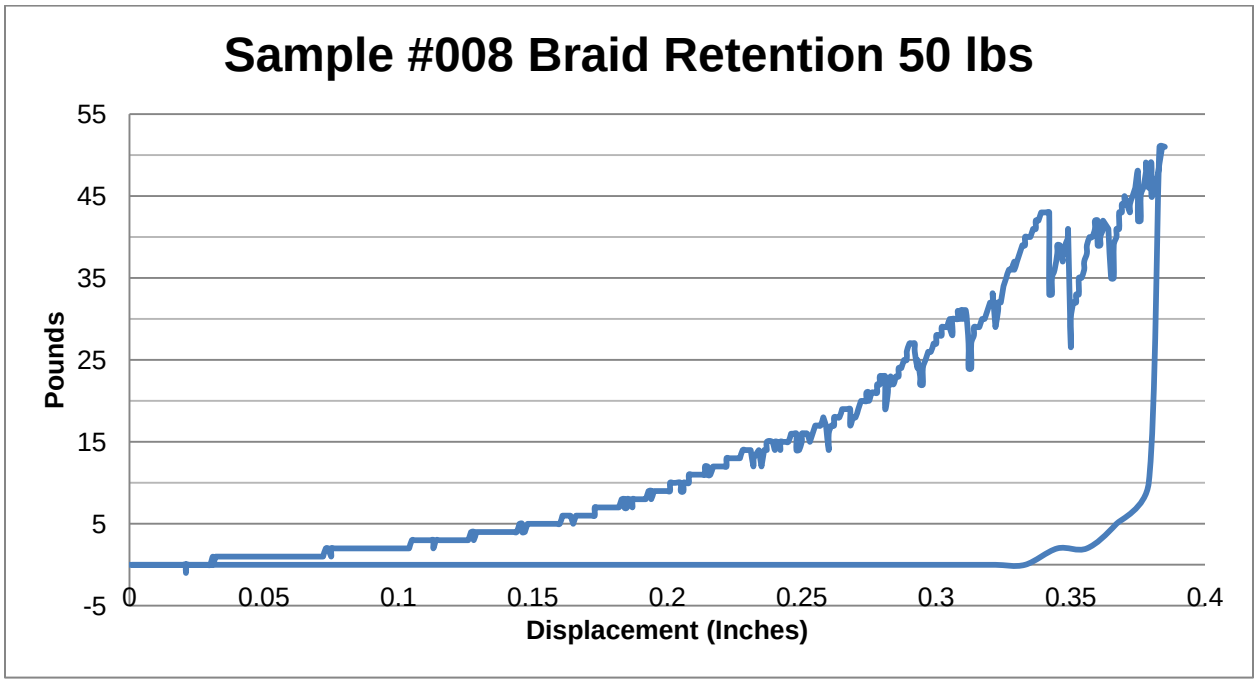
Sample #	Pull Force Maximum	Initial Resistance	Resistance Post Braid Retention
004	50 lbs	1.771	1.810
008	50 lbs	1.359	1.566
012	75 lbs	0.477	0.533
016	50 lbs	0.162	0.195
020	50 lbs	0.100	0.131
024	75 lbs	0.080	0.097
028	50 lbs	1.534	1.675
032	50 lbs	1.235	1.532
036	75 lbs	0.443	0.541
040	50 lbs	0.161	0.172
044	50 lbs	0.112	0.139
048	75 lbs	0.083	0.098

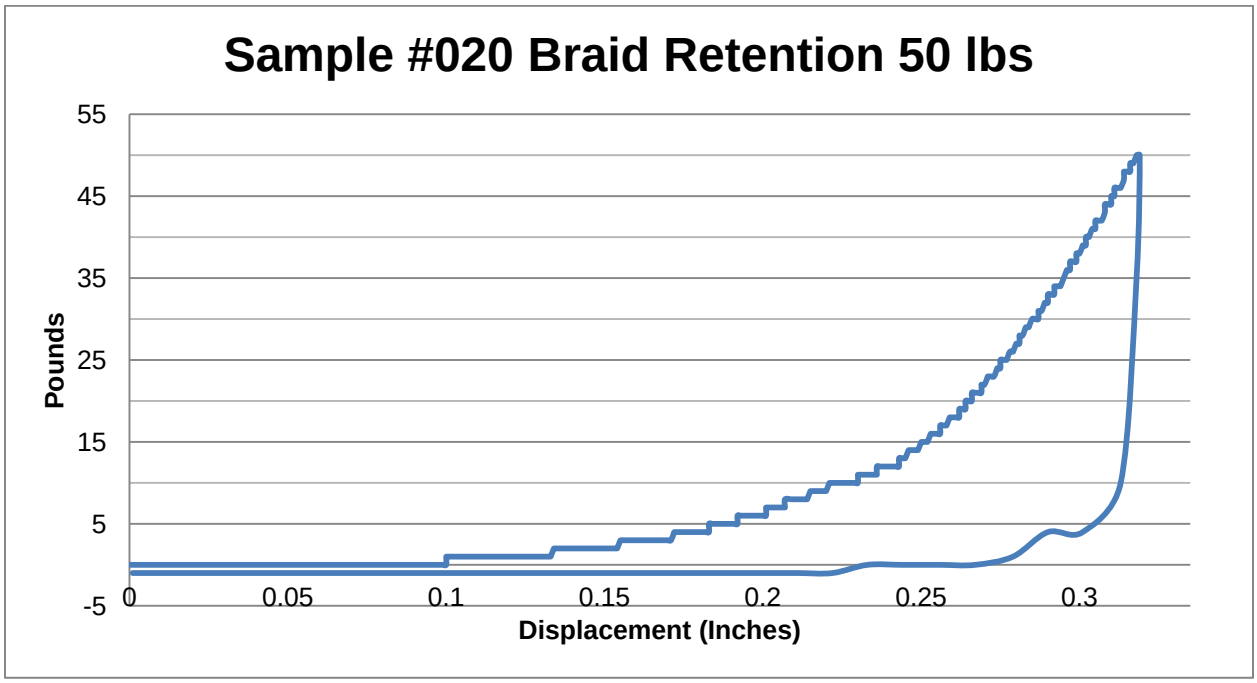


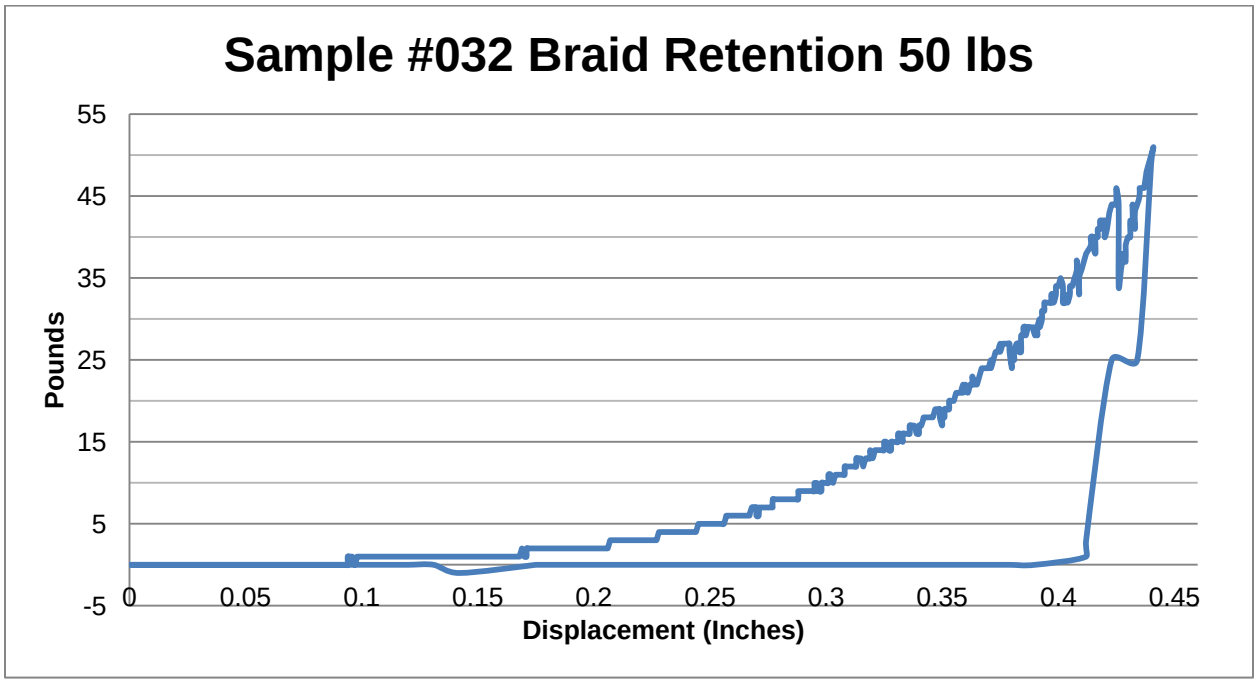


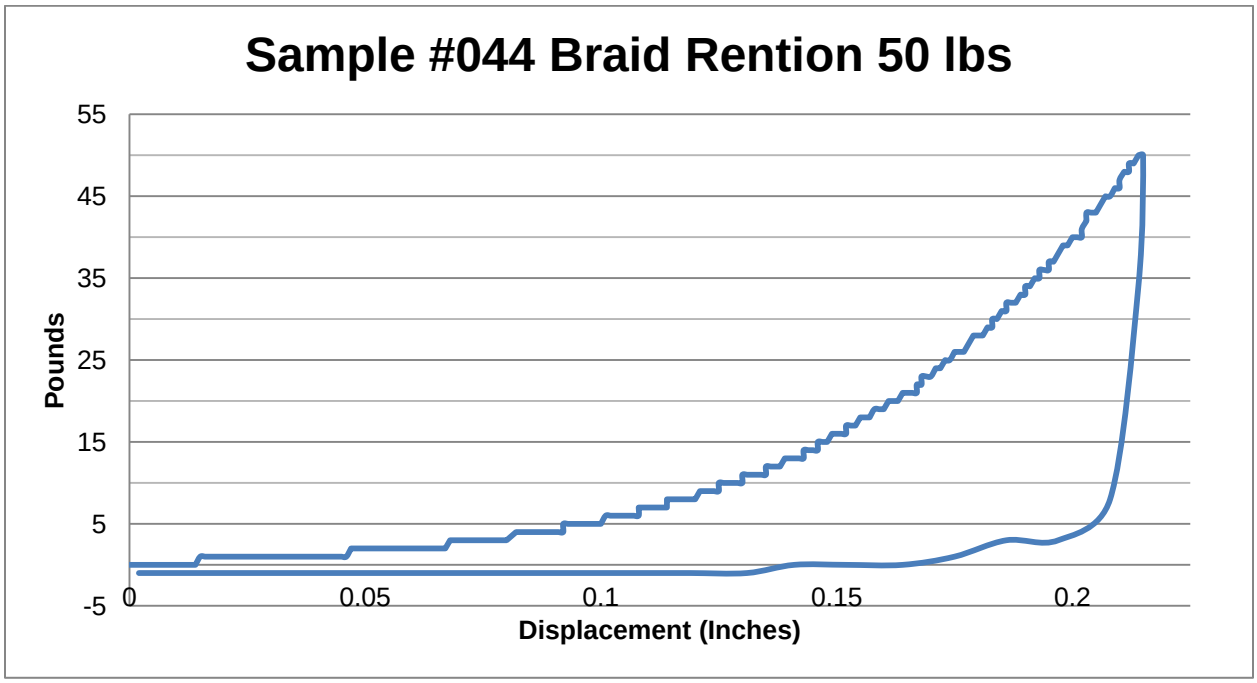


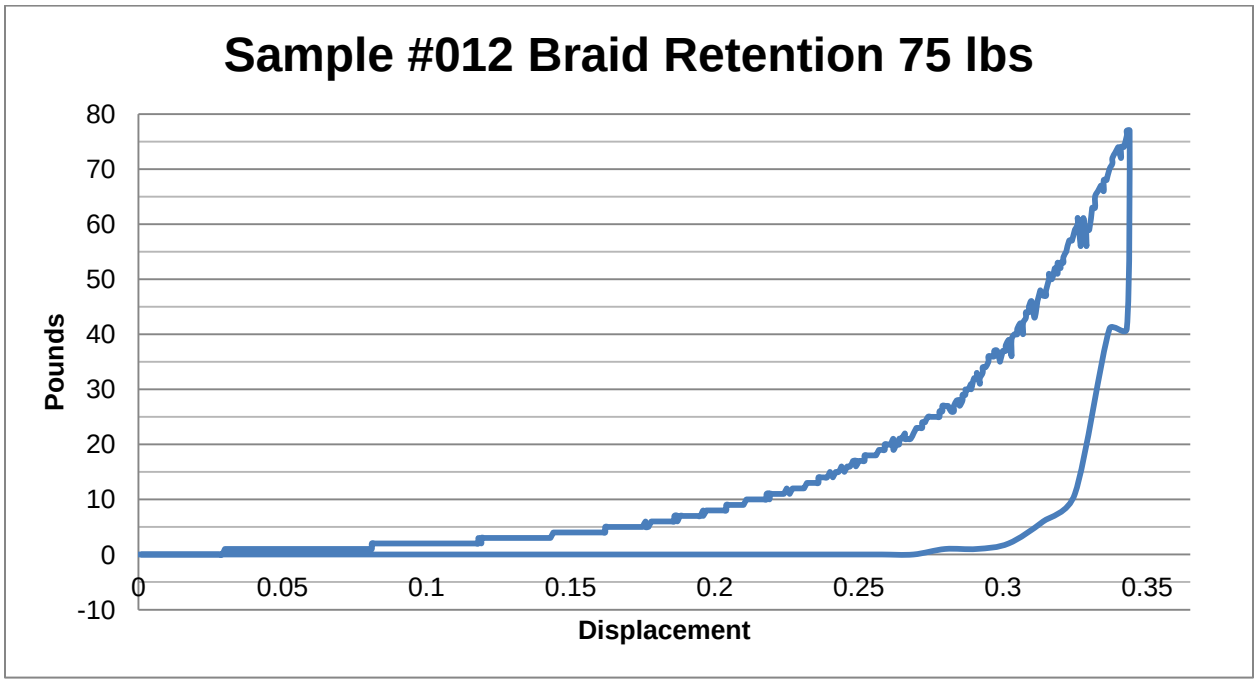


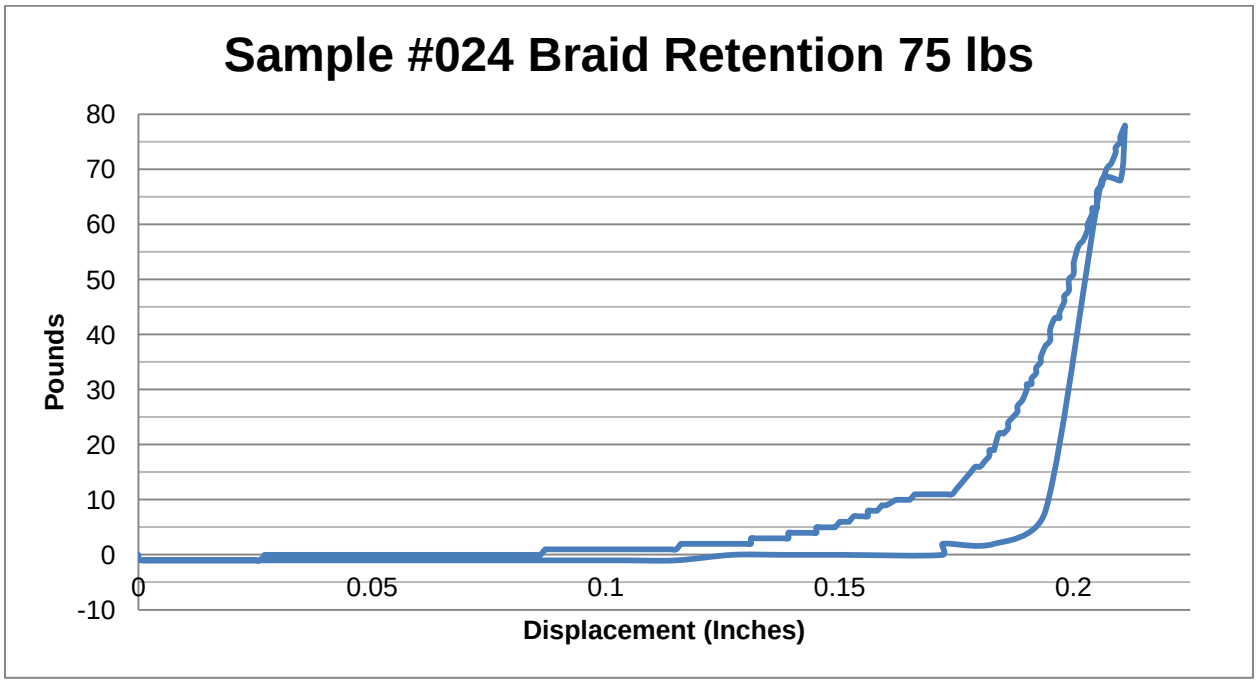


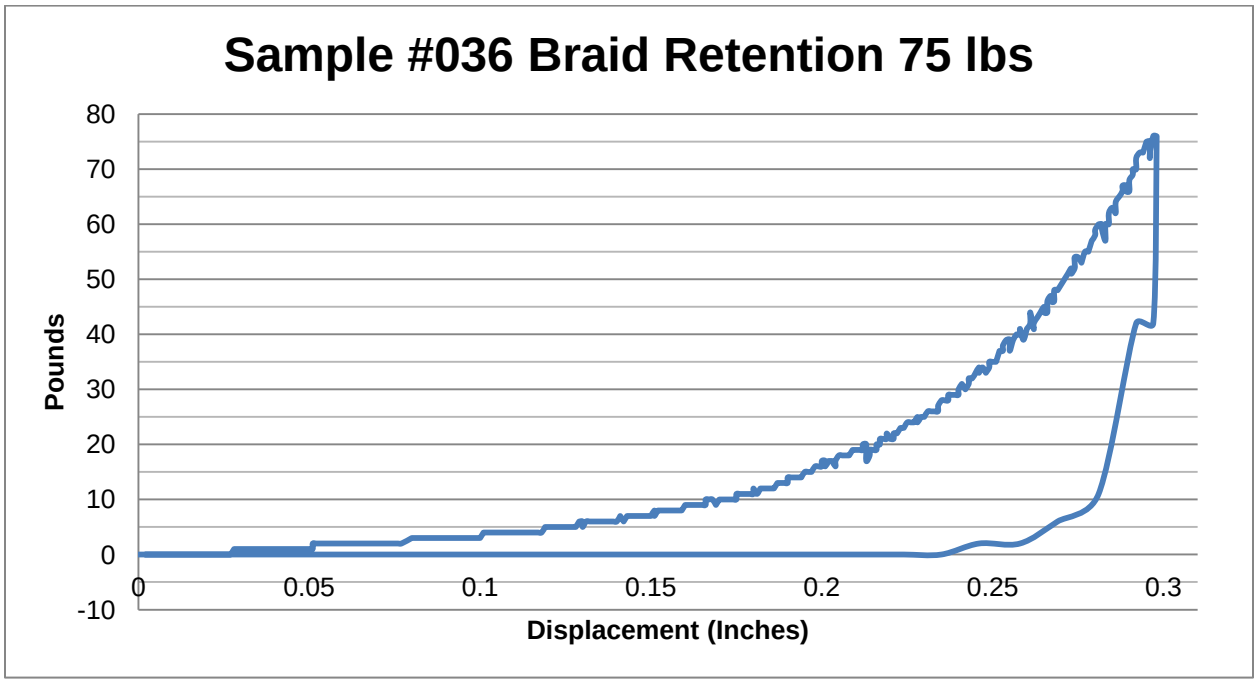


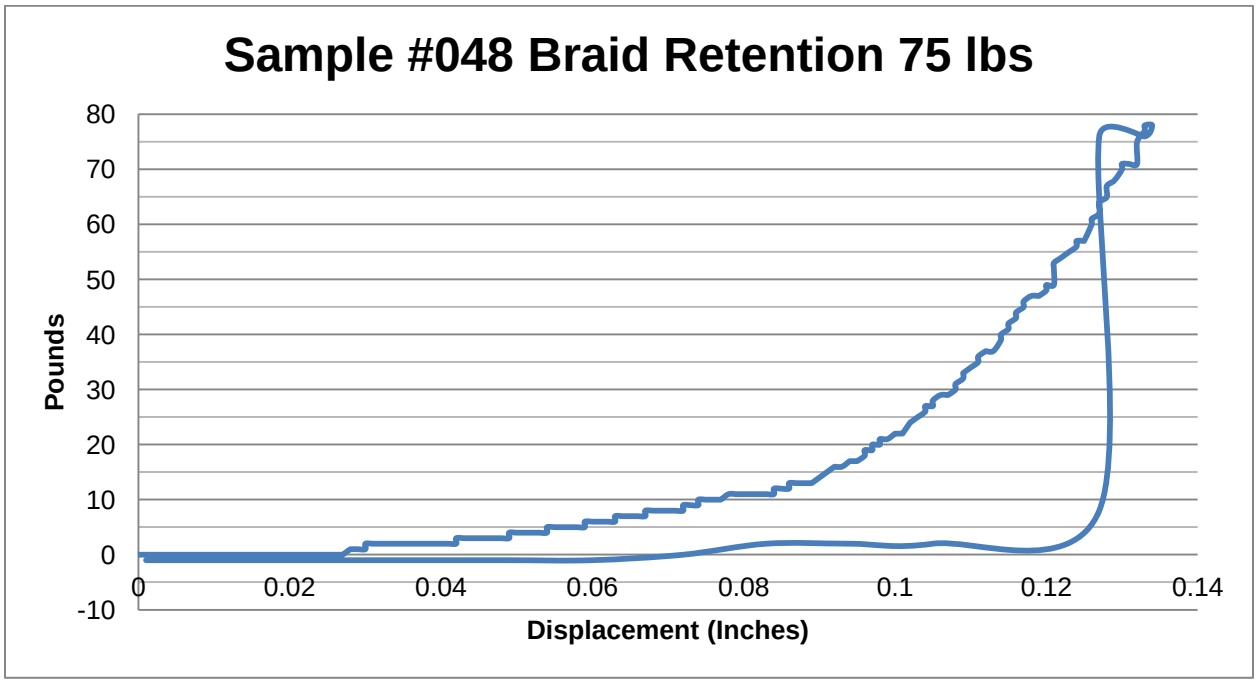






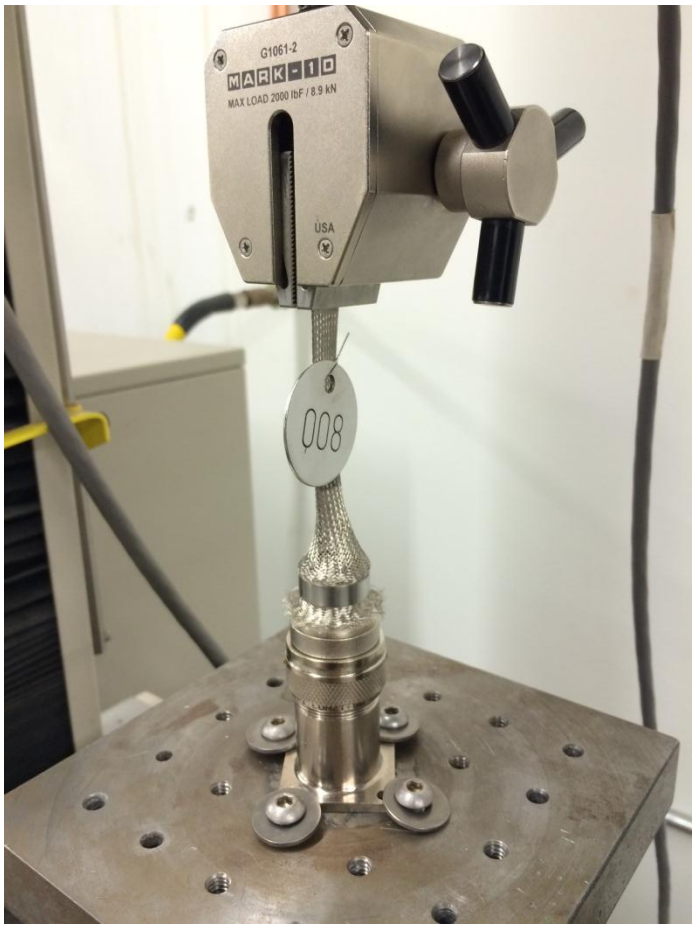






7. Braid Retention to Destruction:

Test Set Up:

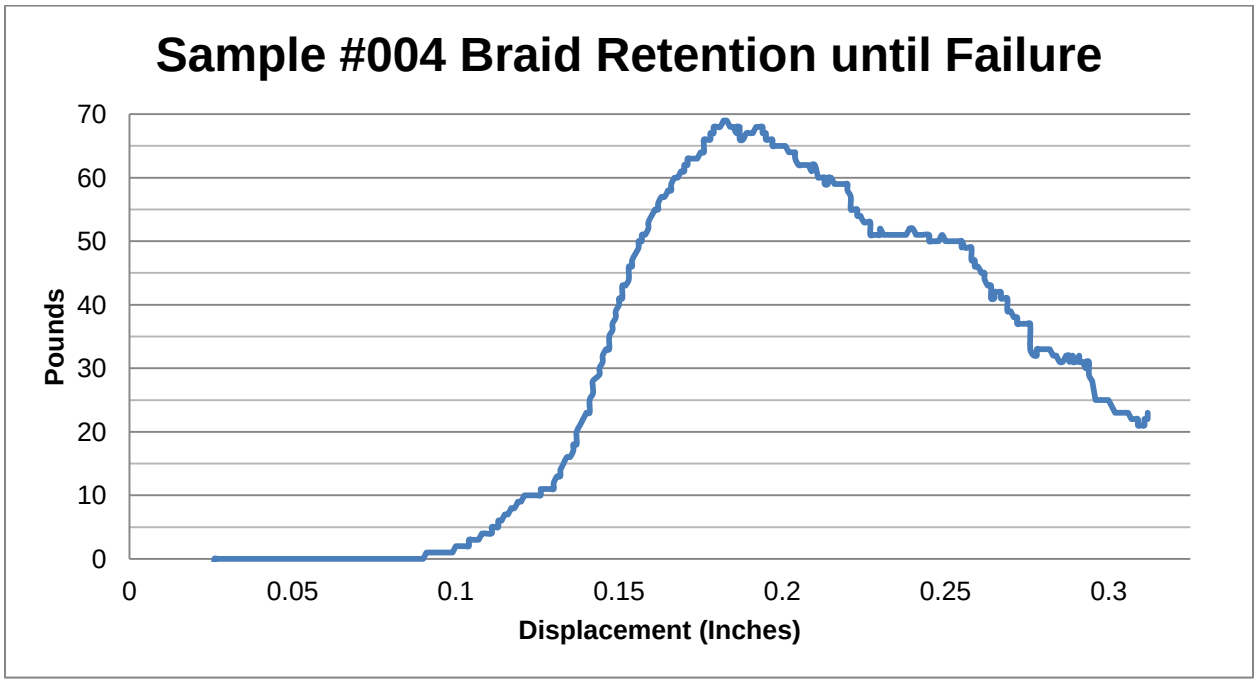


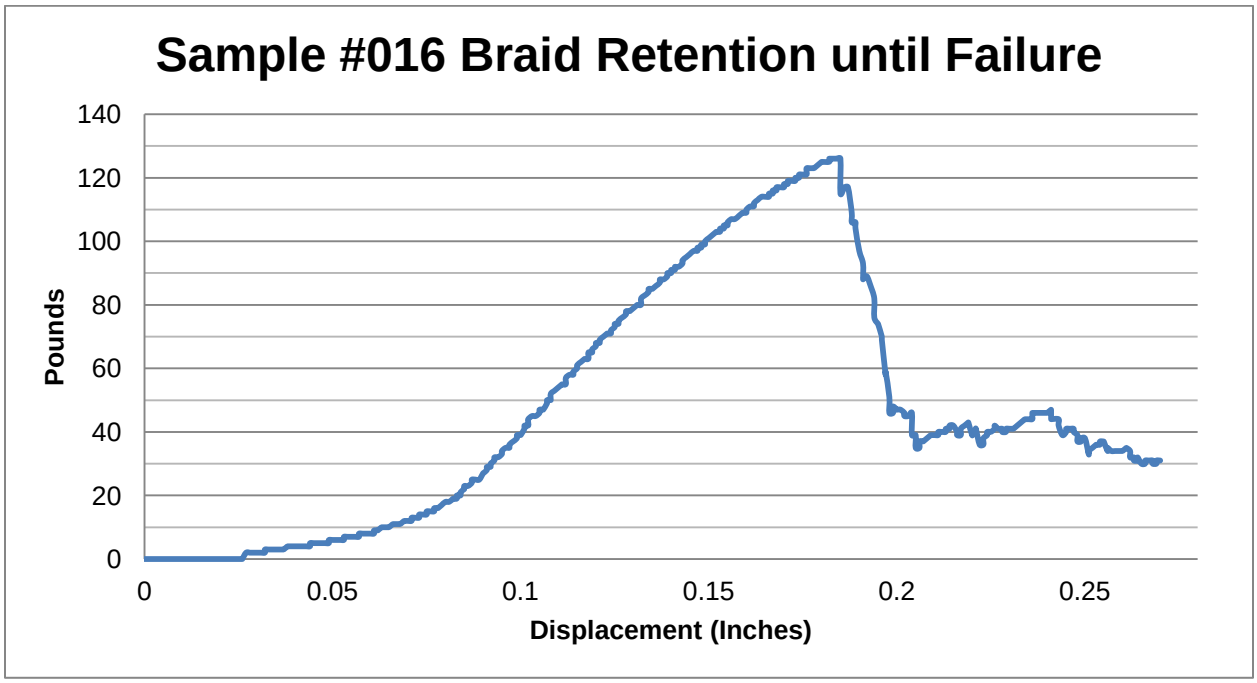
Braid Retention to Destruction test set up.

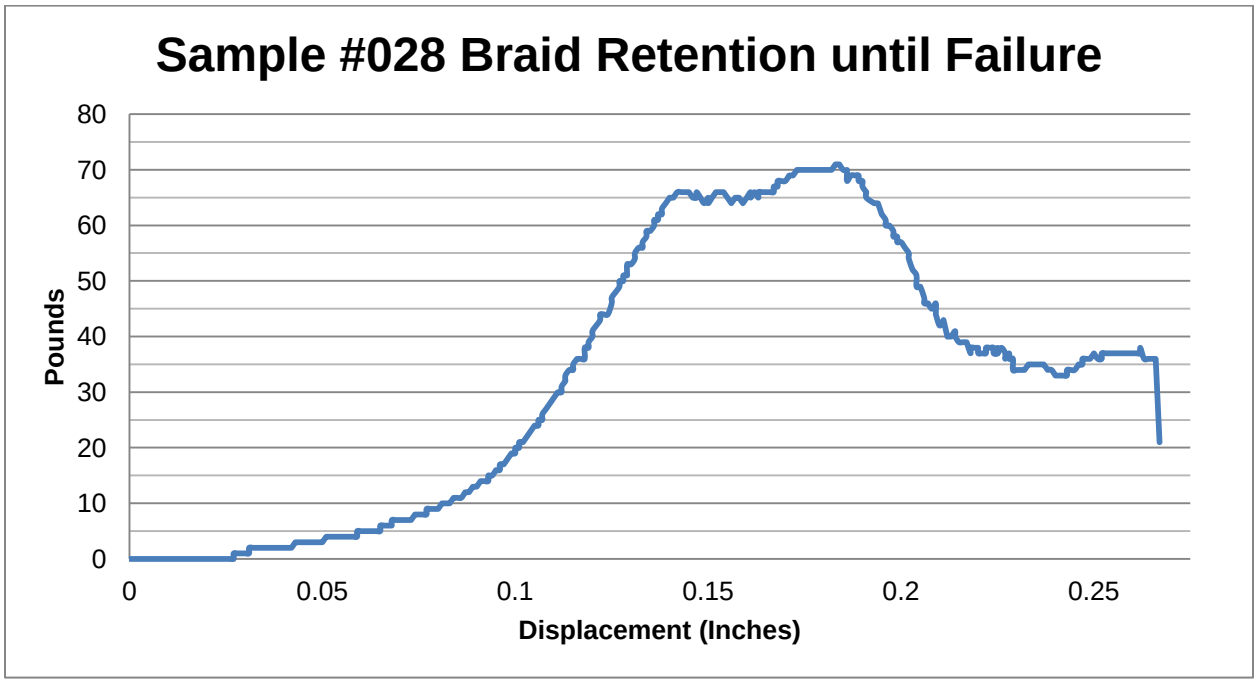
Example of sample, post Braid Retention to Destruction.

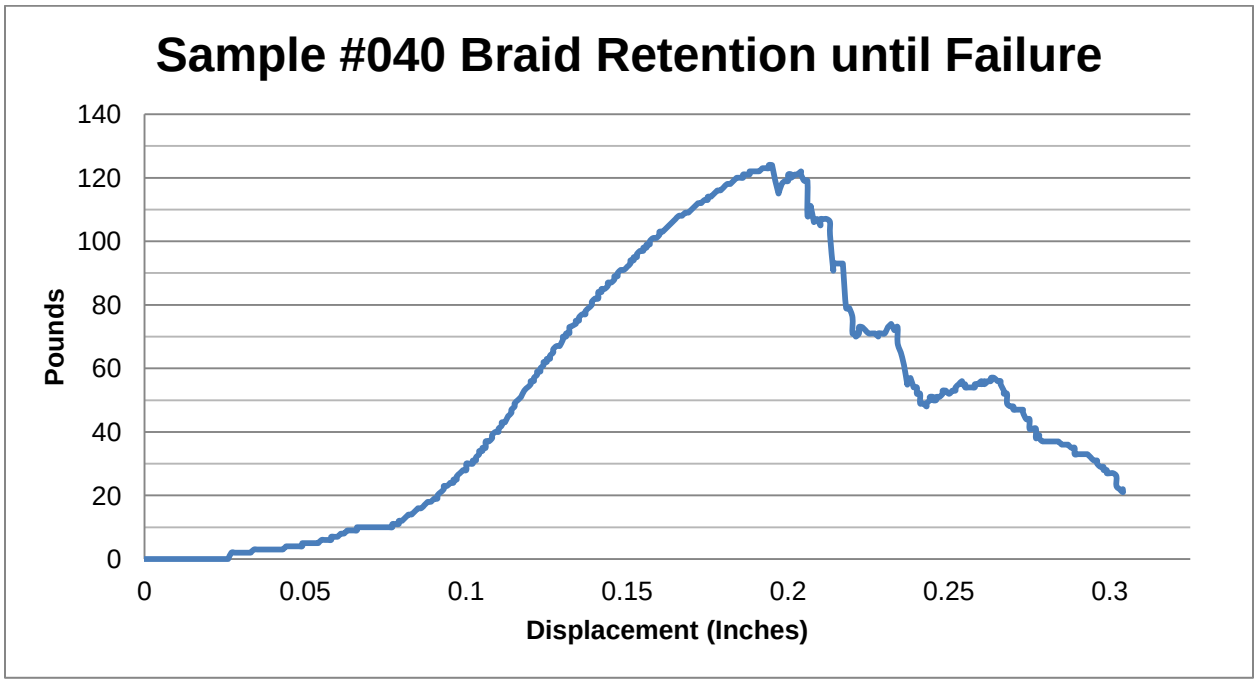
Results:

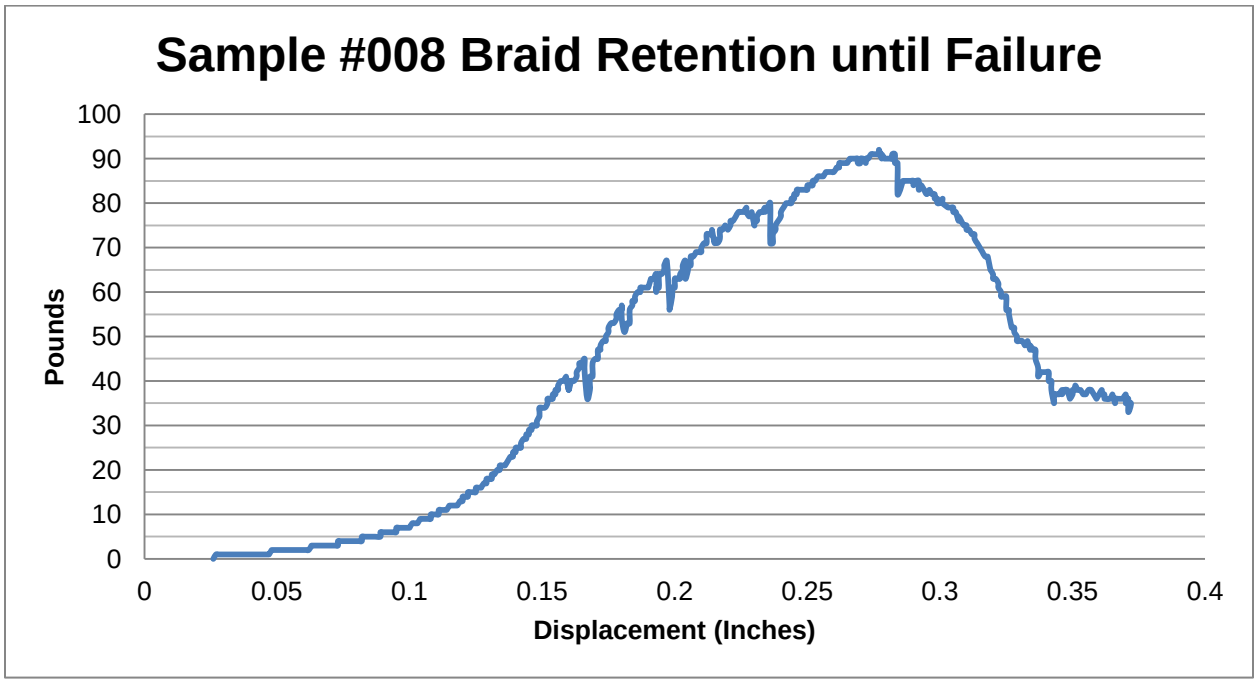
All test samples were pulled on the tensile tester until the majority of the braid was removed from the banding porch. Every failure was attributed to the braid ripping and failing. Not a single band popped off or was damaged in anyway after the test. All bands were checked by hand and none were loose to the touch.

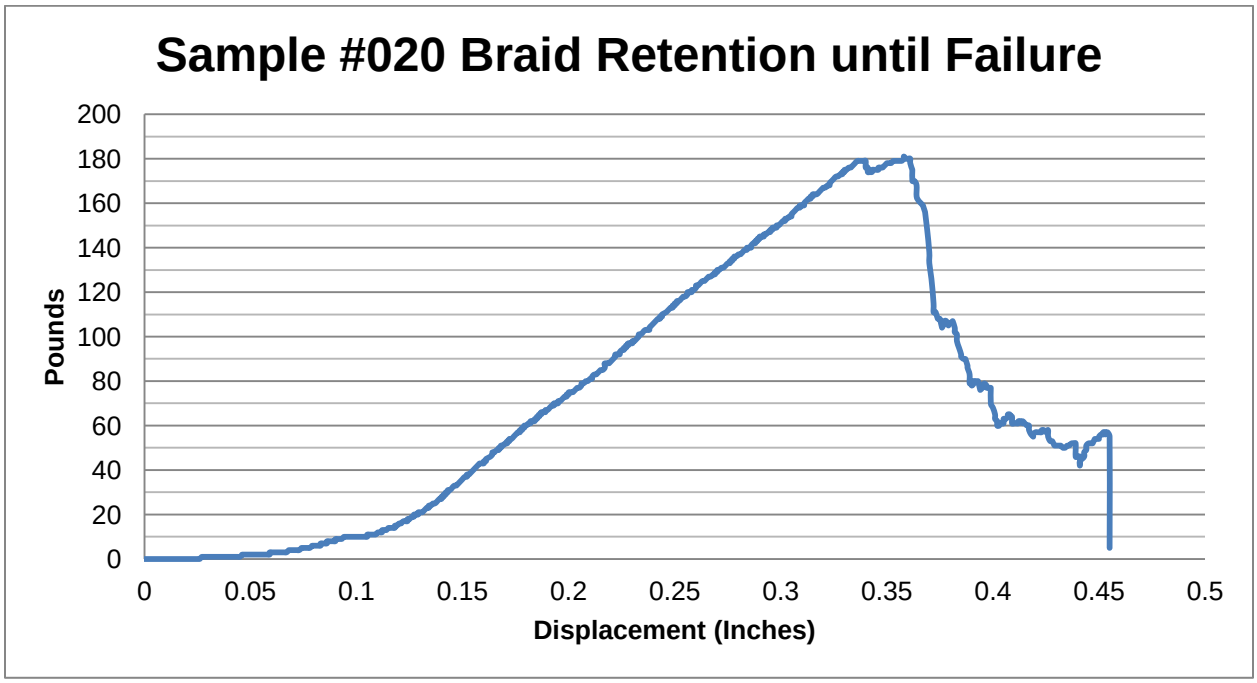


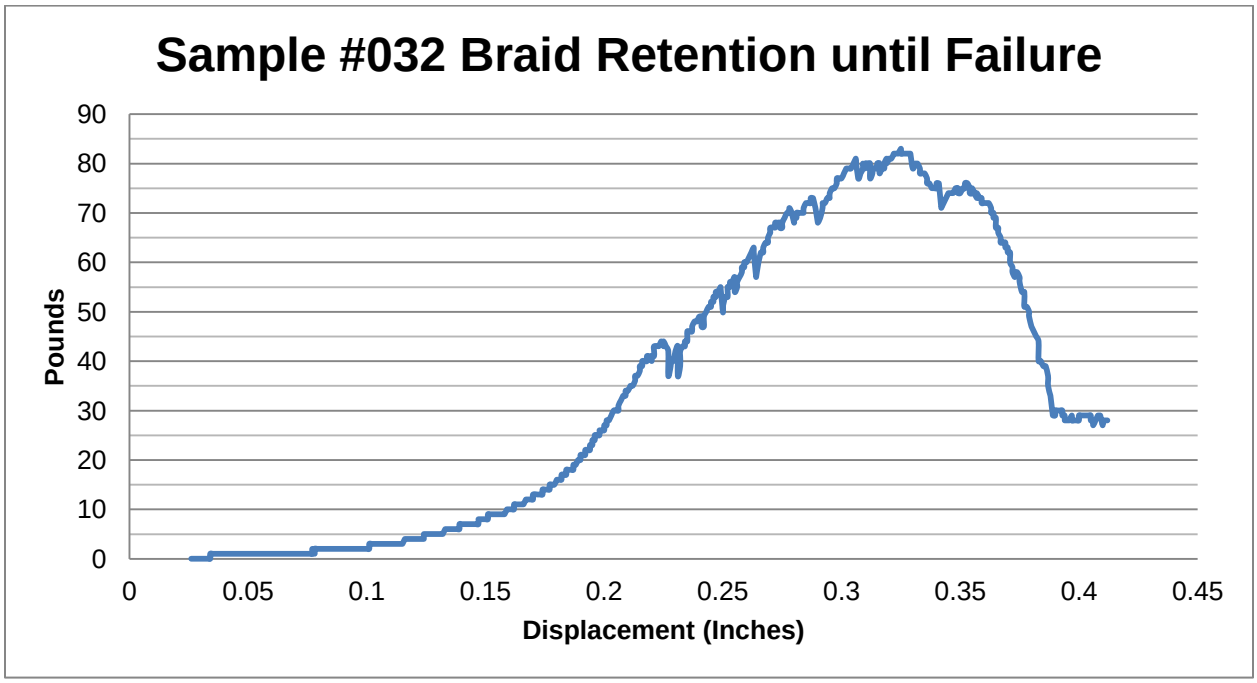


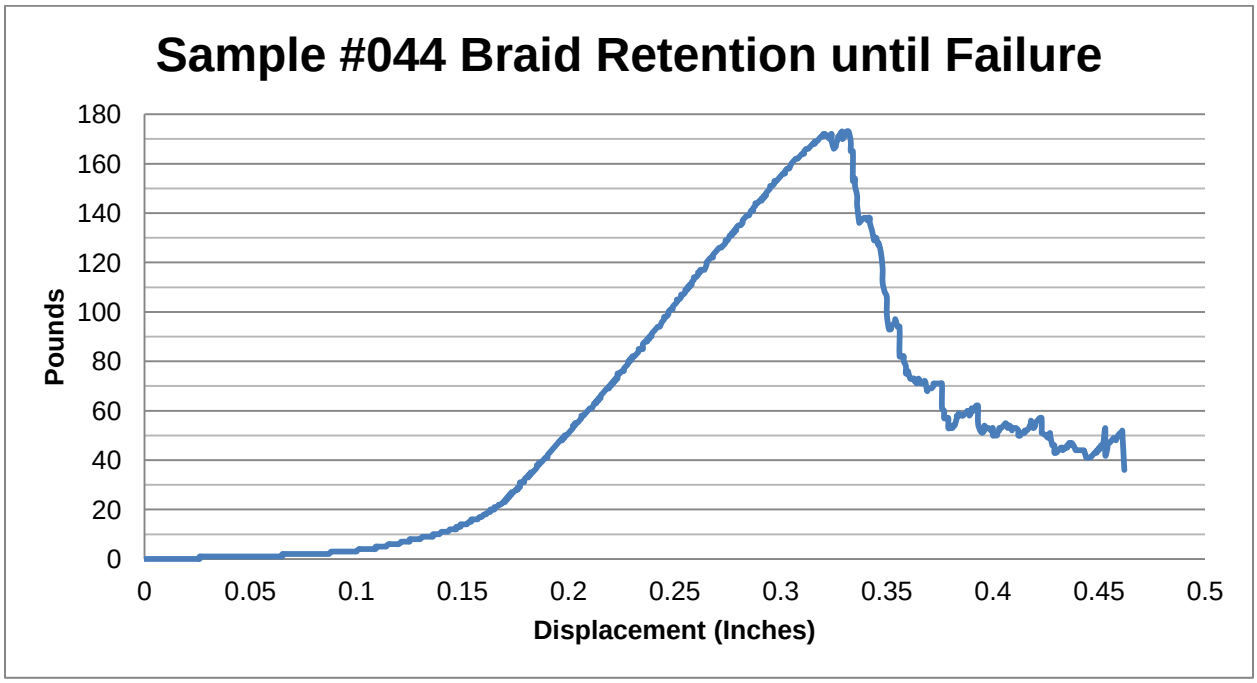


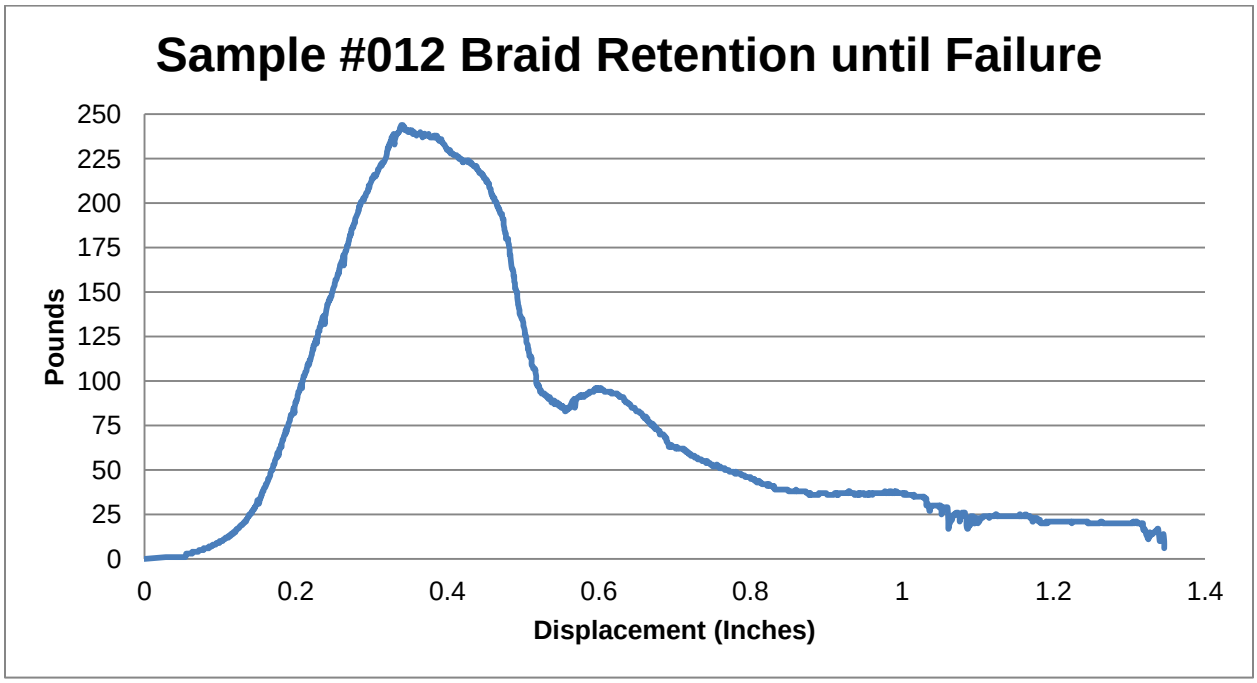


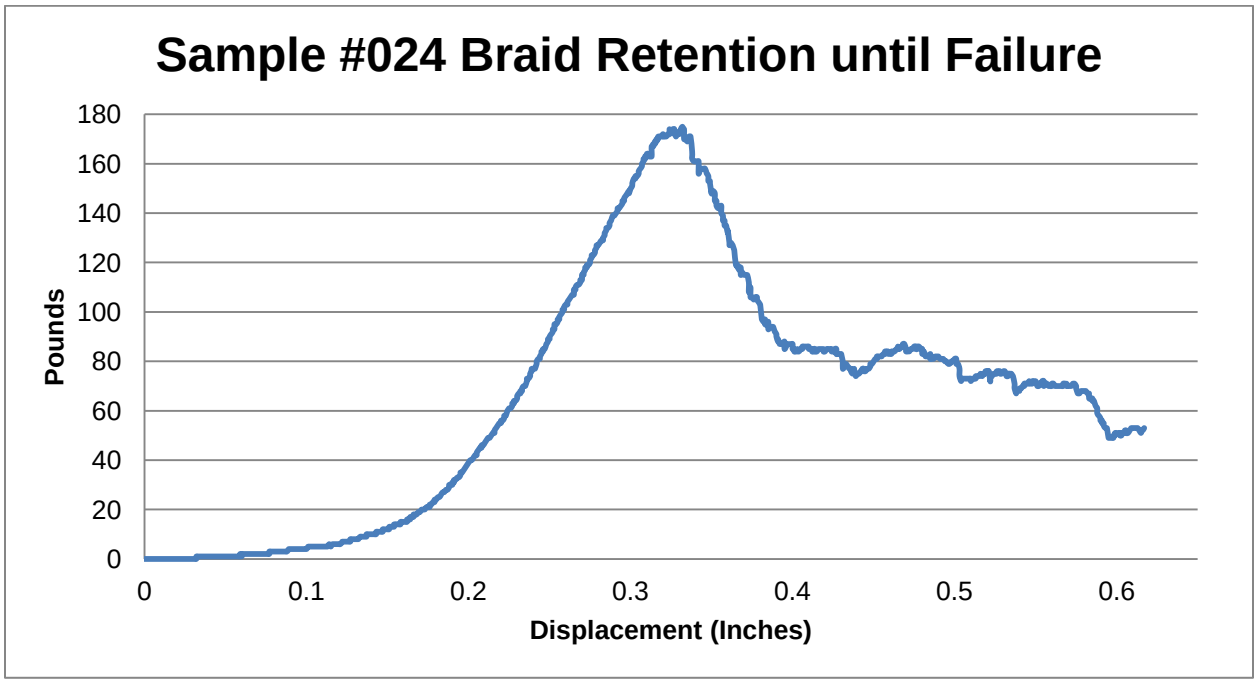


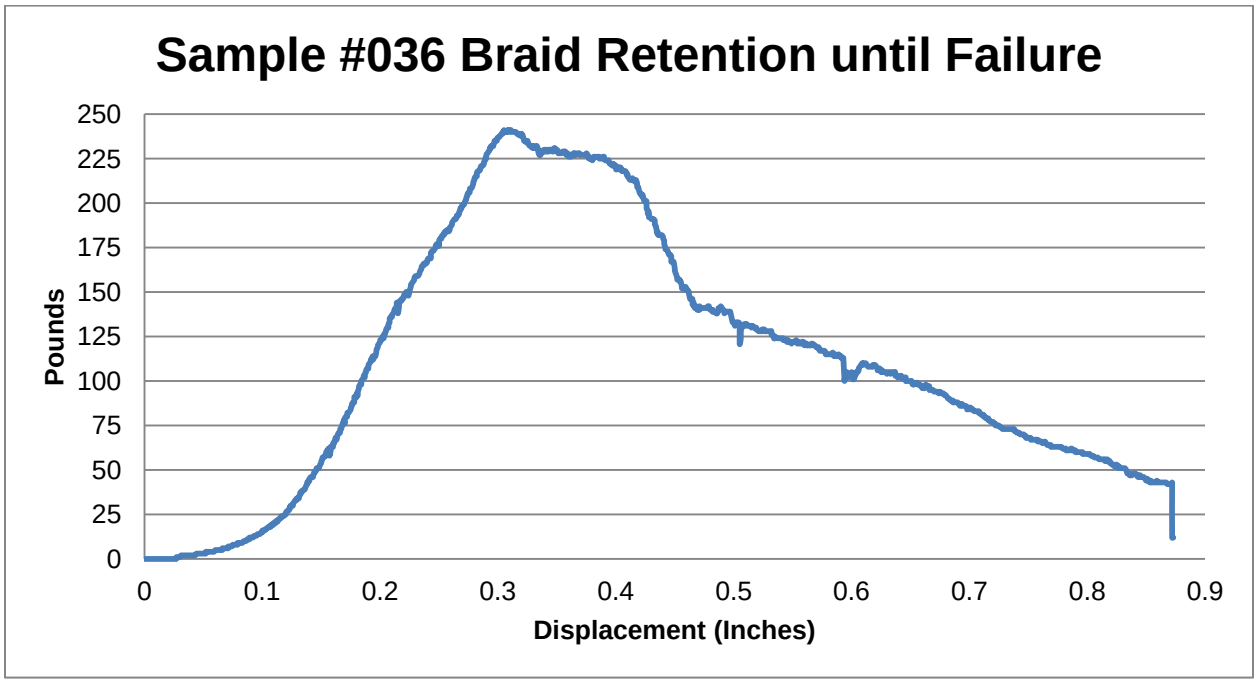


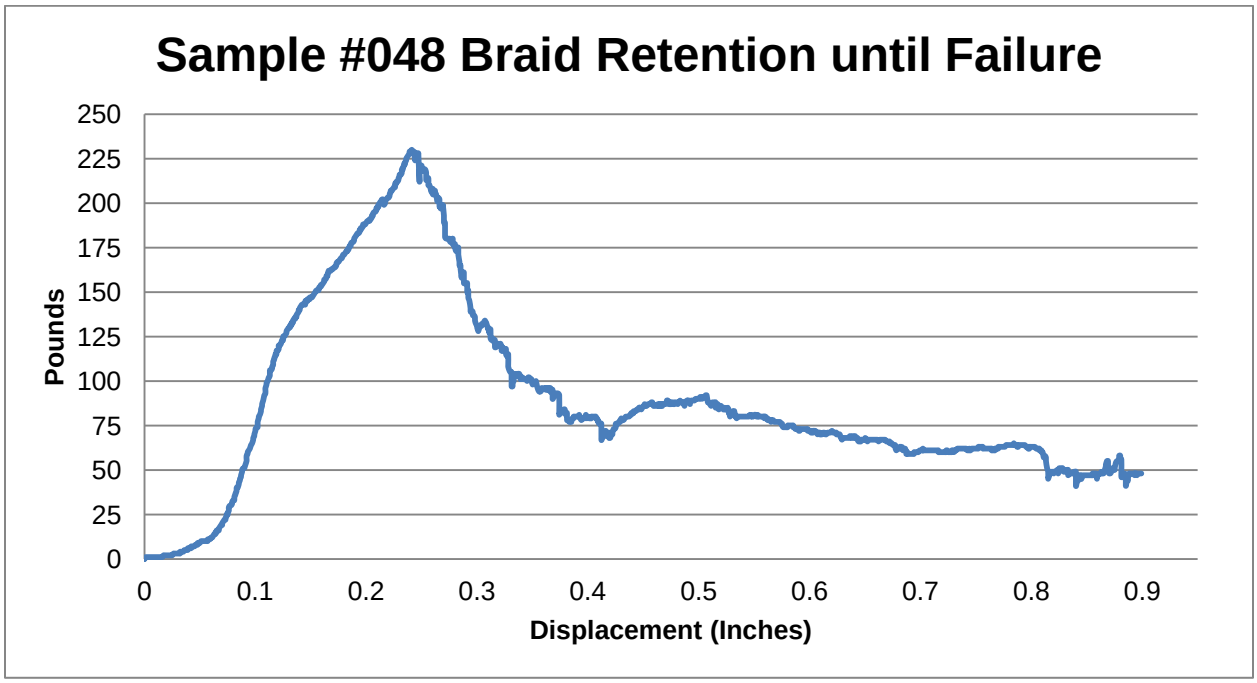












Glenair Inc. 1211 Air Way, Glendale California 91201
Telephone: (818) 247-6000, Fax: (818) 543-0317
Cage Code: 06324

Certificate of Accuracy

(Banding Tool)

Scope:

This certification is issued in accordance with Glenair's calibration system, MIL-STD-45662A. All outside calibrations house are A2LA accredited I.A.W ANSI/NCSL Z 540-1994, ISO 10012-1 ISO Guide 25 & ISO/IEC 17025. The devices designated below have been compared with weights and measures traceable to the N.I.S.T. (National Institute of Standards and Technology) to insure continued accuracy; Glenair recommends this device be checked after 500 terminations using 601-200 Calibration Kit. User should further determine desired recalibration intervals. Certificate &/or Test Reports shall not be reproduced except in full without written approval of any laboratory or manufacturer as stated herein.

Designation		**Calibration Data – Linear Force (Uncertainty + / - 1%)**		
INSTRON® Tester Model 3366 Serial#: 3366R4614	**Calibrated Date: 4/30/2014** **Calibrated Due: 4/30/2015**	**601-200 Calibration Kit Serial#: 30314**	**Calibrated Date: 8/13/2014** **Calibrated Due: 8/13/2015**	**Temperature: 68°F** **Humidity: 40%**

Part #	Serial #	Description	Nominal	Measured	Date of Test
~~600-058 (601-102, 600C058)~~	N/A	~~1/4" Band Tool~~	~~150 (+/- 5)~~	N/A	N/A
~~601-100~~	N/A	~~1/4" Band Tool w/ Counter~~	~~150 (+/- 5)~~	N/A	N/A
~~600-061 (601-103, 600C061)~~	N/A	~~1/8" Band Tool~~	~~80 (+/- 5)~~	N/A	N/A
~~601-101~~	N/A	~~1/8" Band Tool w/ Counter~~	~~80 (+/- 5)~~	N/A	N/A
~~601-108~~	N/A	~~NANO Band Tool w/ Counter~~	~~50 (+/- 3)~~	N/A	N/A
601-109	36124	Slim Band Tool w/ Counter	100 (+/- 3)	100 lbs/ Count: 46	8/15/2014

Before Calibration UNSERVICED Received as:

Inoperative: ☐ Functional: ☐

Measurement Reading: _____

Patrick L. McGee

Pat L. McGee (V.P. of Quality Management)

Dytran Instruments, Inc.
21592 Marilla St. Chatsworth, CA 91311 Ph: 818-700-7818 Fax 818-700-7880
www.dytran.com email: info@dytran.com

CALIBRATION CERTIFICATE
VOLTAGE MODE ACCELEROMETER

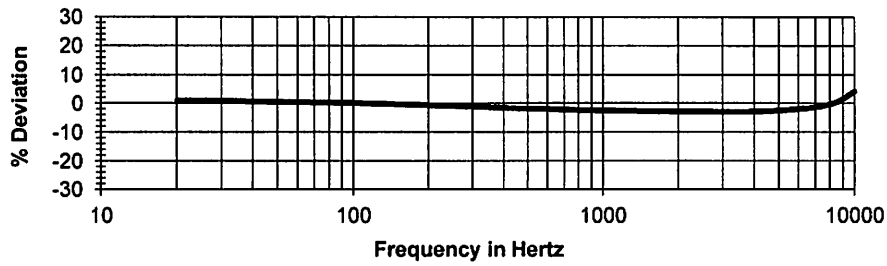
ACCREDITED Calibration Laboratory CERT#2472.01

CUSTOMER:	*PILOT GROUP, THE*				**TEST REPORT #:**	*19669*	
PURCHASE ORDER #:	*PC-050214-2-3203*		**SALES ORDER #:**	*165923*	**PROCEDURE:**	*TP3002*	
MODEL:	*3055B6*	**SERIAL #:**	*19669*		**RANGE, F.S. (g's):**	*+/- 25*	
NEW UNIT	X	**RE-CALIBRATION [1]**		**AS RECEIVED CODE**		**AS RETURNED CODE**	
REF. SENSITIVITY (mV/g) [2]:	*205.98*			**TEMP (°C):**	*23*	**HUMIDITY (%):**	*40*

FREQUENCY RESPONSE [3]

FREQUENCY (Hz)	SENSITIVITY (mV/g)	FREQUENCY (Hz)	SENSITIVITY (mV/g)
20	*207.93*	500	*202.13*
30	*207.55*	1000	*200.65*
50	*206.84*	3000	*199.81*
100	*205.98*	5000	*200.55*
300	*203.47*	8000	*205.06*
TRANSVERSE SENSITIVITY (%):	*0.9*	10000	*214.53*
DISCHARGE TIME CONSTANT (sec):	*1.1*	**BIAS VOLTAGE (VDC):**	*12.2*

Amplitude Response



REMARKS:

TEST EQUIPMENT LIST - CALIBRATION STATION # 9

DII #	MANUFACTURER	MODEL	SERIAL #	DESCRIPTION	CAL DATE	DUE DATE
1655	*NATIONAL INST.*	*PCI-4461*	*1802c1f*	*DATA ACQUISITION CARD*	*12/12/13*	*12/12/14*
686	*DYTRAN INST.*	*3010M14*	*1684*	*ACCELEROMETER*	*03/21/14*	*03/21/15*

[1] AS RECEIVED / AS RETURNED CODES:
1 = IN TOLERANCE, NO ADJUSTMENTS
2 = IN TOLERANCE, BUT ADJUSTED
3 = OUT OF TOLERANCE < 5%
4 = OUT OF TOLERANCE > 5%
5 = REPAIR REQUIRED
6 = REPAIRED AND CALIBRATED
7 = UNIT NON-REPAIRABLE, RECOMMEND REPLACEMENT
8 = UNIT SERVICEABLE WITH CURRENT CALIBRATION DATA

[2] THE REFERENCE SENSITIVITY IS MEASURED AT 100 Hz, 1G RMS.

[3] THIS CALIBRATION WAS PERFORMED IN ACCORDANCE WITH ANSI/NCSL Z540-1-1994, ISO 10012-1, ISO/IEC17025 USING THE BACK-TO-BACK COMPARISON METHOD PER ISA RP37.2 AND IS TRACEABLE TO THE NIST THROUGH TEST REPORT # 0663 DUE 03/21/15.
ESTIMATED UNCERTAINTY OF CALIBRATION: 2% FROM 20-100 Hz, 1.5% FROM 100-2500 Hz, 2.8% FROM 2.5kHz-10 kHz. APPLIES TO FREQUENCY RESPONSE ONLY.

CALIBRATION TECHNICIAN: *DAVID NUTE* 1 CAL

TEST DATE : *05/05/14*

RECOMMENDED RECALL DATE : *05/05/15*

CERTIFICATE OF CONFORMANCE

Part #: MODEL EC13HA

Serial #: AA2907

PO#: SAR101413-1

Manufacture Date: 10/30/13

Sun Electronic Systems, Inc. hereby certifies that the material supplied on this order complies in every respect to the specifications and/or drawings referenced on the order. Documented evidence is on file at our facility and is available for review upon request. The products were manufactured at our Florida facility in the USA.

Temperature probe(s) calibration has been checked to be within +/- 1° C relative to NBS traceable instrument.

Vendor Name: **Sun Electronic Systems, Inc.**

Company Official: _____ Date: 10/30/13
Jerry Garvey

SUN ELECTRONIC SYSTEMS, INC.
1845 Shepard Drive
Titusville Florida
32780

Tel: 321-383-9400
Fax: 321-383-9412
Email:info@sunelectronics.com
Web: www.sunelectronics.com

ECON Econ Technologies Co., Ltd.
Add:Building 4, 1418-41 Moganshan Rd.,Hangzhou 310015,China
Tel:+86-571-88178378 Fax:+86-571-88178385 http://www.econ-group.com

Certificate of Calibration

Certificate No.:e14018

Instrument					
Instrument Name: Vibration Controller				**Part Number:** UCON VT-9002	
Manufacturer: ECON Technologies Co., Ltd				**Serial Number:** 209997978	
Calibration Info					
Calibration Date: **02-20-2014**				Calibration Due: **02-19-2015**	
Calibration Procedures: automated run with ECON Calibration Software-90CAL					
Calibration Results: **Qualified**					
File: Calib209997978.dat & Report: Calib209997978.doc					
Calibration Institute: ECON Quality Supervision Department					
Calibration Technician: Webber					
Extra Equipment Used for Calibration					
Serial Number	Manufacturer	Model	Calib. Date	Due Date	Traceability Cert. No.
MY41029025	Agilent	34401A	08-30-13	08-29-14	DC-2013081271

Ambient Temperature: 22 ℃ (25℃±5℃)
Ambient Humidity : 46 % (10%~80%)

Remarks/Comments

Econ Technologies certifies that all calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology. Alternatively, accuracies have been derived from accepted values of natural physical constants, or have been derived by the ratio of self-calibration techniques. This certificate applies only to the instrument identified above and shall not be reproduced, except in full, without the specific written approval by the calibration organization issuing this report.

Technician Confirm: Webber QC Inspector Confirm: Allen

Calibration Report

Serial No: 209997978
Date of Calibration: 02/20/2014

Calibrated by: Webber
Instrument/ID: Agilent
Instrument Model Number: 34401A

Number of Output Channels: 1
Number of Input Voltage Channels: 2
Number of Input Charge Channels: 2

Output Channels Initial (UnCalibrated) Data

Channel	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	
DRIVE	0.016172V	2.266%	

Output Channels Final (Calibrated) Data

Channel	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	Result
DRIVE	2.6e-005V	0.0039959%	Pass

Input Voltage Channels (DC Gnd Couple) Initial (UnCalibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	
1	-0.00170939V	2.55617%	9.69771e-005V	2.47817%	0.012803V	2.56023%	
2	7.92731e-005V	1.67346%	0.00313913V	1.58312%	0.0309931V	1.66441%	

Input Voltage Channels (DC Gnd Couple) Final (Calibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	Result
1	1.12497e-005V	0.00576973%	2.15904e-005V	0.00730753%	-1.86369e-005V	0.00321865%	Pass
2	1.80601e-005V	0.00600815%	2.34206e-005V	0.00661612%	-0.000122518V	0.00292063%	Pass

Input Voltage Channels (DC Dif Couple) Initial (UnCalibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	
1	-0.00169761V	2.56552%	0.000116584V	2.48339%	0.0127663V	2.5622%	
2	9.30954e-005V	1.68258%	0.00316755V	1.58752%	0.0309402V	1.66634%	

Input Voltage Channels (DC Dif Couple) Final (Calibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	Result
1	2.85166e-005V	0.00320673%	2.86042e-005V	0.00354052%	2.92482e-005V	0.00104904%	Pass
2	2.69133e-005V	0.00295639%	2.00705e-005V	0.00344515%	-1.91189e-005V	0.0015974%	Pass

Input Voltage Channels (AC Gnd Couple) Initial (UnCalibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	
1	0.00012722V	2.56629%	0.00194243V	2.48963%	0.0145935V	2.56826%	
2	0.000105487V	1.68446%	0.00317096V	1.59446%	0.0309317V	1.67165%	

Input Voltage Channels (AC Gnd Couple) Final (Calibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	Result
1	1.90973e-005V	0.00742674%	6.7634e-006V	-0.000762939%	-1.50393e-005V	-0.000554323%	Pass
2	1.59937e-005V	0.00687838%	5.11277e-006V	-0.000220537%	-5.10143e-005V	8.34465e-005%	Pass

Input Voltage Channels (AC Dif Couple) Initial (UnCalibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	
1	0.000135027V	2.5674%	0.001937V	2.48973%	0.0146138V	2.56823%	
2	0.000109514V	1.6857%	0.0031639V	1.5949%	0.0309194V	1.67137%	

Input Voltage Channels (AC Dif Couple) Final (Calibrated) Data

Channel	Offsets of 0.1 Volt Range	Gain Error of 0.1 Volt Range	Offsets of 1.0 Volt Range	Gain Error of 1.0 Volt Range	Offsets of 10.0 Volt Range	Gain Error of 10.0 Volt Range	Result
1	-3.59305e-006V	0.00369549%	4.75919e-006V	0.0018239%	-2.75604e-005V	0.00298023%	Pass
2	-6.60783e-006V	0.00272989%	-2.71649e-006V	0.00146627%	-3.84198e-005V	0.00268221%	Pass

Input Charge Channels Initial (UnCalibrated) Data

Channel	Gain Error(%) of 1.0 mV/pC	Gain Error(%) of 10.0 mV/pC	
1	1.46241%	1.43739%	
2	-1.46055%	-2.0625%	

Input Charge Channels Final (Calibrated) Data

Channel	Gain Error(%) of 1.0 mV/pC	Gain Error(%) of 10.0 mV/pC	Result
1	0.000679493%	-0.00987649%	Pass
2	-0.0077486%	-0.0106215%	Pass

End of calibration report

Singer Laboratories

CERTIFICATE OF CALIBRATION

Customer # Singer Labs	Singer Laboratories 139 W. Walnut Ave. Monrovia, CA 91016			Purchase Order None
Certificate # 1103	Calibrated: Onsite	Calibration Date 7/23/2014	Next Calibration 7/23/2015	Recall 12 Months
Instrument ID CE00005	Manufacturer Tenney		Instrument Type Environmental Chamber	
	Model Number TJR	Serial Number 0909000066-03	Measuring Range -73 C to 205 C	
	Procedure Temp Chamber Cal	Temperature 73 F	Humidity 41.2%	Technician POC

CONDITION RECEIVED:	CONDITION RETURNED:	REASON FOR SERVICE:
WITHIN TOLERANCE	WITHIN TOLERANCE	CALIBRATION AND CERTIFICATION

All calibrations conform to ISO 17025

ADDITIONAL INFORMATION

Accuracy

TEMPERATURE CONTROLLER: +/- 1 C

ENVIRONMENTAL CHAMBER: +/- 1 C

Analysis

Calibrated Chamber with 1 Temperature controller Watlow, F4 (-78 C to 205 C)

Chamber Nominal	Measured (Controller Probe)	Measured (Chamber Center)
-65 C	-65.6 C	-64.4 C
-40 C	-40.0 C	-39.8 C
-20 C	-20.1 C	-20.0 C
0 C	.3 C	.4 C
50 C	49.5 C	49.1 C
100 C	100.2 C	99.9 C
150 C	150.1 C	150.2 C
200 C	200.0 C	199.2 C

Chamber

This is to certify that the equipment noted hereon has been compared to the standards listed below in accordance with the reference procedure or specification and has been found to conform to the specified limits. Although the item calibrated meets the specification and performance at the time of calibration, due to any number of factors, the recommended due date of the item calibrated does not imply continuing conformance to specification during the recommended interval. Pertinent data, if any, is listed on the attached sheets. The standards that have been utilized in this calibration are certified by, or are traceable to, the National Institute of Standards and Technology (NIST), and meet or exceed manufacturer's requirements for the above mentioned item.

Singer Laboratories
139 W Walnut Ave, Monrovia, CA 91016
Tel: (626)599-9080 Fax: (626)773-8180

Singer Laboratories

CERTIFICATE OF CALIBRATION

Standards employed:

EM0006

Calibration Standard	Model Number	Instrument Type	Due Date
Fluke Temperature Calibrator	724	Thermometer	6/10/2015

Technician Signature

Approval Signature

Singer Laboratories
139 W Walnut Ave, Monrovia, CA 91016
Tel: (626)599-9080 Fax: (626)773-8180

Customer # N/A
Certificate # 1103

ISO/IEC 17025-2005
ACCREDITED

CERTIFICATE OF CALIBRATION
MICRO QUALITY CALIBRATION
• The First •

Western Commercial Laboratory Designed Exclusively For Precision Measurement.

Customer #					
THE110	THE PILOT GROUP 128 W. WALNUT AVE UNIT C MONROVIA, CA 91016			Calibrated: At MQC	
Barcode	**Cert Number**	**Purchase Order**	**Cal Date**	**Next Cal**	**Recall**
148185	1000598247	PC053015-1	06/10/2014	06/10/2015	12 M

Instrument Type	Manufacturer	Model Number	Measuring Range
CALIBRATOR, TEMPERATURE, FLU 724	FLUKE	724	MULTI

Instrument Id	Serial Number	Procedure	Tech	Temperature	68 deg F
9240057	9240057	1001	HDN	Humidity	40%

CONDITION RECEIVED:	CONDITION RETURNED:	REASON FOR SERVICES:
WITHIN TOLERANCE	WITHIN TOLERANCE	CALIBRATION AND CERTIFICATION

All calibrations conform to ISO 10012.2003, ANSI/NCSL Z-540.3-2006.

ADDITIONAL INFORMATION

Accuracy

VOLTAGE & mA	: ±(0.2% + 2 LSD)
THERMOCOUPLE (J,K,T,E,L,N,U)	: ±0.7°C
THERMOCOUPLE (B,R,S)	: ±1.4°C
RTD	: ±0.2°C

Nominal	Actual	Minimum	Maximum	Deviation
100 mVDC	99.994	99.960	100.040	-0.006
10 VDC	9.9996	9.9960	10.0040	-0.0004
-100°C (TYPE K)	-99.89	-100.70	-99.30	0.11
100°C	100.12	99.30	100.70	0.12
500°C	500.09	499.30	500.70	0.09
1000°C	1000.15	999.30	1000.70	0.15

This is to certify that the equipment noted hereon has been compared to the standards listed below in accordance with the reference procedure or specification and has been found to conform to the specified limits. Although the item calibrated meets the specification and performance at the time of calibration, due to any number of factors, the recommended due date of the item calibrated does not imply continuing conformance to specification during the recommended interval. Pertinent data, if any, is listed on the attached sheets. The standards that have been utilized in this calibration are certified by, or are traceable to, the National Institute of Standards and Technology (NIST), and meet or exceed manufacturer's requirements for the above mentioned item.

STANDARDS EMPLOYED

Cal Std	Model Number	Instrument Type	Due Date
3812	5520A	CALIBRATOR, MULTI-FUNCTION	02/28/2015
3688	3458A	MULTIMETER, HP 3458A	07/01/2014

Numbers traceable to National Institute of Standards and Technology:

(3812)260638 (3812)261059 (3812)264236 (3688)260638 (3688)261059
(3688)264236

MQC 11

Technician Signature

Approval Signature

20743 Marilla Street, Chatsworth, California 91311-4408
Tel: (818)701-4969 Fax: (818)341-9109

Starrett®

ATTN: QUALITY ASSURANCE
MCMASTER-CARR SUP CO
9630 NORWALK BLVD
SANTA FE SPRINGS, CA 90670-2932

May 1, 2014

STANDARD LETTER of CERTIFICATION

THIS IS TO CERTIFY THAT THE ITEM LISTED BELOW MEETS THE REQUIREMENTS OF ACCURACY OF THE APPLICABLE SPECIFICATION ON DATE OF SHIPMENT.

STANDARDS AND EQUIPMENT USED FOR INSPECTION ARE CERTIFIED ACCURATE WITH REFERENCE TO 68 DEGREES F, TRACEABLE TO MASTER STANDARDS AT THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, GAITHERSBURG, MD. CALIBRATION IS PERFORMED WITH TRANSFER STANDARDS WHICH ARE PROGRESSIVELY MORE ACCURATE IN THE ORDER OF 4: 1.

WE ATTEST THAT OUR MEASURING AND TEST EQUIPMENT, AND CALIBRATIONS PERFORMED ON THE ITEM (S) LISTED BELOW, ARE IN ACCORDANCE WITH ISO 17025, ISO GUIDE 25, ANSI/NCSL Z540-1, MIL-STD-45662A.

YOURS VERY TRULY,
THE L. S. STARRETT COMPANY

Susan Mason (for)

DEXTER J. CARLSON,
CHIEF INSPECTOR

YOUR ORDER NO.:	FA-78751580
STARRETT ORDER NO.:	2380307
CATALOG NO.:	KTX1-25-N POCKET TAPE 1" x 25'
SERIAL NO.:	14184866
N.I.S.T. TEST NO.	683/282436
SPECIFICATION:	GGG-T-106F
ACCURACY:	± 1/32" for the first 12 Feet, ± 1/16" for the remainder

The estimated uncertainties reflect a Confidence Probability of approximately 95%.

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www.starrett.com

FLUKE®

Certificate of Calibration

Everett Service Center

ISO 9001:2008 (10100/2)

Certificate Number: 2740201-23650184:1386088552

Result Summary:	PASS	**Date of Calibration:**	03 December 2013
Data Type:	FOUND-LEFT	**Recommended Due Date:**	03 December 2014
Manufacturer:	FLUKE	**Date of Certificate:**	03 December 2013
Model:	287	**Received Date:**	26 November 2013
Serial Number:	23650184	**Temperature:**	21.6 °C
Description:	TRUE RMS MULTIMETER	**Relative Humidity:**	24 %RH
Procedure Name:	FLUKE 287:(1YR) ZCAL VER RS-232 /5520	**Procedure Revision:**	1.6

Customer Name:	DIGI-KEY
City, State:	THIEF RIVER FALLS, MN
Customer Item ID:	
PO Number:	COC
RMA Number:	COC

This calibration is traceable to the International System of Units (SI), through National Metrology Institutes, ratiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. Calibration certificates without signature are not valid. The calibration has been completed in accordance with Fluke Electronics Corporation Quality System Document 111.0 Rev 116 08/12 and Fluke Customer Support Services QAM 400 Rev. 002 03/22/2012.

The Data Type found in this certificate must be interpreted as:

- As - Found Calibration data collected before the unit is adjusted and / or repaired.
- As - Left Calibration data collected after the unit has been adjusted and / or repaired.
- Found-Left Calibration data collected without any adjustment and / or repair performed.

Sierra Freeman
Metrology Technician

Standards Used

Asset #	Instrument Model	Cal Date	Cal Due
10418	FLUKE 5520A CALIBRATOR	11 October 2013	11 January 2014

End of Report

FLUKE®

Certificate of Calibration

Everett Service Center

ISO 9001:2008 (10100/2)

Certificate Number: 2740201-26060019:1386086564

Result Summary:	PASS	**Date of Calibration:**	03 December 2013
Data Type:	FOUND-LEFT	**Recommended Due Date:**	03 December 2014
Manufacturer:	FLUKE	**Date of Certificate:**	03 December 2013
Model:	287	**Received Date:**	26 November 2013
Serial Number:	26060019	**Temperature:**	21.8 °C
Description:	TRUE RMS MULTIMETER	**Relative Humidity:**	24 %RH
Procedure Name:	FLUKE 287:(1YR) ZCAL VER RS-232 /5520	**Procedure Revision:**	1.6

Customer Name:	DIGI-KEY
City, State:	THIEF RIVER FALLS, MN
Customer Item ID:	
PO Number:	COC
RMA Number:	COC

This calibration is traceable to the International System of Units (SI), through National Metrology Institutes, ratiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. Calibration certificates without signature are not valid. The calibration has been completed in accordance with Fluke Electronics Corporation Quality System Document 111.0 Rev 116 08/12 and Fluke Customer Support Services QAM 400 Rev. 002 03/22/2012.

The Data Type found in this certificate must be interpreted as:

- As - Found Calibration data collected before the unit is adjusted and / or repaired.
- As - Left Calibration data collected after the unit has been adjusted and / or repaired.
- Found-Left Calibration data collected without any adjustment and / or repair performed.

Sierra Freeman
Metrology Technician

FLUKE ®

Certificate Number:
2740201-26060019:1386086564

Calibration Date:
3-Dec-13

Standards Used

Asset #	Instrument Model	Cal Date	Cal Due
10418	FLUKE 5520A CALIBRATOR	11 October 2013	11 January 2014

End of Report