PRODUCT ADVISORY NOTICE

KEEPING YOU INFORMED OF PRODUCT CHANGES

To: **All Customers, Sales Representatives and Distributors**

Date: March 17, 2017

Subject: Expanded Surface Mount Pick and Place Capacity in our Shenzhen, China Facility

This Product Advisory Notice is to alert you that there is an upcoming process change in our Grayhill Shenzhen, China production facility. Your company has purchased one or more of the affected part numbers in the past. Please forward this notification to the appropriate person(s) in you organization.

Description of Change
Grayhill's Shenzhen, China production facility produces various electronic products, including many different optical encoders. The Shenzhen facility has been performing the Surface Mount printed circuit board component assembly on the majority, but not all, of the two million optical encoders we produce on a yearly basis. Grayhill has now expanded its Surface Mount Technology component Pick and Place capacity in the Shenzhen, China facility. This now permits us to perform the Surface Mount assembly for all the encoders that are assembled in Shenzhen. Grayhill will maintain the ability to provide printed circuit board assemblies from its LaGrange USA facility as a backup, if required. There are no changes to the piece part components or the printed circuit board assemblies used in the encoders. Grayhill has performed comprehensive qualification of the pick and place assembly, the individual printed circuit board assemblies, and the finished encoders using the Shenzhen assembled printed circuit boards. The printed circuit boards and finished encoders have passed all of the stringent environmental tests which include thermal shock, mechanical shock, mechanical vibration, four corner testing, and 500 hour +85C/85%RH testing.

Reason for Change
Plant capacity expansion and supply risk mitigation. The option of performing the printed circuit board assembly in Shenzhen or USA also provides a backup in the event a line is down for an extended period of time.

Effective Date
The process change will be effective April 1, 2017.

Part Numbers Affected
All variants of Grayhill part numbers beginning with 60C, 62AG, 62NG, 62SG, assembled in our Shenzhen, China facility (example 62AG11-L5-020C).

Data Availability
The qualification test reports are available on-line at http://www.grayhill.com/about-us/product-advisory-notices/

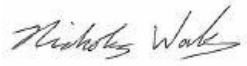
Action Required
If you have questions, please contact your Grayhill, Inc. sales associate for further information at 708.354.1040.

Grayhill INC.
Intuitive Human Interface Solutions

Device Under Test:
62SY15045

Physical Test:
Dimensional, Mechanical Vibration, Mechanical Shock

Electrical Test:
Contact Resistance, Thermal Shock

Test Report Number:	**SP02-1875**
Test Start Date:	**January 30, 2017**
Test Completion Date:	**March 7, 2017**
Test Facility:	**Grayhill, Inc.** **La Grange, IL**
Test Requested By:	**Gene Knorps**
Test Performed By:	 **Sam Castro** **Laboratory Technician**
Report Written By:	 **Sam Castro** **Laboratory Technician**
Report Approved By:	 **Nick Walls** **Quality Lab Manager**

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SUBJECT **PAGE #**

REVISION HISTORY

Revision	Date	Written By	Description
A	03/07/2017	S. Castro	Original

1.0 SUMMARY

1.1. PURPOSE

The Shenzhen China facility has a new Fuji pick and place line. The Lab tests per Grayhill 62 Series Optical Encoder Qualification Plan group 5 will verify that the product produced from the new line is compliant to Grayhill specifications. A PCN will then be created for the customer approval of the Fuji pick and place process

1.2. REQUIREMENTS & METHODS

- Functionality
- Dimensional
- Dielectric/Insulation Resistance
- Thermal Shock
- Mechanical Vibration
- Mechanical Shock

1.3. TEST SUMMARY

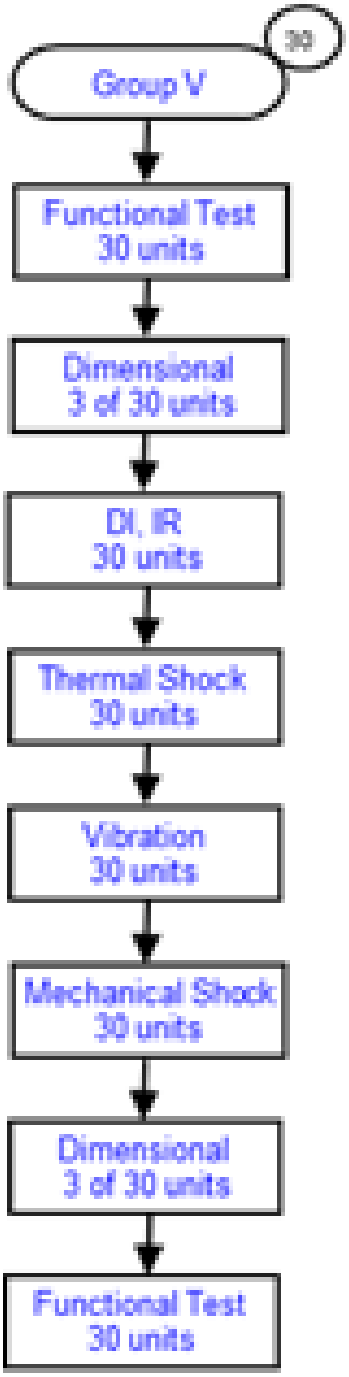
All DUT passed production screening per Grayhill 62 Series Optical Encoder Qualification Plan
All Test results are shown in the table below.

Table 1 – Test Summary

Test Description	Basic Standard	Test Results	Test Location	Test Date
Functionality	62 Series Optical Encoder Qual.	PASS	Grayhill, Inc.	01/27/2017 - 03/07/2017
Dimensional	62 Series Optical Encoder Qual.	PASS	Grayhill, Inc.	01/27/2017 - 03/07/2017
Dielectric	62 Series Optical Encoder Qual.	PASS	Grayhill, Inc.	01/28/2017
Insulation Resistance	62 Series Optical Encoder Qual.	PASS	Grayhill, Inc.	01/28/2017
Thermal Shock	62 Series Optical Encoder Qual.	PASS	Grayhill, Inc.	01/31/2017
Mechanical Vibration	62 Series Optical Encoder Qual.	PASS	Grayhill, Inc.	03/03/2017
Mechanical Shock	62 Series Optical Encoder Qual.	PASS	Grayhill, Inc.	02/27/2017-03/02/2017

2.0 FLOW CHART

20 units each from the old line and new Fuji line were tested per the following group of tests.



3.0 DIMENSION

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Dimension	Drawing 62SY15045_A	62SY15045	6 – 8 (Old Line), 26 - 28 (Fuji Line)	Grayhill Inc.	1/27/2017 03/07/2017

3.1. PURPOSE

The purpose of the test is to determine if the DUT is within physical tolerance per Grayhill Engineering Drawing 62SY15045_A

3.2. TEST SETUP DETAILS

1. Acquire data for each DUT to be measured.
2. Zero out Caliper, Height Gage, or set Vision System to its origin.
3. Measure DUT per drawing.
4. Verify dimensions for DUT are within tolerance.

Table 2 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
T-119	Caliper	500-125	Mitutoyo	09/2017

Table 3 –Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	6
Measurement 1	Inch	0.2165 ± 0.020
Measurement 2	Inch	0.230 ± 0.002
Operational Mode		Unpowered
Temperature	°C	23.7
Humidity	%RH	28

3.3. TEST SETUP PHOTOS

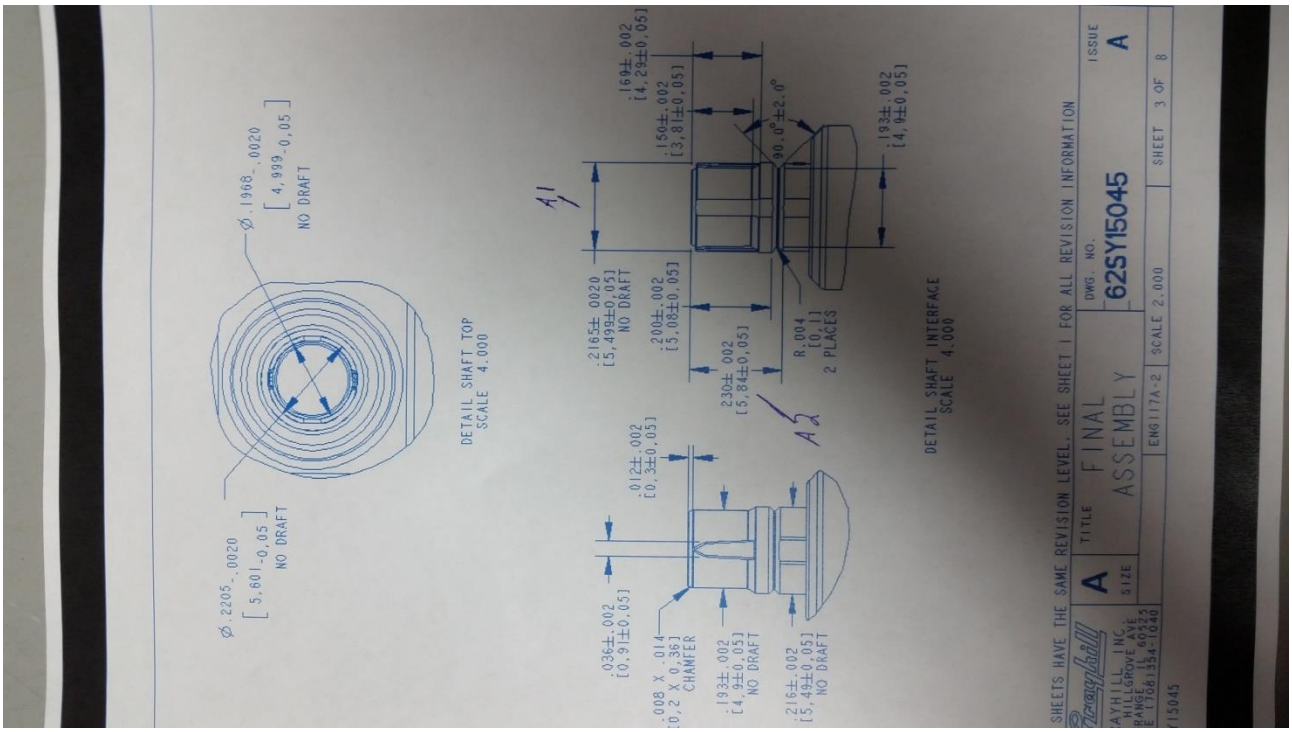


Figure 1 – Dimensions per drawing 62SY15045_A

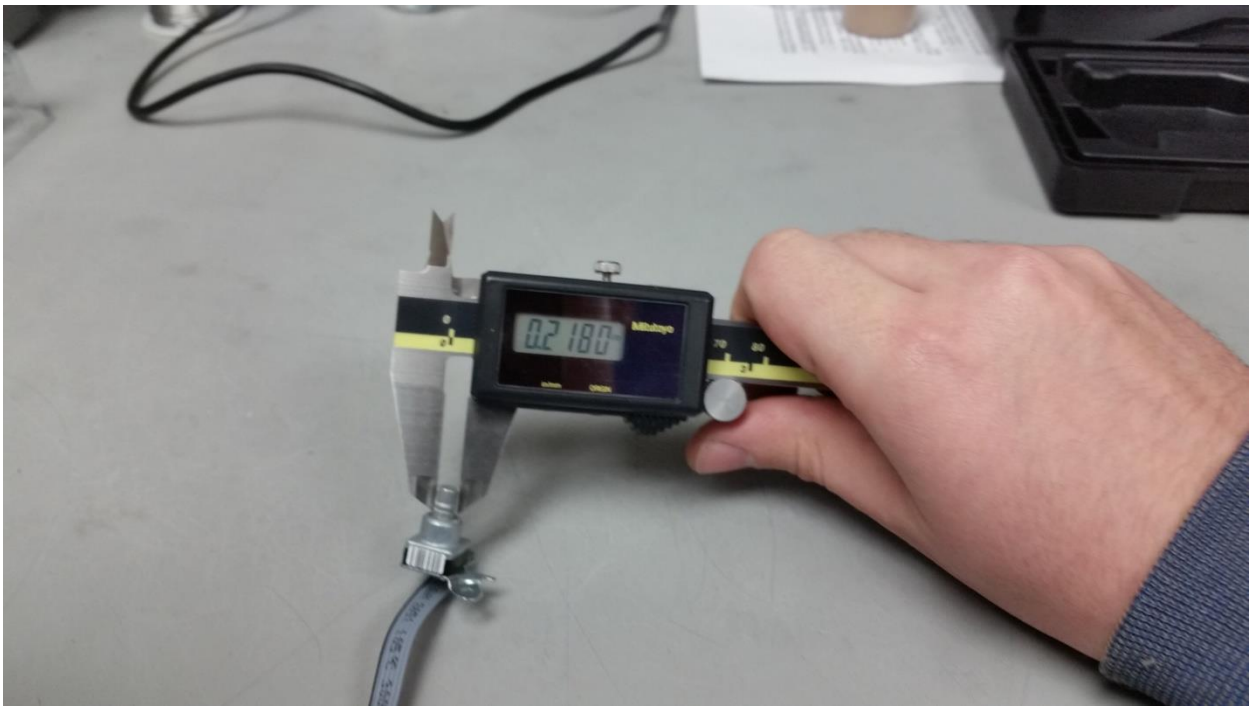


Figure 2 – Caliper Setup

3.4. ACCEPTANCE CRITERIA

All Dimensions shall be within specification

3.5. TEST RESULTS

All DUT passed dimension test and were within tolerances per Grayhill Engineering Drawing 62SY15045_A

Table 4 – Test Results

DUT	Test	Specification	DUT Serial Number	Pass / Fail	Test Location	Test Date
62SY15045	Dimension	Drawing 62SY15045_A	6 – 8 (Old Line), 26 - 28 (Fuji Line)	PASS	Grayhill Inc.	1/27/2017 03/07/2017

4.0 DIELECTRIC

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Dielectric Withstand	MIL-STD-202G, Method 301	62SY15045	001 - 040	Grayhill Inc.	01/28/2017

4.1. PURPOSE

This test is performed to verify that the DUT can withstand the effects of temporary overvoltage conditions resulting from switching, surges, and other similar phenomenon. Typical environmental effects of this test are changes in physical properties of materials resulting in:

- Intermittent operation
- Unit failure
- Increased leakage currents

4.2. TEST SETUP DETAILS

1. Perform a functional test before the test.
2. Set Dielectric tester to 1000 VRMs, 100 µA , 60 second Dwell
3. Clamp Terminals on shaft and connector board
4. Perform a functional test after the test.

Table 5 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-632	Dielectric Withstand	Hypot III	Associated Research Inc.	02/2017

Table 6 –Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	40
Voltage	Vrms	1000
Frequency of Voltage	Hz	60
Current	µA	100
Dwell	Sec	60
Operational Mode		Unpowered
Temperature	°C	23.9
Humidity	%RH	29

4.3. TEST SETUP PHOTOS

Figure 3 – Dielectric Test Setup

4.4. ACCEPTANCE CRITERIA

The DUT must be functionally tested and operate as intended after test.

4.5. TEST RESULTS

All DUT was within tolerance per MIL-STD-202G, Method 301 and functioned as intended after test.

Table 7 – Test Results

DUT	Test	Specification	DUT Serial Number	Pass / Fail	Test Location	Test Date
62SY15045	Dielectric Withstand	MIL-STD-202G, Method 301	001 - 040	PASS	Grayhill Inc.	01/28/2017

5.0 INSULATION RESISTANCE

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Insulation Resistance	MIL-STD-202G, Method 302	62SY15045	001 - 040	Grayhill Inc.	01/28/2017

5.1. PURPOSE

This test is performed to verify the resistance offered by the insulating members of a component part to an impressed direct voltage tending to produce a leakage of current. Typical environmental effects of this test are changes in physical properties of materials resulting in:

- Intermittent operation
- Unit failure
- Increased leakage currents

5.2. TEST SETUP DETAILS

1. Visual Inspection of the DUT is to be performed before and after testing.
2. Perform the Functional Test.
3. Apply the voltage level for the specified time to the points of application
4. Measure and document resistance value after the specified electrification time.
5. Repeat 2-3 for all points of application.
6. Perform the Functional Check after exposure

Table 8 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-76	IR TESTER	1865	QuadTech	10/2017

Table 9 –Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	40
Voltage level	Vdc	100
Required Resistance	MΩ	>1000
Operational Mode		Unpowered
Points of application		Between terminals and shaft
Temperature	°C	23.9
Humidity	%RH	29

5.3. TEST SETUP PHOTOS

Figure 4 – Test Setup

5.4. ACCEPTANCE CRITERIA

Contact Resistance shall be greater than 1000 Mega ohms. Results should be recorded as pass or fail

5.5. TEST RESULTS

All DUT was within tolerance per MIL-STD-202G, Method 302. Contact Resistance was greater than 1000 Mega ohms for all DUT after test.

Table 10 – Test Results

DUT	Test	Specification	DUT Serial Number	Pass / Fail	Test Location	Test Date
62SY15045	Insulation Resistance	MIL-STD-202G, Method 302	001 - 040	PASS	Grayhill Inc.	01/28/2017

6.0 THERMAL SHOCK

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Thermal Shock	MIL-STD-810G Method 503.4 Procedure I	62SY15045	01 – 40	Grayhill Inc.	1/31/2017

6.1. PURPOSE

This test is performed to verify that the DUT tested is free from manufacturing defects caused by thermally induced stresses, which could occur during intended useful life. This test is intended specifically for assessing thermal coefficient mismatch issues, particularly solder fatigue cracking. Typical environmental effects of this test are fatiguing of materials due to stress created by contraction and expansion of materials. Fatigue issues can occur in solder, solder connections, and PCB traces.

6.2. TEST SETUP DETAILS

1. DUT shall be tested in accordance with Method 503.4 of MIL-STD-810G.
2. Visual Inspection and functional check of the DUT is to be performed before and after testing.
3. Place the DUT inside the chamber.
4. Power up the chamber and let it stabilize at the specified temperatures.
5. Continue to cycle the DUT according to the test condition table.
6. When the total number of cycles are complete, return the DUT to ambient conditions.
7. Verify output code and Visual Check after Thermal Shock.

Table 11 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT- 1008	Thermal Shock	VTS-3-6-6-SC/WC	Sub Zero	Oct-2017

Table 12 - Test Conditions

Test Condition	Units	Parameters
Quantity	Assemblies	40
Operational Mode		Unpowered
Test Duration	Cycles	25
Minimum Temperature	°C	-55
Maximum Temperature	°C	100
Minimum Dwell Time	Minutes	60 Per Temperature

6.3. TEST SETUP PHOTOS

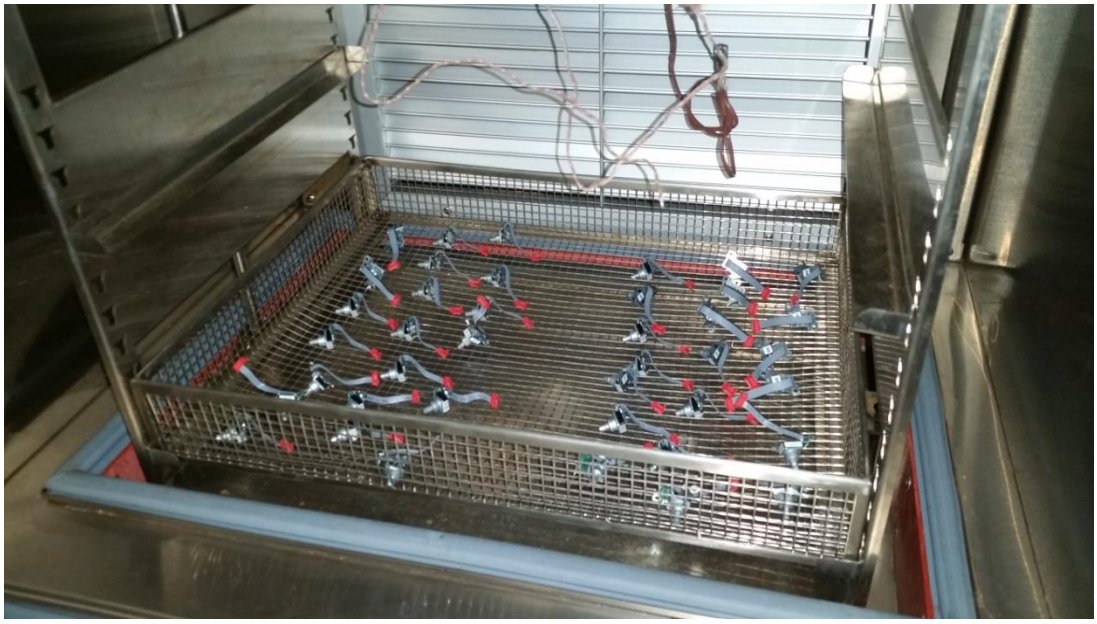


Figure 3 - Thermal Shock test setup

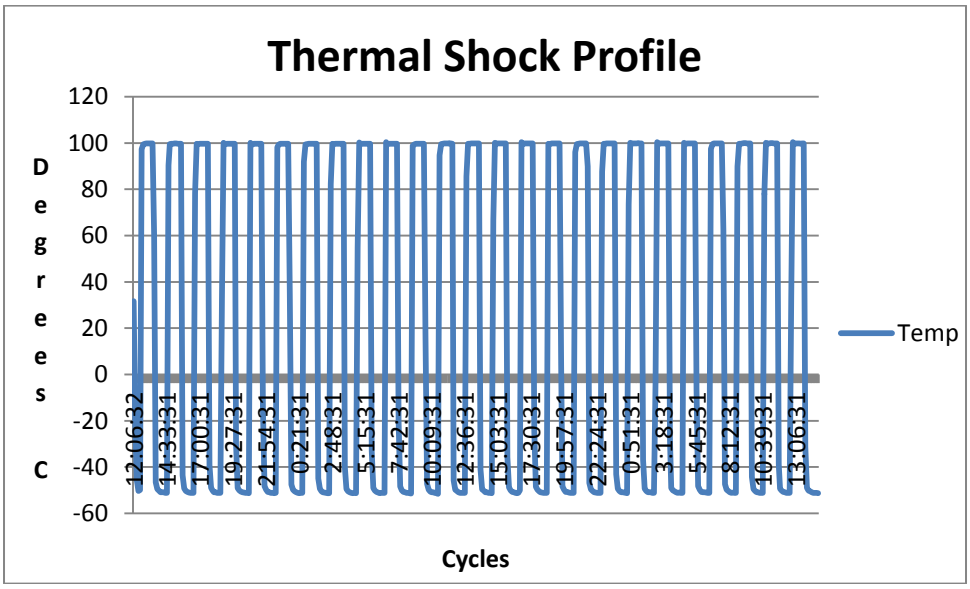


Figure 4 – Thermal Shock Test Profile

6.4. ACCEPTANCE CRITERIA

There shall be no mechanical or electrical damage, loosening of rivets or other fastening devices. DUT shall function as intended during functional checks.

6.5. TEST RESULTS

There was no evidence of any electrical, mechanical, or physical damage. DUT operates as intended after the Thermal Shock test.

Table 13 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
62SY15045	Thermal Shock	MIL-STD-810G, Method 503.4 Procedure I	**PASS**	Grayhill	1/31/2017

7.0 VIBRATION

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Vibration (Sinusoidal)	MIL-STD-202, Meth.204, Cond. B	62SY15045	001 - 020	Grayhill Inc.	3/3/2017
				Results:	PASS

7.1. PURPOSE

The purpose of this test is to evaluate the DUT of its ability to withstand Sinusoidal vibration. The potential product failure modes and effects detected in this test are:

- Cracked housing/components
- Broken product/components
- Open solder joints
- Dislodged parts
- Loose mounting interfaces.

7.2. TEST SETUP DETAILS

62SY15045 DUTs were tested in accordance with PS62 except 1 hour per Axis.
Only 20 DUTs were tested per engineering request.

Test Profile and Setup Details:

1. Visual Inspection of the DUT is to be performed before and after testing
2. Attach DUT in specified orientation.
3. Attach connector(s) and tie down wire harness(es) at appropriate lengths, if required.
4. Apply vibration per specified levels
5. Vibrate the DUT for specified duration.
6. Repeat steps 1 thru 5 until all DUT have been tested for all orientations.
7. Perform the Visual Examination and Functional Check after the test.

Table 14 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-355	Vibration Controller	DVC-8	Vibration World	05/2017
GT-353	Shaker Table	JS-1100VH117-50	Dynamic Solution	N/A
GT-535	Accelerometer	JTLD352C04	Piezotronics	04/2017
GT-354	Shaker Amplifier	SA-30	Dynamic Sol.	N/A
GT-531	Power Supply	34410A	Agilent	N/A

Table 15 - Test Condition B per MIL-STD-202G, Method 204D

Test Condition	Units	Parameters
Quantity	DUT	20
Duration	Hours	1
Applicable Axes	3	Longitudinal, Transverse, and Vertical
Operational Mode		Powered
Temperature	°C	Ambient
Acceleration Level(s)	Grms	15

Lower Limit Frequency	Hz	10
Upper Limit Frequency	Hz	2000
Sweep Rate	Min./Cycle	10
Sweep Type		Log
Mating Connector / Harness Attached	Y/N	Yes
Pass/Fail Criteria		See below

7.3. TEST SETUP PHOTOS

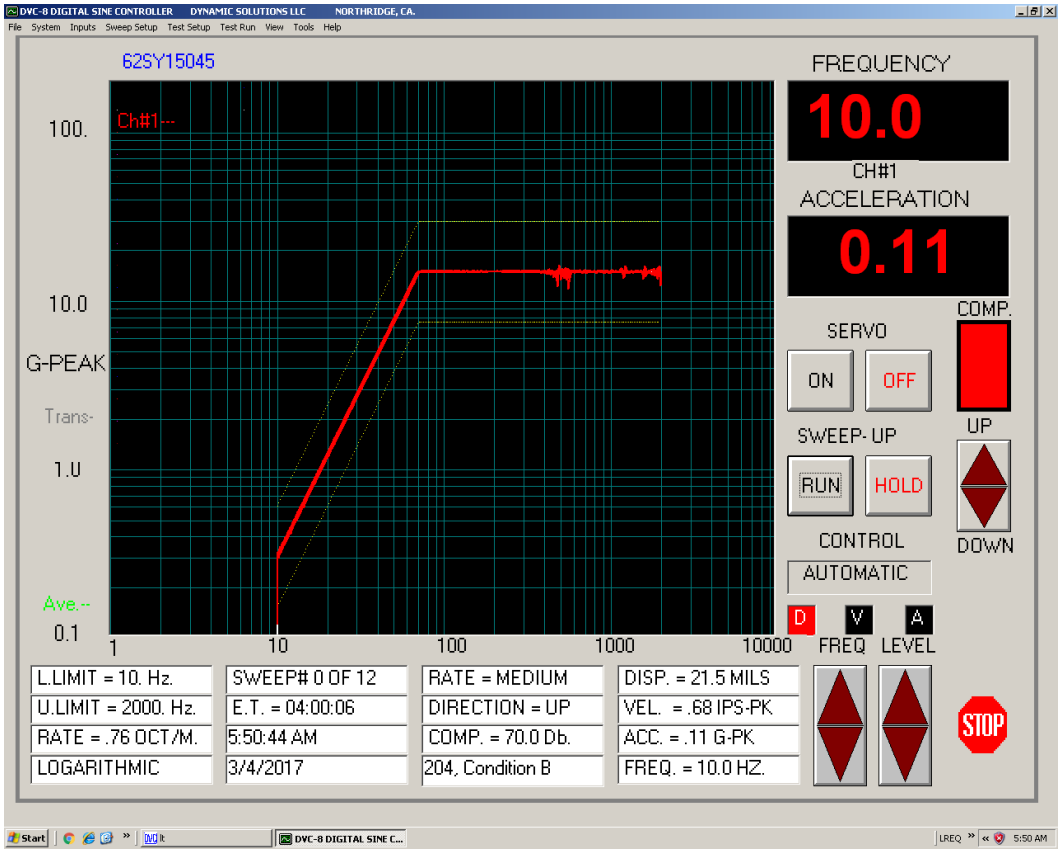


Figure 5 - Test Profile

7.4. ACCEPTANCE CRITERIA

Upon completion of the Sinusoidal Vibration test, the DUT must be functionally tested and operate as intended. There shall not be any visible damage such as broken, loose, deformed or displaced parts. There shall be no change in the shaft position. All DUT shall be monitored and show no evidence of false activation.

7.5. TEST RESULTS

All mounting hardware was intact.

All DUTs passed post-test functionality.

Table 16 - Test Results

DUT	Test	Specification	Pass/Fail	Test Location	Test Date
62SY15045	Vibration (Sinusoidal)	MIL-STD-202, Meth. 204, Condition B	PASS	Grayhill Inc.	3/3/2017

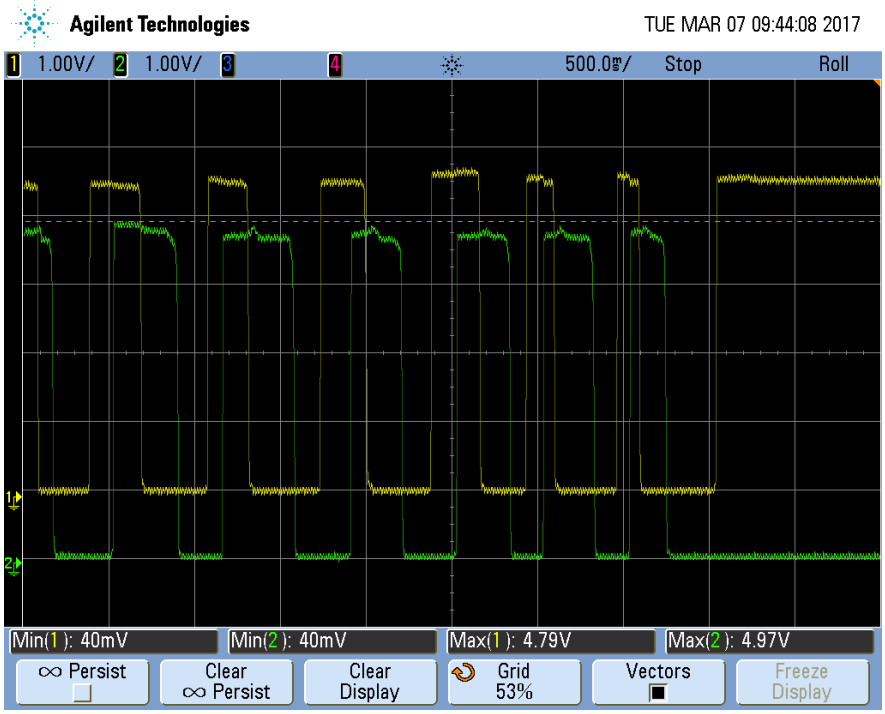


Figure 6 - Post Test Functionality

8.0 MECHANICAL SHOCK

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Mechanical Shock	MIL-STD-202, Method 213 Test Condition C and I	62SY15045	01 – 40	Grayhill Inc.	02/27/2017-03/02/2017

8.1. PURPOSE

The purpose of this test is to validate the manufacturing process in its ability to produce a product capable of withstanding the effects of shipping, handling, installation, and operational shock. The potential product issue modes and effects detected in this test are:

- Housing cracks
- Product/component breakage
- Inadvertent activation

8.2. TEST SETUP DETAILS

1. Visual Inspection of the DUT is to be performed before and after testing.
2. Verify specified test conditions table with test fixture on test table.
3. Place product in a holding fixture in specified orientation.
4. Attach connector(s) and tie down wire harness at appropriate lengths, if required.
5. Power up DUTs and test product for specified shocks/axis.
6. Repeat until all DUT have completed their total shocks/unit in each orientation.
7. Perform the Visual Examination and Functional Check after the test.

Table 17 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT – 203	Power Supply	179 True RMS	Fluke	08/2017
MS-06	DC Power Supply	E3649A	Agilent	Checked w/ GT – 203
GT – 356	VST Pneumatic Shock Machine	PSM 500	VST	Calibration Not Required
GT – 533	Accelerometer	JTLD352C04	PCB Piezotronics	09/2017

Table 18 - Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	40
Operational Mode		Powered
Pulse Type A		Half Sine
Pulse Type B		Saw Tooth
Acceleration	G	100
Pulse duration	‘msec.	6
Direction		3 in each of +/-X, +/-Y, +/-Z (18 shocks total)

8.3. TEST SETUP PHOTOS

Figure 7 – Mechanical Shock Setup

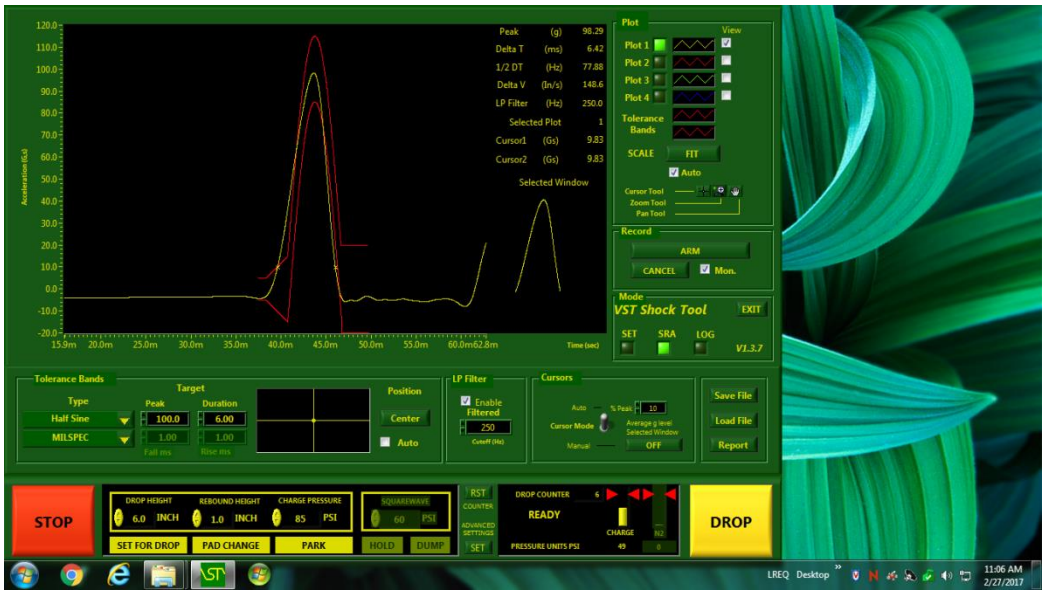


Figure 8 – Half-Sine Profile

Figure 9 – Saw Tooth Profile

8.4. ACCEPTANCE CRITERIA

Upon completion of the Mechanical Shock test, the DUT must be functionally tested and operate as intended There shall not be any visible damage

8.5. TEST RESULTS

Functional status was verified by performing a functional test on the DUT after testing. This functional test included visual validation of the DUT as well as electrical and mechanical validation of each test sample. All DUT passed the functional testing.

Table 19 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
62SY15045	Mechanical Shock	MIL-STD-202, Method 213 Test Condition C and I	**PASS**	Grayhill	02/27/2017-03/03/2017

Grayhill
Intuitive Human Interface Solutions

Device Under Test:
62AGY22024

Electrical Test:
Dielectric, Insulation Resistance

Environmental Test:
Humidity 85/85, Thermal Shock, Four Corner

Physical Test:
Vibration, Mechanical Shock, Dimensional

Test Report Number:	**SP02-1750**
Test Start Date:	**10/7/2016**
Test Completion Date:	**10/25/2016**
Test Facility:	**Grayhill, Inc.**
Test Requested By:	**Gene Knorps**
Test Performed By:	 **Jamall Davis** **Quality Laboratory Technicians**
Report Written By:	 **Jamall Davis** **Quality Laboratory Technicians**
Report Approved By:	 **Nick Walls** **Quality Lab Manager**

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1.0 REVISION HISTORY

Revision	Date	Written By	Description
A	11/30/2016	Jamall Davis	New
B	3/8/2017	Nick Walls	Corrected all references to 62Nxxx to 62Axxx

2.0 SUMMARY

2.1 PURPOSE

The purpose is to qualify production of 62AG encoders produced on a new Fuji pick and place line. Tests performed per 62 Series encoder test plan.

2.2 REQUIREMENTS & METHODS

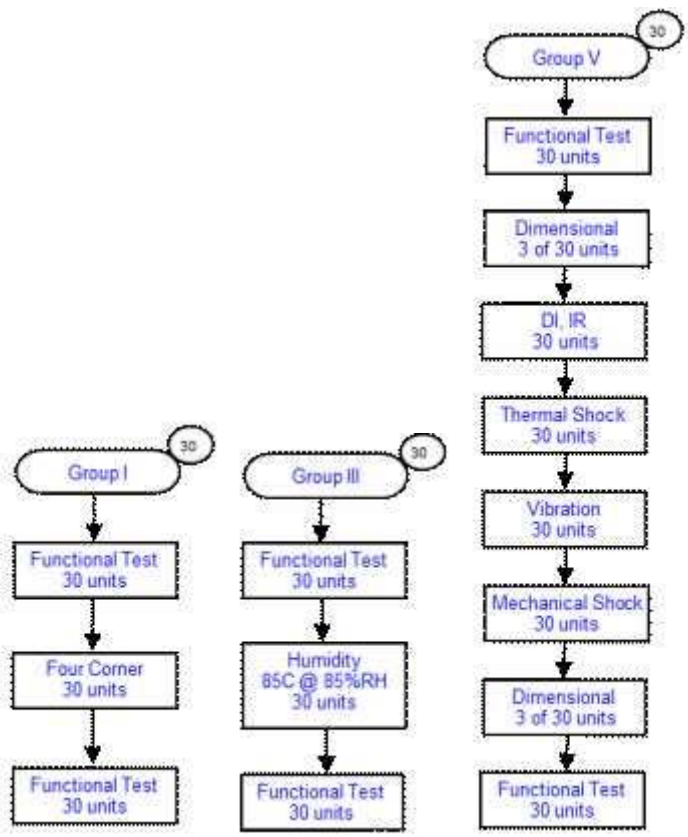
Tests to be performed to flow chart of report

2.3 TEST SUMMARY

Table 1 – Test Summary

Test Description	Basic Standard	Test Results	Test Date	Test Location
F.A.T.E.	Per 62AGY-X Drawing	**PASS**	10/07/2016 11/09/2016	Grayhill, Inc.
Four Corners	62 Series Optical Encoder Plan	**PASS**	10/10/2016 10/14/2016	Grayhill, Inc.
85/85	62 Series Optical Encoder Plan IPC-TM-650, Class T	**PASS**	10/17/2016 11/08/2016	Grayhill, Inc.
Dimensional	Drawing 62AGY-X 62AGY22024	**PASS**	10/18/2016 10/25/2016	Grayhill, Inc.
Dielectric	MIL-STD-202, Method 301	**PASS**	10/20/2016	Grayhill, Inc.
Insulation Resistance	PS62	**PASS**	10/20/2016	Grayhill, Inc.
Thermal Shock	62 Series Optical Encoder Plan MIL-STD-202, Method 107	**PASS**	10/14/2016 10/16/2016	Grayhill, Inc.
Vibration	PS62, MIL-STD-202, Method 204 Test condition B	**PASS**	10/18/2016 10/19/2016	Grayhill, Inc.
Mechanical Shock	MIL-STD-202, Method 213 Test Condition C and I	**PASS**	10/23/2016 10/24/2016	Grayhill, Inc.

3.0 FLOW CHART



4.0 F.A.T.E. TEST (62AGY-X)

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
F.A.T.E. Test	Per 62AGY-X Drawing	62AGY22024	1 – 90	Grayhill Inc.	10/07/2016 11/09/2016

4.1 PURPOSE

The purpose of the Functional Test is to ensure DUT output codes matches with the true table output before and after Environmental, Physical, Electrical, and Mechanical tests.

4.2 TEST SETUP DETAILS

1. Use correct housing and shaft holder
2. Secure unit, housing, and shaft into the tester.
3. Run test procedure.

Table 2 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
-	F.A.T.E. Tester	-	-	-

Table 3 – Test Conditions

Test Condition	Units	Parameters
Quantity	Assemblies	90
Operational Mode		Powered
Temperature	°C	23.8
High Minimum Output	DC Volts	≥ 3.8
Low Maximum Output	DC Volts	≤ 0.8
Test Voltage	DC Volts	5.25

4.3 TEST SETUP PHOTOS

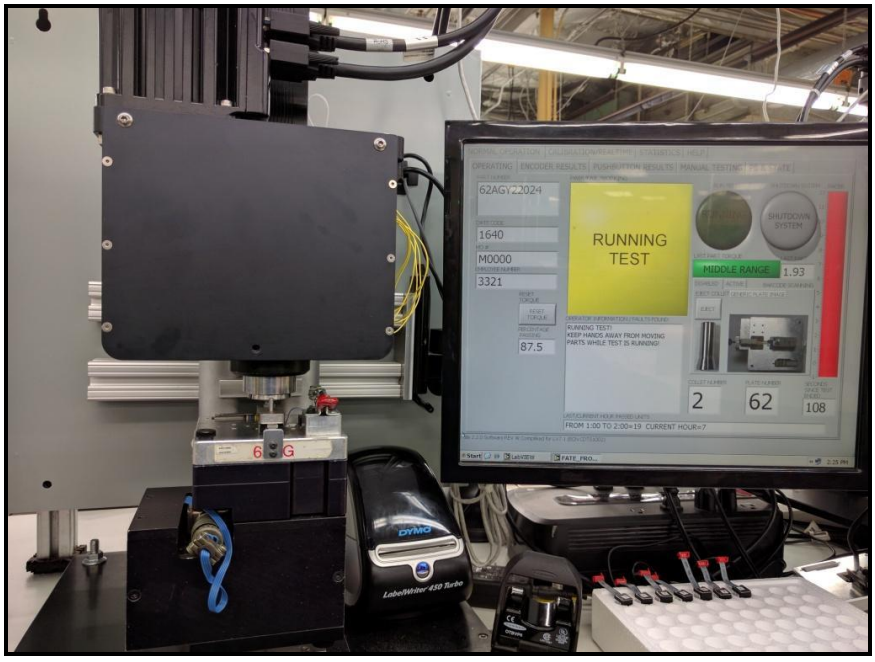


Figure 1 – F.A.T.E. Test setup

4.4 ACCEPTANCE CRITERIA

Before, during, and after Electrical, Physical, and Environmental tests, DUT switch position and code position shall be corresponding with each output characteristics where the maximum logic high being no less than 4.75V and the Low maximum being no greater than 0.8V.

4.5 TEST RESULTS

All DUT passed initial Output Code Test. See table below for Output Code test results after Electrical, Physical, and Environmental tests.

Table 4 – Output Code Test Results

Test Category	Total Tested per Group	Total Pass	Total Fail
Vibration	30	**30**	**0**
Mechanical Shock	30	**30**	**0**
Humidity B (85/85)	30	**30**	**0**
Four Corner	30	**30**	**0**

5.0 FOUR CORNERS TEST

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Four Corners	62 Series Validation Test Plan LREQ-SP02-1750	62AGY22024	1 – 30	Grayhill, Inc.	10/10/2016 10/14/2016

5.1 PURPOSE

This test is performed to ensure that the DUT operates at extreme temperatures and voltages.

5.2 TEST SETUP DETAILS

1. Set DUT at various detent positions at start of test and measure and record PWM duty cycle and frequency.
2. Place DUT in environmental chamber capable of high and low temperatures. The DUT will be exposed to four voltage / temperature extremes as follows:

    - Minimum voltage/minimum temperature, for the duration specified below.
    - Maximum voltage/maximum temperature, for the duration specified below.
    - Minimum voltage/maximum temperature, for the duration specified below.
    - Maximum voltage/minimum temperature, for the duration specified below.

3. Soak DUT for at least eight hours at each temperature and voltage level.
4. Measure and record PWM duty cycle and frequency.

Table 5 - Test Conditions

Test Condition	Units	Parameters
Quantity	Assemblies	30
Duration	Hours per Corner	>8
Operational Mode		Powered
Minimum Voltage	DC Volts	4.75
Maximum Voltage	DC Volts	5.25
Low Temperature	^{O}C	-40
High Temperature	^{O}C	85
Mating Connector Attached		Yes

Table 6 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-1004	Temperature / Humidity Chamber	SM-8-8200	Thermotron	Mar – 2017
NA	Dual Output DC Power Supply	E3649AGPS-3303	Keysight	Verify at Use
GT-236	Digital Multimeter	87V	Fluke	Aug - 2017
GT-120	True RMS Multimeter	U1272A	Agilent	May - 2017
GT-512	Data Logger	EA15	Extech	Jul - 2017

5.3 TEST SETUP PHOTOS

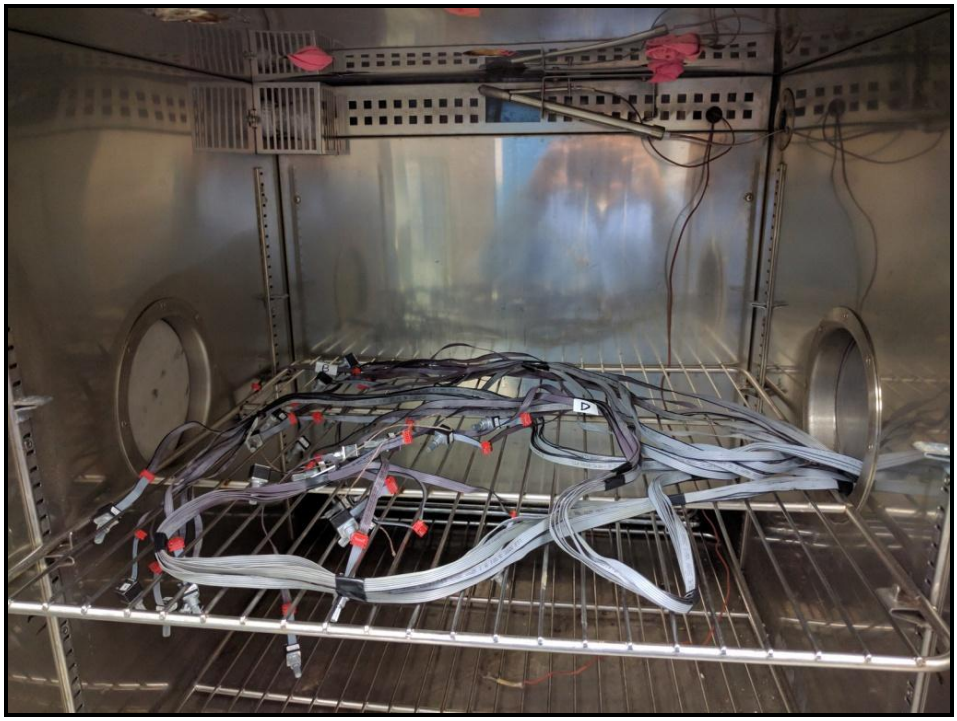


Figure 2 – Four Corners test setup inside chamber

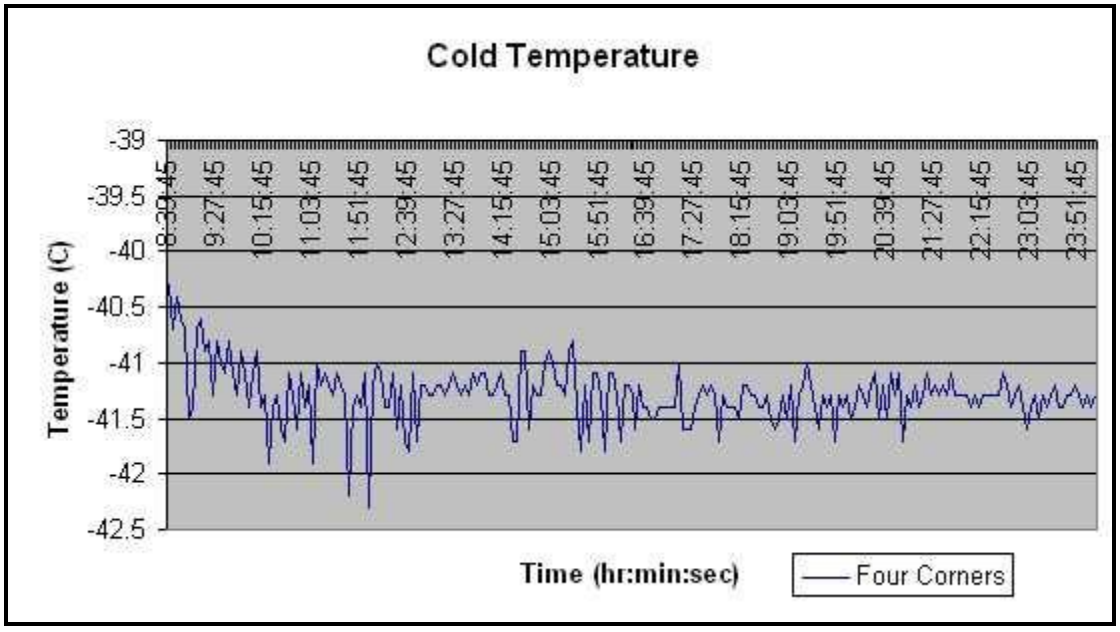


Figure 3 – Cold Temperature Test Profile

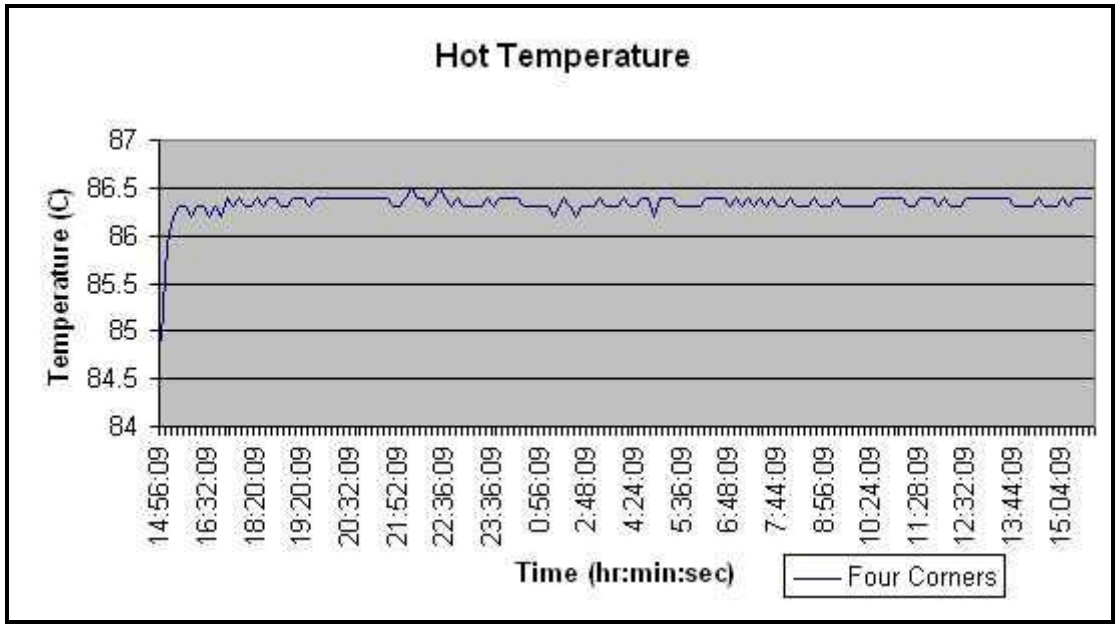


Figure 4 – Hot Temperature Test Profile

5.4 ACCEPTANCE CRITERIA

DUT's PWM Duty Cycle and frequency shall be steady before, during, and after the four corners test.

5.5 TEST RESULTS

All units pass test requirement and continue to function after the test was completed. There were no sign of physical damage or function loss.

Table 7 – Four Corners Test Results

DUT	Serial Number	Test	Specification	Pass	Test Location	Test Date
62AGY22024	1 - 30	Four Corners	62 Series Validation Test Plan LREQ-SP02-1750	PASS	Grayhill Inc.	10/10/2016 10/14/2016

6.0 Humidity 85 /85

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Humidity	MIL-STD 202, Method 103B	62AGY22024	31 – 60	Grayhill Inc.	10/17/2016 11/08/2016

6.1 PURPOSE

This test is performed to evaluate the properties of materials used in components as they are influenced by the absorption and diffusion of moisture and moisture vapor. This is an accelerated environmental test, accomplished by the continuous exposure of the DUT to high relative humidity at an elevated temperature. This method, while not necessarily intended as a simulated tropical test, is of use in determining moisture of insulating materials.

6.2 TEST SETUP DETAILS

1. Perform functional test on all DUT before test.
2. Place DUT in the chamber.
3. Power up the chamber and let it stabilize at the specified temperatures**.**
4. When the set duration is complete, return the DUT to ambient conditions.
5. Perform the Functional Test after exposure.

Table 8 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-603	Multimeter	179 True RMS	FLUKE	02-2017
-	DC Power Supply	HY3305F-3	Dr.Meter	Verified w/GT-603
GT-1005	Temperature Humidity Chamber	SM-16-8200	Thermotron	09-2017

Table 9 - Test Conditions

Test Condition	Units	Parameters
Quantity	Assemblies	30
Duration	Hours	500
Operational Mode		Powered
Temperature	°C	85
Humidity	Relative	85%

6.3 TEST SETUP PHOTOS

Figure 5 – Humidity Test Setup

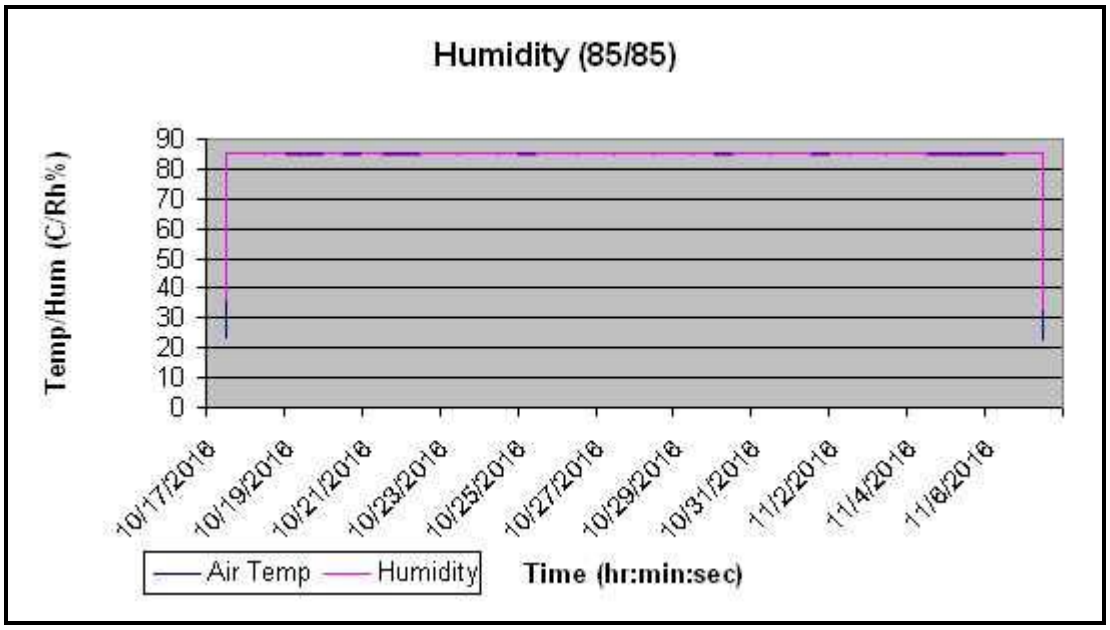


Figure 6 – Test Profile

6.4 ACCEPTANCE CRITERIA

At the conclusion of the test, there shall be no evidence of corrosion, breaking, cracking, or loosening of terminals outside of the confines of the terminal anchoring device, and mounting hardware shall be readily removable.

6.5 TEST RESULTS

After 500 hours of Humidity 85/85, all DUT showed no evidence of any corrosion, breaking, cracking, or loosening of terminals. All DUT passed functional testing.

Table 10 – Test Results

DUT	Serial Number	Test	Specification	Pass	Test Location	Test Date
62AGY22024	31 – 60	85/85	Mil-Std-202 Method 103B	PASS	Grayhill Inc.	10/17/2016 11/08/2016

7.0 DIMENSIONAL TEST (Per 62AGY22024 Drawing, Per 62AGY-X)

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Dimensional	Per 62AGY22024 Drawing, Per 62AGY-X	62AGY22024	61 – 63	Grayhill Inc.	10/18/2016 10/25/2016

7.1 PURPOSE

To assured that DUT dimensions meet customer's drawing number Drawing 62AGY-X for 62AGY22024.

7.2 TEST SETUP DETAILS

1. Acquire data for each DUT to be measured.
2. Zero out Caliper, Height Gage, or set Vision System to its origin.
3. Measure DUT per drawing.
4. Verify dimensions for DUT are within tolerance.

Table 11 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
T-119	Digital Caliper	500-215	Mitutoyo	Sept-2017

7.3 DIMENSIONS TEST SETUP

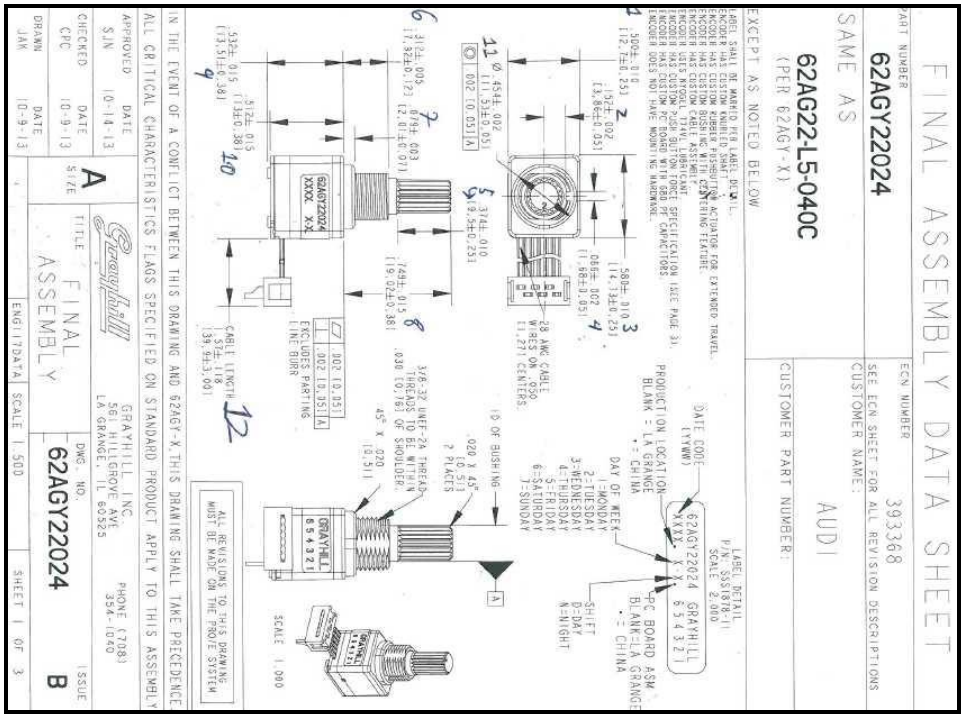


Figure 7 - Dimensions per drawing 62AGY-X

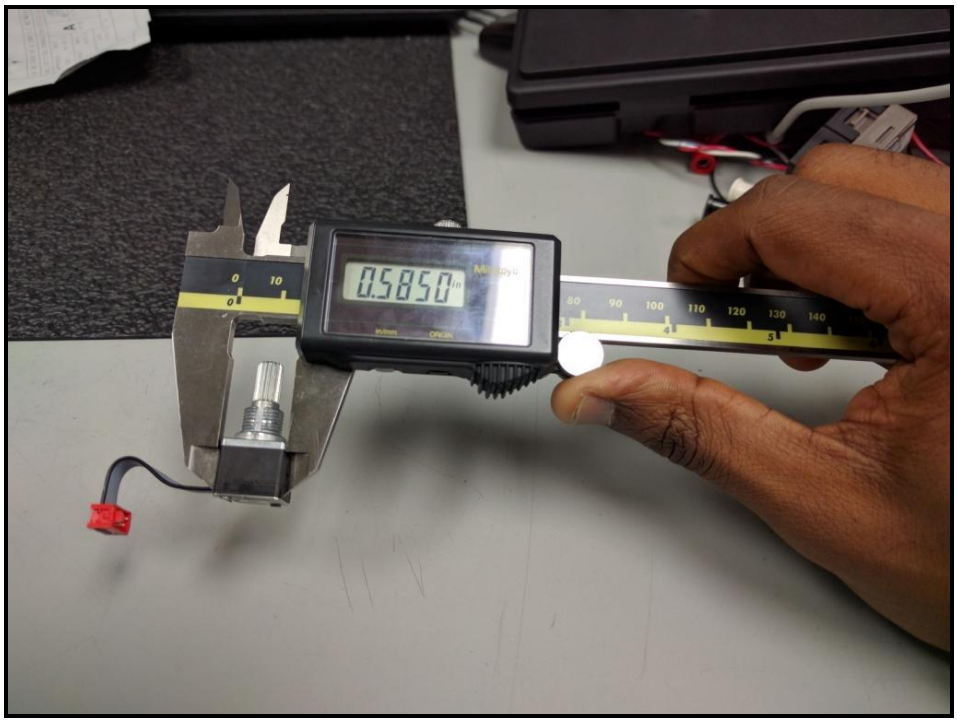


Figure 8 – Caliper Setup

7.4 ACCEPTANCE CRITERIA

All dimensions shall be within specifications.

7.5 TEST RESULTS

All dimensions were within tolerance of drawing.

Table 12 – Test Result

DUT	Test	Specification	Pass/Fail	Test Location	Test Date
62AGY22024 – 61	Dimensional	Drawing 62AGY-X 62AGY22024	PASS	Grayhill Inc.	10/23/2016 10/25/2016
62AGY22024 – 62	Dimensional	Drawing 62AGY-X 62AGY22024	PASS	Grayhill Inc.	10/23/2016 10/25/2016
62AGY22024 – 63	Dimensional	Drawing 62AGY-X 62AGY22024	PASS	Grayhill Inc.	10/23/2016 10/25/2016

8.0 DIELECTRIC TEST (PS62, 3.2.3)

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Dielectric Withstanding Voltage	MIL-STD-202, Method 301	62AGY22024	61 – 90	Grayhill Inc.	10/20/2016

8.1 PURPOSE

This test is performed to verify that the unit under test can withstand the effects of temporary over voltage conditions resulting from switching, surges, and other similar phenomenon. Typical environmental effects of this test are changes in physical properties of materials resulting in:

- Intermittent operation
- Unit failure
- Increased leakage currents

8.2 TEST SETUP DETAILS

1. Visual Inspection of the unit is to be performed before and after testing.
2. Apply specified AC voltage and current level for the specified duration time between terminals.
3. Monitor faults indicator and record reading.

Table 13 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT - 63	Dielectric Withstand Tester	Hypot III	Associated Research, Inc.	02/2017

Table 14 – Test Conditions

Test Condition	Units	Parameters
Quantity	Quantity	30
AC Voltage Level	Vrms	1000
Period of Application	Seconds	60
Maximum Leakage Current	mA	0.10

8.3 TEST SETUP PHOTO

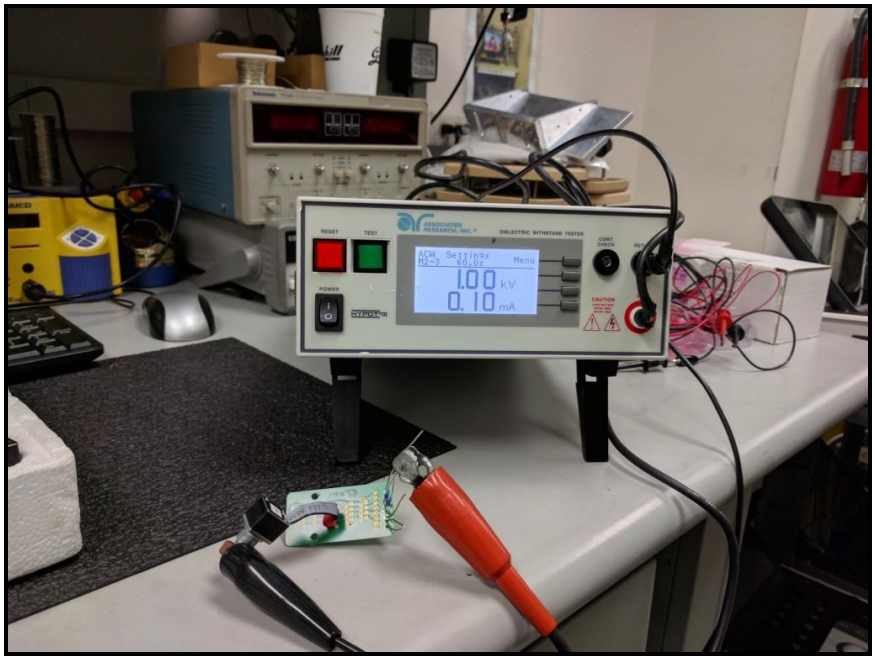


Figure 9 –Test Setup

8.4 ACCEPTANCE CRITERIA

DUT must have no damage or disassembled parts. DUT also shall function normally after the test.

8.5 TEST RESULTS

All DUT met above acceptance criteria.

Table 15 – Test Results

DUT	Serial Number	Test	Specification	Pass	Test Location	Test Date
62AGY22024	61 – 90	Dielectric	MIL-STD-202, Method 301	PASS	Grayhill Inc.	10/20/2016

9.0 INSULATION RESISTANCE

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Insulation Resistance	MIL-STD-202, Method 301	62AGY22024	61–90	Grayhill Inc.	10/20/2016

9.1 PURPOSE

This test is performed to verify the resistance offered by the insulating members of a component part to an impressed direct voltage tending to produce a leakage of current. Typical environmental effects of this test are changes in physical properties of materials resulting in:

- Intermittent operation
- Unit failure
- Increased leakage currents

9.2 TEST SETUP DETAILS

1. Visual Inspection of the DUT is to be performed before and after testing.
2. Apply the voltage level for the specified time to the points of application
3. Measure and document resistance value after the specified electrification time.
4. Perform the Functional Check after exposure.

Table 16 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-76	Megohmmeter	1865	Quadtech	10/17

Table 17 – Test Conditions

Test Condition	Units	Parameters
Quantity	Assemblies	30
DC Voltage Level	DC Volts	100
Temperature	°C	25.5
Humidity	%Rh	15.4
Frequency of Voltage	Hz	60
Period of Application	Seconds	5

9.3 TEST SETUP PHOTOS

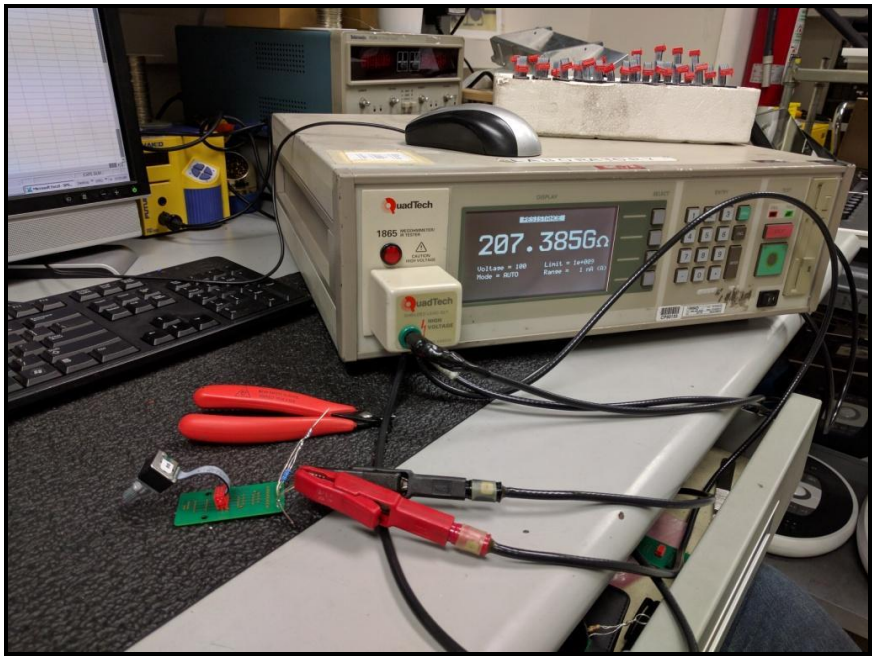


Figure 10 – Insulation Resistance test setup

9.4 ACCEPTANCE CRITERIA

When tested in accordance with MIL-STD-202G Method 302, the insulation resistance between terminals and shaft of DUT shall be greater than 5,000 Megaohms initially and shall be greater than 1,000 Megaohms after life test.

9.5 TEST RESULTS

There was no evidence of arcing, flashover, breakdown of the insulation, or any damage to DUT. The insulation resistances of DUT were greater than 5,000 Megaohms initially and after Electrical, Physical, and Environmental tests.

Table 18 – Insulation Resistance test results

DUT	Serial Number	Test	Specification	Pass	Test Location	Test Date
62AGY22024	61–90	Insulation Resistance	MIL-STD-202, Method 301	PASS	Grayhill Inc.	10/20/2016

10.0 THERMAL SHOCK

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Thermal Shock	MIL-STD-810F, Method 503.4, Procedure I	62AGY22024	31 – 60	Grayhill Inc.	10/14/2016 10/16/2016

10.1 PURPOSE

This test is performed to verify that the DUT tested is free from manufacturing defects caused by thermally induced stresses, which could occur during intended useful life. This test is intended specifically for assessing thermal coefficient mismatch issues, particularly solder fatigue cracking. Typical environmental effects of this test are fatiguing of materials due to stress created by contraction and expansion of materials. Fatigue issues can occur in solder, solder connections, and PCB traces.

10.2 TEST SETUP DETAILS

1. DUT shall be tested in accordance with Method 503.4, Procedure I of MIL-STD-810F.
2. Visual Inspection of the DUT is to be performed before and after testing.
3. Place the DUT inside the chamber.
4. Power up the chamber and let it stabilize at the specified temperatures.
5. Continue to cycle the DUT according to the test condition table.
6. When the total number of cycles are complete, return the DUT to ambient conditions.
7. Verify output code and Visual Check after Thermal Shock.

Table 19 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT- 1008	Thermal Shock	VTS-3-6-6-SC/WC	Sub Zero	Oct-2016

Table 20 - Test Conditions

Test Condition	Units	Parameters
Quantity	Assemblies	30
Operational Mode		Unpowered
Test Duration	Cycles	25
Minimum Temperature	°C	-55
Maximum Temperature	°C	85
Minimum Dwell Time	Minutes	60 Per Temperature

10.3 TEST SETUP PHOTOS

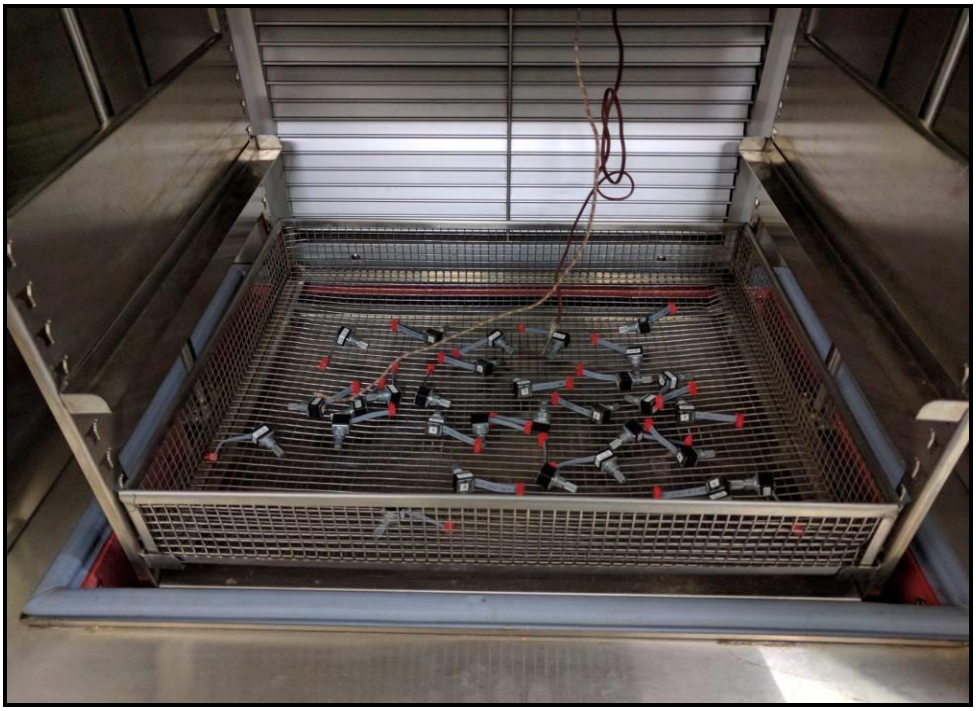


Figure 11 - Thermal Shock test setup

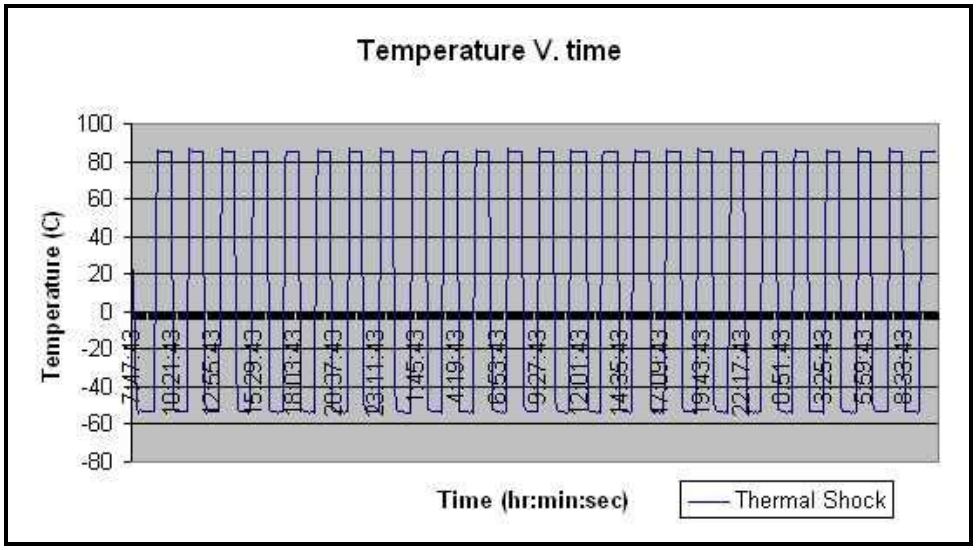


Figure 12 – Thermal Shock Test Profile

10.4 ACCEPTANCE CRITERIA

There shall be no mechanical or electrical damage, loosening of rivets or other fastening devices.

10.5 TEST RESULTS

There was no evidence of any electrical, mechanical, or physical damage. DUT operates as intended after the Thermal Shock test.

Table 21 – Test Results

DUT	Serial Number	Test	Specification	Pass	Test Location	Test Date
62AGY22024	31 – 60	Thermal Shock	MIL-STD-810F, Method 503.4, Procedure I	PASS	Grayhill	10/14/2016 10/16/2016

11.0 VIBRATION (SINE)

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Vibration (Sinusoidal)	MIL-STD-202, Method 204, Test Condition B	62AGY22024	61–90	Grayhill Inc.	10/18/2016 10/19/2016
				Results:	PASS

11.1 PURPOSE

The purpose of this test is to evaluate the DUT of its ability to withstand Sinusoidal vibration. The potential product failure modes and effects detected in this test are:

- Cracked housing/components
- Broken product/components
- Open solder joints
- Dislodged parts
- Loose mounting interfaces.

11.2 TEST SETUP DETAILS

Test Profile and Setup Details:

1. Visual Inspection of the DUT is to be performed before and after testing
2. Attach DUT in specified orientation.
3. Attach connector(s) and tie down wire harness(es) at appropriate lengths, if required.
4. Apply vibration per specified levels
5. Vibrate the DUT for specified duration.
6. Repeat steps 1 thru 5 until all DUT have been tested for their total duration.
7. Perform the Visual Examination and Functional Check after the test.

Table 22 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-355	Vibration Controller	VR 8500	Vibration World	05/2017
GT-353	Vibration Table	DS-1100VH/1.75	Dynamic Solution	N/A
GT-534	Accelerometer	JTLD353B04	Piezotronics	04/2017
GT-354	Shaker Amplifier	SA-50	Dynamic Sol.	N/A

Table 23 - Test Condition B per MIL-STD-202G, Method 204D

Test Condition	Units	Parameters
Quantity	DUT	30
Duration	Hours	4
Applicable Axes	3	Longitudinal, Transverse, and Vertical
Operational Mode		Powered
Temperature	°C	Ambient
Acceleration Level(s)	Grms	15
Lower Limit Frequency	Hz	10
Upper Limit Frequency	Hz	2000
Sweep Rate	Min./Cycle	10
Sweep Type		Log
Mating Connector / Harness Attached	Y/N	Yes
Pass/Fail Criteria		See below

11.3 TEST SETUP PHOTOS

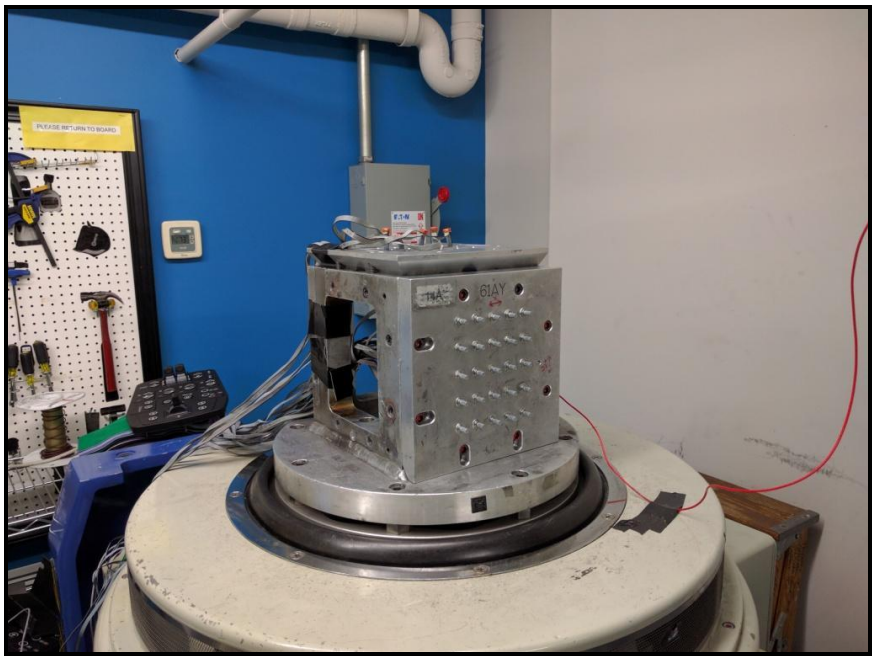


Figure 13 – Vibration Setup

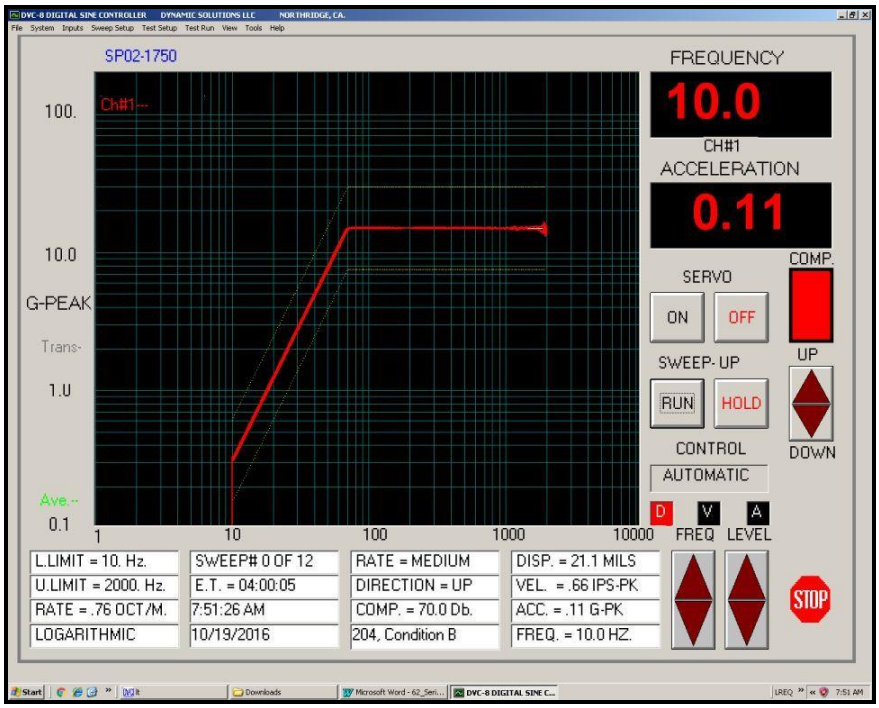


Figure 14 – Vibration Profile

11.4 ACCEPTANCE CRITERIA

Upon completion of the Sinusoidal Vibration test, the DUT must be functionally tested and operate as intended. There shall not be any visible damage such as broken, loose, deformed or displaced parts. There shall be no change in the shaft position. All DUT shall be monitored and show no evidence of false activation.

11.5 TEST RESULTS

All DUT passed the functional testing and showed no evidence of damage. All mounting hardware was intact.

Table 24 – Test Results

DUT	Serial Number	Test	Specification	Pass/Fail	Test Location	Test Date
62AGY22024	61 – 90	MIL-STD-202, Method 204, Test Condition B	PS62 Modified	**PASS**	Grayhill Inc.	10/18/2016 10/19/2016

12.0 MECHANICAL SHOCK

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Mechanical Shock	MIL-STD-202, Method 213 Test Condition C and I	62AGY22024	61 – 90	Grayhill Inc.	10/23/2016 10/24/2016

12.1 PURPOSE

The purpose of this test is to validate the manufacturing process in its ability to produce a product capable of withstanding the effects of shipping, handling, installation, and operational shock. The potential product issue modes and effects detected in this test are:

- Housing cracks
- Product/component breakage
- Inadvertent activation

12.2 TEST SETUP DETAILS

1. Visual Inspection of the DUT is to be performed before and after testing.
2. Verify specified test conditions table with test fixture on test table.
3. Place product in a holding fixture in specified orientation.
4. Attach connector(s) and tie down wire harness at appropriate lengths, if required.
5. Test product for specified shocks/axis.
6. Repeat until all DUT have completed their total shocks/unit.
7. Perform the Visual Examination and Functional Check after the test.

Table 25 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT – 203	Multimeter	179 True RMS	Fluke	02/2017
GHSD-050	DC Power Supply	72–2075	TENMA	Checked w/ GT – 203
GT – 356	VST Pneumatic Shock Machine	PSM 500	VST	Calibration Not Required
GT – 533	Accelerometer	JTLD352C04	PCB Piezotronics	9-2017

Table 26 - Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	30
Operational Mode		Powered
Pulse Type A		Half Sine
Pulse Type B		Saw Tooth
Acceleration	G	100
Pulse duration	‘msec.	6
Direction		3 in each of +/-X, +/-Y, +/-Z (18 shocks total)

12.3 TEST SETUP PHOTOS

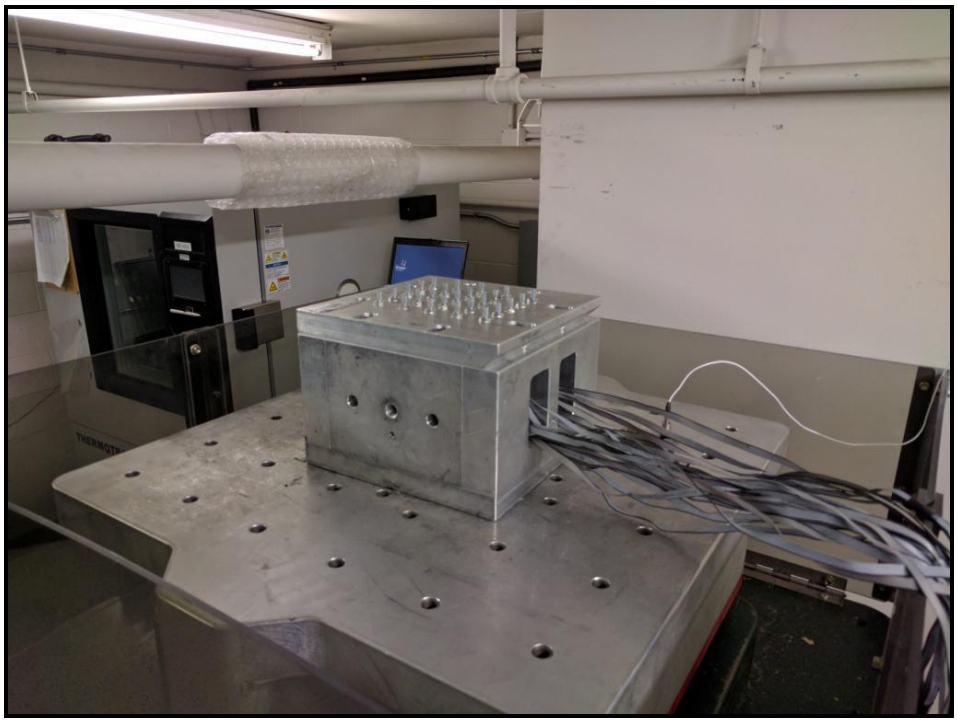


Figure 15 – Mechanical Shock Setup

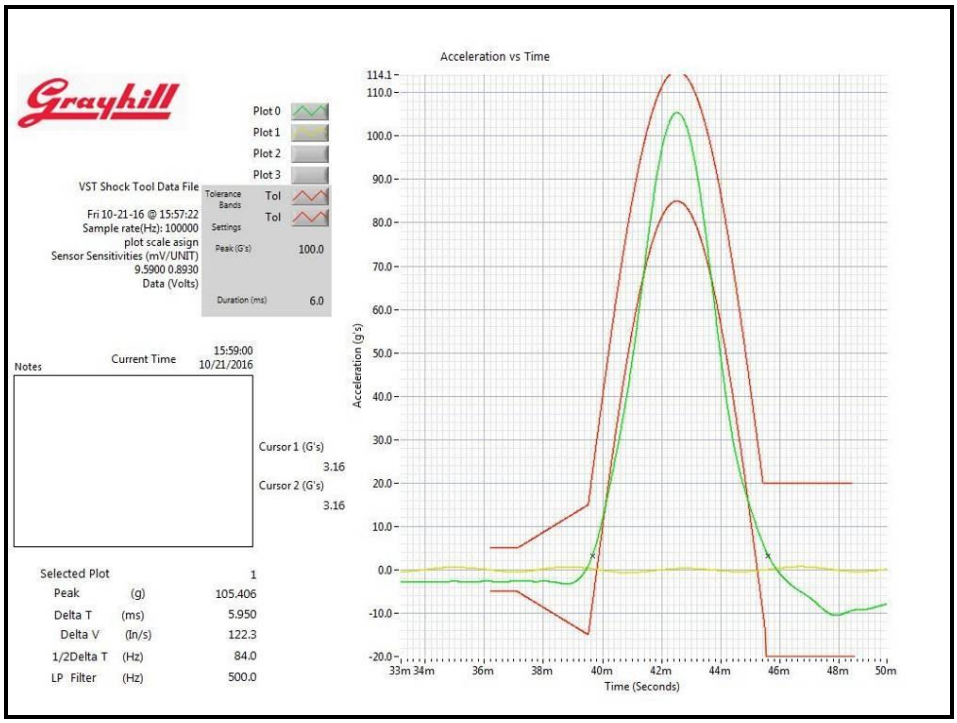


Figure 16 – Half-Sine Profile

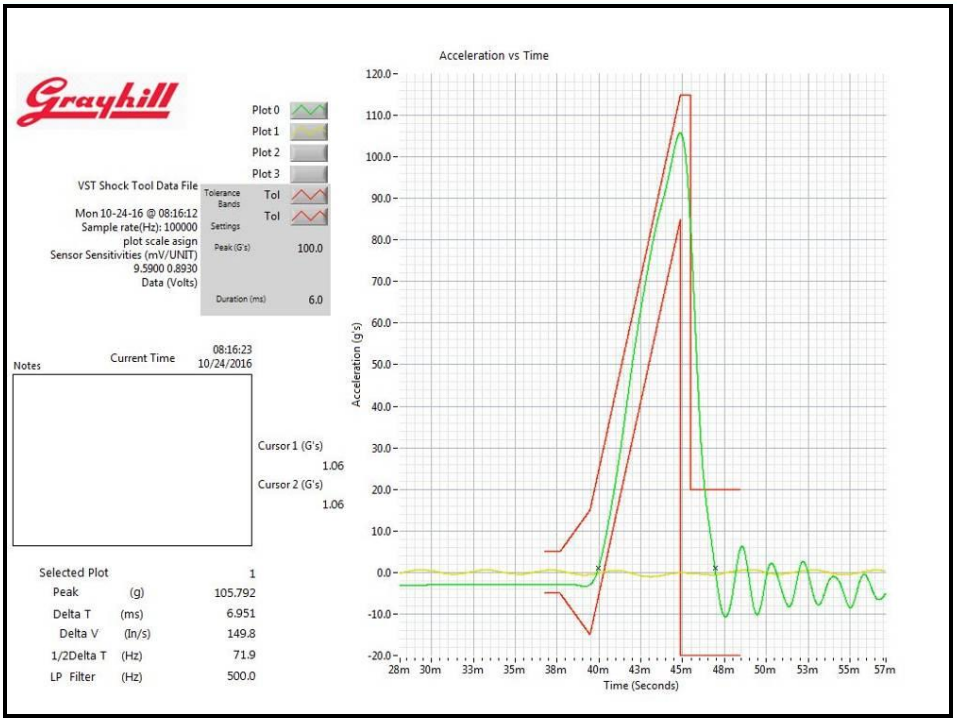


Figure 17 – Saw Tooth Profile

12.4 ACCEPTANCE CRITERIA

Upon completion of the Mechanical Shock test, the DUT must be functionally tested and operate as intended There shall not be any visible damage

12.5 TEST RESULTS

Functional status was verified by performing a functional test on the DUT after testing. This functional test included visual validation of the DUT as well as electrical and mechanical validation of each test sample. All DUT passed the functional testing.

Table 27 – Test Results

DUT	Serial Number	Test	Specification	Pass	Test Location	Test Date
62AGY22024	61 – 90	Mechanical Shock	MIL-STD-202, Method 213 Test Condition C and I	**PASS***	Grayhill	10/23/2016 10/24/2016

Note: Two units terminals were snagged and lost their grounding. These are not considered failures

Grayhill INC.
An ISO-9001 Company

DEK Horizon 8 AP Screen Printer System Validation Plan
Fuji XPFL System Validation Plan
Fuji XPFL+MTU System Validation Plan

Equipment Validation Plan/Results

Project:	New Screen Printer – China Facility
Part Numbers/ Products that will use this equipment:	Various
Equipment/Process to be Validated:	DEK Horizon 8 AP Screen Printer
Process/Product ECN Number:	N/A
Date Required:	11/1/2016
Project Manager(s):	Jamie Dobravec / Alfred Sham
Team Member(s):	Matthew Wong, Michael Yip, Franky Tang, Lisa Yan

This form is used to approve new equipment for product. This form is provided as a base to describe "what" and "how" of the validation. Sections may be added at the discretion of the project manager or engineer.

1. Introduction

A new DEK Horizon 8 AP Screen Printer System machine has been purchased to assist in the production of the PCBA's at Grayhill's Shenzhen facility.This plan will aid in the proper installation and validation of the new equipment.

1.1. Objective

Receive, install, and qualify the new screen printer for use in all China PCBA assembly.

1.2. Reference Documents

- DEK Horizon 8AP Installation Documentation
- DEK Horizon 8AP Operator Manual
- DEK Horizon 8AP Technical Manual
- DEK Horizon 8AP Crate unpacking instructions manual

2. Validation Plan

2.1. Installation Qualification Plan

The machine was delivered to the Shenzhen, China facility on 2016.08.29. An electrician wired the machine before Grayhill's installation team arrived on 2016.09.01. The electricity was run to the breaker box next to the machine and can produce 8 to 20A. Operating conditions are between 20 and 30C.

2.2. Operational Qualification Plan

After the machine is completely installed, all specifications located in the user manual will be verified. A representative sample of stencils and stencil programs will be loaded and run to ensure proper application of the solder paste. The Horizon 8AP Screen Printer System machine will be added to eMaint for preventative maintenance.

2.3. Performance Validation/Qualification Plan

A representative sample PCBA will be processed through the screen printing operation. Nominal settings to ensure a good process will be used. After screen printing, the following measurements will validate the proper performance. They will include solder paste height, shape, and registration on a minimum sample of 32 pieces. Cpk values should be in the acceptable range (>1.33) for the process.

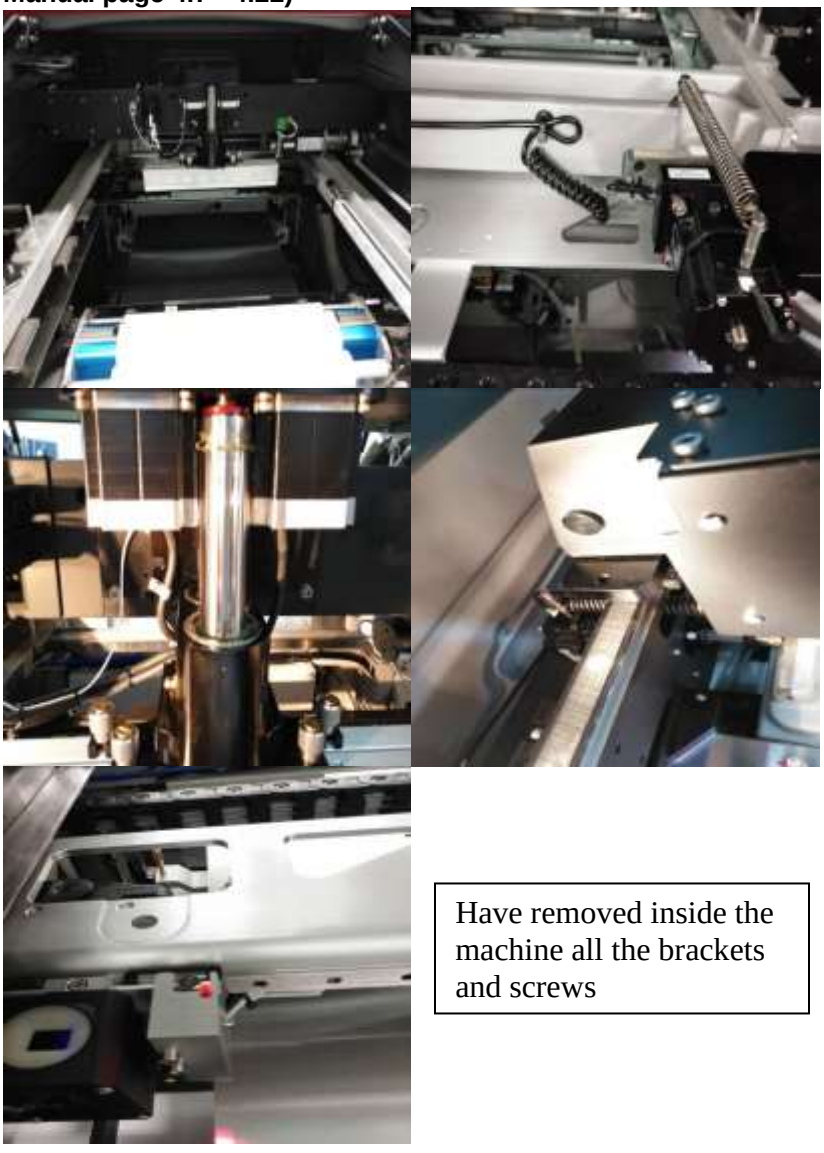
3. Results

3.1. Installation Qualification Results

☒ **Use Installation Manual checklist (Page 6.1 - 6.4) to ensure proper installation steps are completed**

☒ **Remove packing braces (Crate unpacking instructions manual)**

☒ **Machine preparation transit brackets and screws removal(Installation Manual page 4.7 - 4.22)**



Have removed inside the machine all the brackets and screws

Equipment Validation Plan/Results

☒ **Verify the following equipment is on site for installation**

Assembly Tricolour Beacon

1.Fit the tricolour beacon to the beacon bracket ensuring that the cable is not trapped between the beacon and the cover frame.

2. Connect the tricolour beacon connection 14PL07 to 14SK07.

3 Cable tie the loose cable to the cover frame.

Tricolour Beacon installation is good

Assembly MMI Assembly Fitting

Assembly External Solvent Tank

☒ **Ensure floor is capable of holding 1984 pounds and level level**

☒ **Ensure space is capable of supporting System 55”x55”x65”**

Equipment Validation Plan/Results

☒ **The environment is clean**

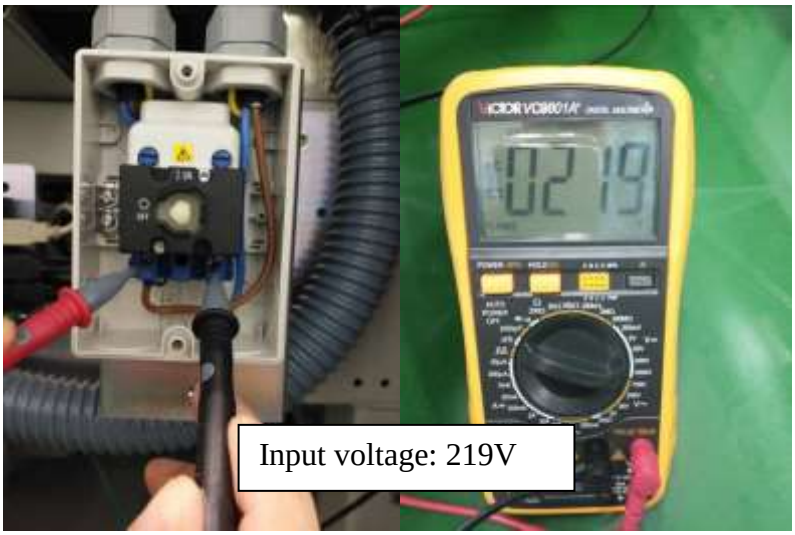
☒ **Verify environmental temperature is 20-30°C**
Verify relative humidity is 30-80%

In front of the machine

Rear of machine

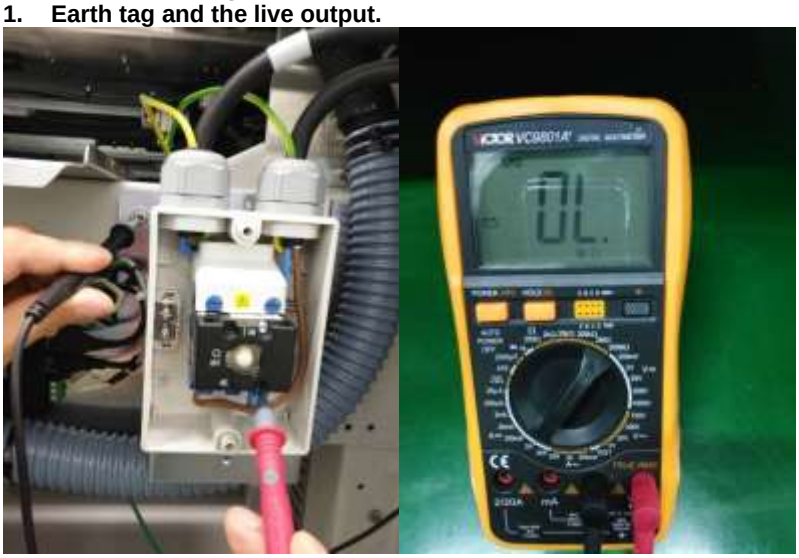
☒**Run and verify wall outlet is machine transformer must be tapped to the nearest selectable voltage within the following limits:**

- **220V ±2.5%**



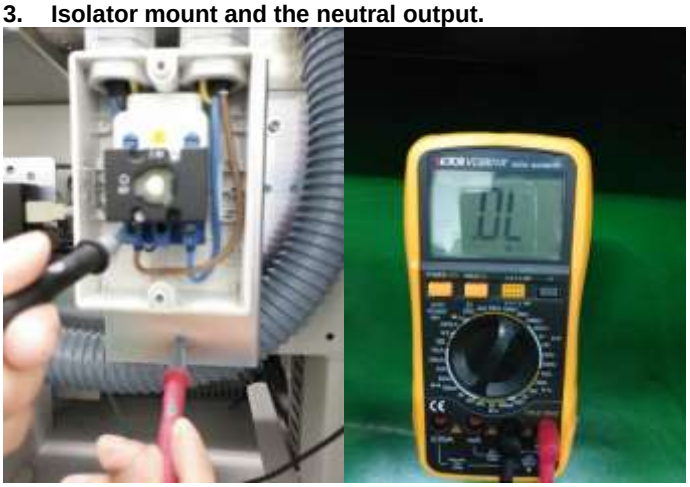
☒ **Verify the earth input and earth output cables are connected to the earth tag**
Verify the Measure the resistance between the following points ensuring that all the measurements are greater than 2MΩ

1. **Earth tag and the live output.**



2. Earth tag and the neutral output.

3. Isolator mount and the neutral output.



4. Isolator mount and the live output.

☒ **Verify the Measure the resistance between the following points ensuring that all measurements are less than 0.5Ω:**

1. **PC earth stud and a securing screw that secures the PC to the machine frame.**

2. **M36 earth stud and a securing screw that secures the M36 to the machine frame.**

3. **M37 earth stud and a securing screw that secures the M37 to the machine frame.**

☒ **Verify the Carry out the following procedure for E Stop loop operation check:**

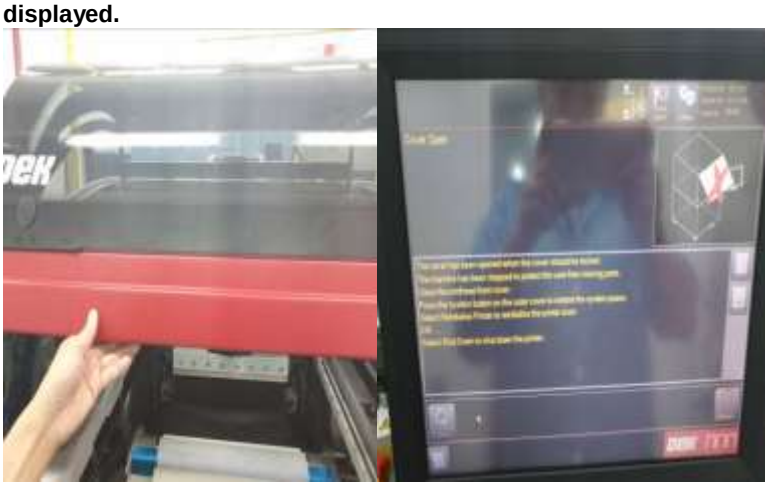
1. **Press the E Stop button. The E Stop Pressed window is displayed**

2. **Reset the E Stop by turning the E Stop button clockwise until it unlatches.**

3. **Press the System button when prompted**

4. **Select Reinitialise Printer.**

☒ **Verify the after initialisation, open the front printhead cover. The open cover page is displayed.**

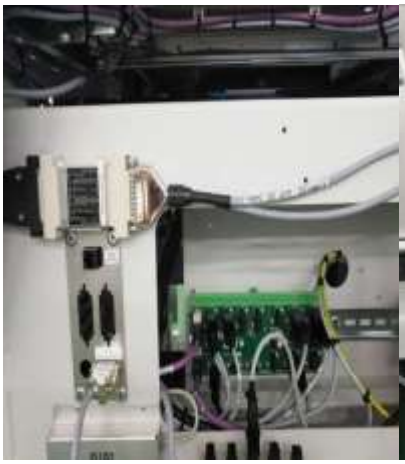


☒ **Verify the Stencil Cleaner Function Check**

1. Press the two button control switches simultaneously until the fabric is wet

2. **Press the two button control switches simultaneously to feed a clean area of dry fabric over the solvent dispense bar ensuring that the fabric feeds correctly.**

☒ **Ensure MIU is configured with the correct protocols for upline and downline machines as detailed (Page 5.13-5.18 of Installation Manual)**



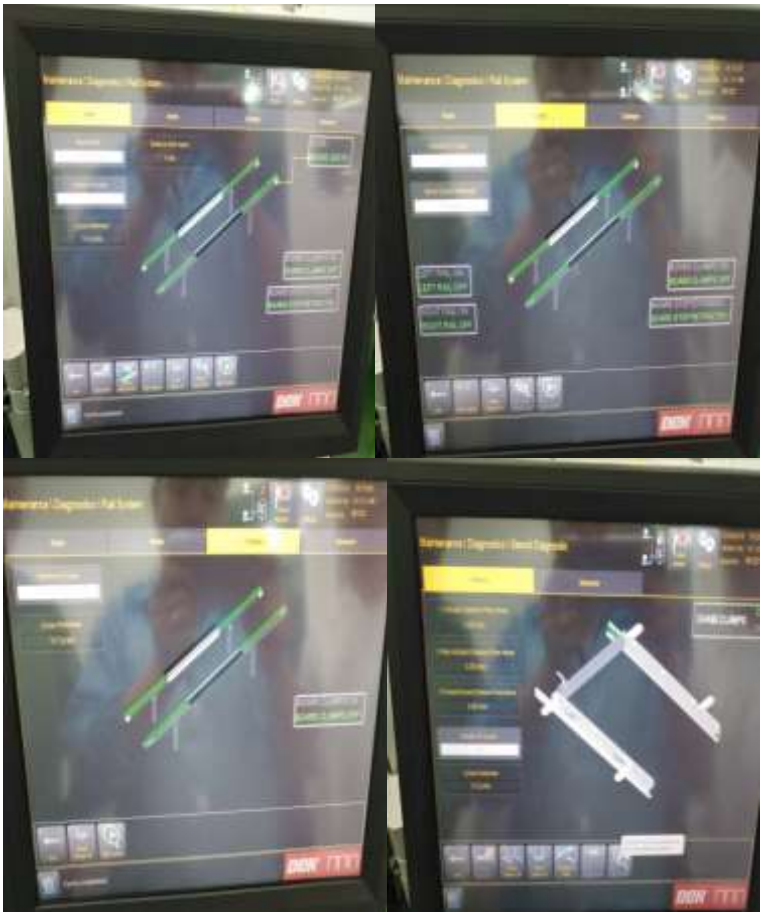
☒ **Verify the machine pneumatic supply of clean, non lubricated air which should maintain a minimum pressure 5 Bar and a maximum of 8 Bar.**

3.2. Operational Qualification Results

Operational testing will qualify system hardware and software functionality

☒ **Follow Users Manual and complete all 9 stages of operational capability for programability**

Verify diagnostic capability



Verify inspection function capability is working

☒ **Verify the following characteristics:**

Board handling – Minimum size 50 mm, Maximum 510 mm

Transport can move left and right

Print pressure 0-20 kg

Verify print speed at 2-300 mm/sec

☒ **Training**

The following associates have been properly trained.

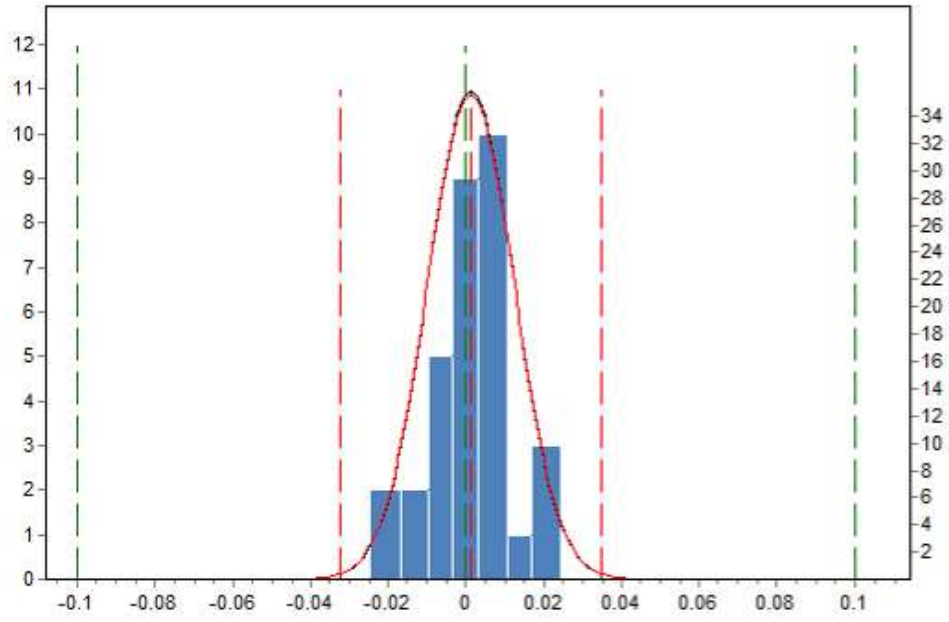
_Franky tang_____

_Pen Huihua_____

_Wang guangquan_____

3.3. Performance Qualification Results

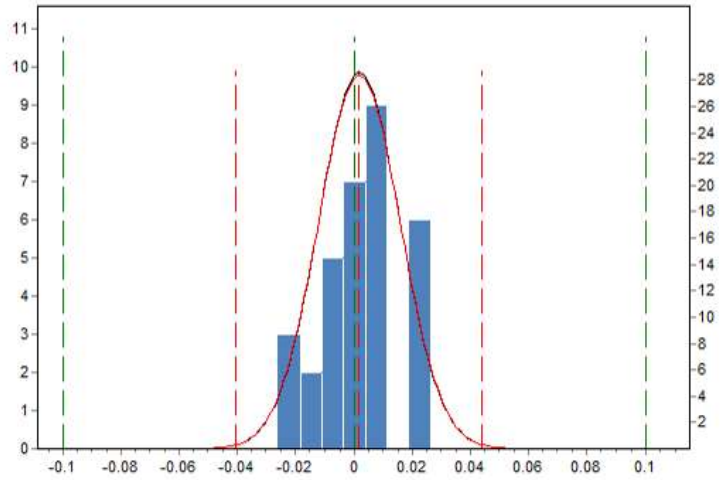
Ran one representative PCBA order of 88 pieces through all processing following the use of the new screen printer. Printing on the PCBA's was visually inspected with no abnormalities. Assemblies using these PCBA's were built and tested with no electrical issues.



总样本数	32		子组大小	32		
平均值	0.0012		最大值	0.024	最小值	-0.024
上规格	0.1		目标值	0	下规格	-0.1
+3Sigma	0.035		-3Sigma	-0.033		

	组内	整体	实测		
STDEV	0.011247	0.011157			
CPK	2.929	2.952			

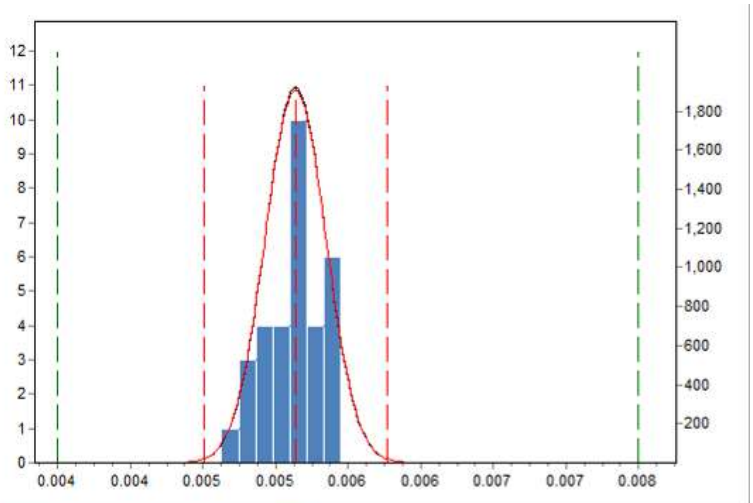
DEK screen printer-X Direction:CPK 2.929



总样本数	32		子组大小	32		
平均值	0.0018		最大值	0.026	最小值	-0.026
上规格	0.1		目标值	0	下规格	-0.1
+3Sigma	0.044		-3Sigma	-0.04		

	组内	整体	实测		
STDEV	0.014076	0.013963			
CPK	2.324	2.343			

DEK screen printer-Y Direction:CPK 2.324



总样本数	32		子组大小	32		
平均值	0.005638		最大值	0.00595	最小值	0.00514
上规格	0.008		目标值	0	下规格	0.004
+3Sigma	0.00627		-3Sigma	0.00501		

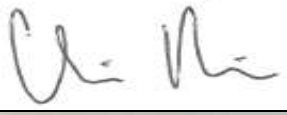
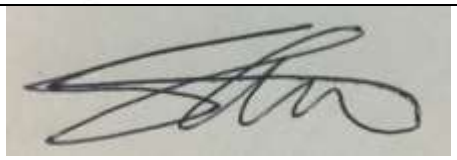
	组内	整体	实测		
STDEV	0.00021	0.000208			
CPK	2.6066	2.62762			

DEK screen printer-height:CPK 2.6066

4. Conclusion

Following installation of the new DEK printer, all functions of the machine appear to be normal and production utilizing this equipment was found to be without error.

Approvals

	VP – Global Quality	October 17, 2016	Date
	Project Manager	October 17, 2016	Date
	Operations BUL/VP	October 17, 2016	Date

Equipment Validation Plan/Results

Project:	High Speed Placement SMD System Installation - China
Part Numbers/ Products that will use this equipment:	Various
Equipment/Process to be Validated:	XPF-L
Process/Product ECN Number:	N/A
Date Required:	11/1/2016
Project Manager(s):	Jamie Dobravec / Alfred Sham
Team Member(s):	Matthew Wong, Michael Yip, Franky Tang, Lina Yan

This form is used to approve new equipment for product. This form is provided as a base to describe "what" and "how" of the validation. Sections may be added at the discretion of the project manager or engineer.

1. Introduction

A new FUJI XPF-L High Speed SMC Placement System System machine has been purchased to assist in the production of the various PCBA's at Grayhill's Shenzhen facility. This plan will aid in the proper installation and validation of the new equipment.

1.1. Objective

Receive, install, and qualify the new placement machine for use in all China PCBA assembly.

1.2. Reference Documents

- FUJI XPF-L Installation Documentation
- FUJI XPF-L Operator Manual
- FUJI XPF-L Technical Manual

2. Validation Plan

2.1. Installation Qualification Plan

The machine was delivered to the Shenzhen, China facility on 2016.08.29. An electrician wired the machine before Grayhill's installation team arrives on 2016.09.01. The electricity run to the breaker box next to the machine will able to produce 200 VAC, 3 phase, 50-60Hz power. Operating conditions will be between 20 and 30C.

2.2. Operational Qualification Plan

After the machine is completely installed, all specifications located in the user manual will be verified. All potential profiles will be run to ensure each profile is operational within the program and the wave solder machine. The FUJI XPF-L System machine will be added to eMaint for preventative maintenance.

2.3. Performance Validation/Qualification Plan

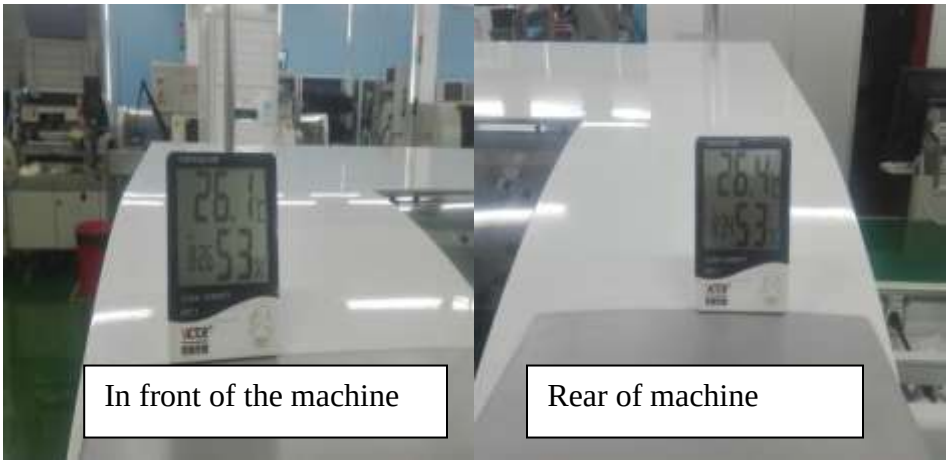
A representative sample PCBA will be processed through the placement equipment. Nominal settings to ensure a good process will be used. After placement of the components, location of components to nominal will be measured on a minimum sample of 32 pieces. Cpk values should be in the acceptable range (>1.33) for the process.

3. Results

3.1. Installation Qualification Results

☒ **Verify Environmental requirements:**

20 – 30C
30 – 80% Humidity
60 – 80 Decibals



☒ **Ensure floor is capable of holding 1500kg and level level**

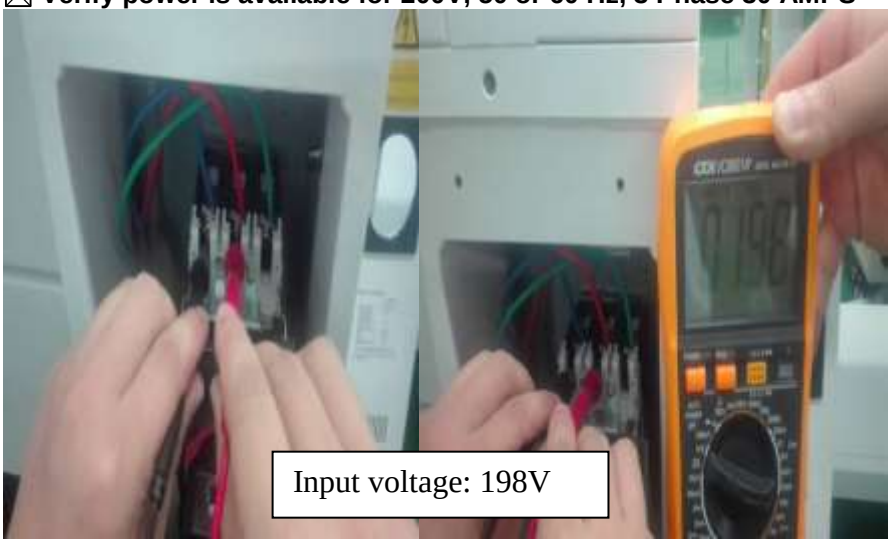
Equipment Validation Plan/Results

☒ **Ensure space is capable of supporting System**

Length	Depth	Height
1500mm	1607.5mm	1419.5mm

☒ **The environment is clean**

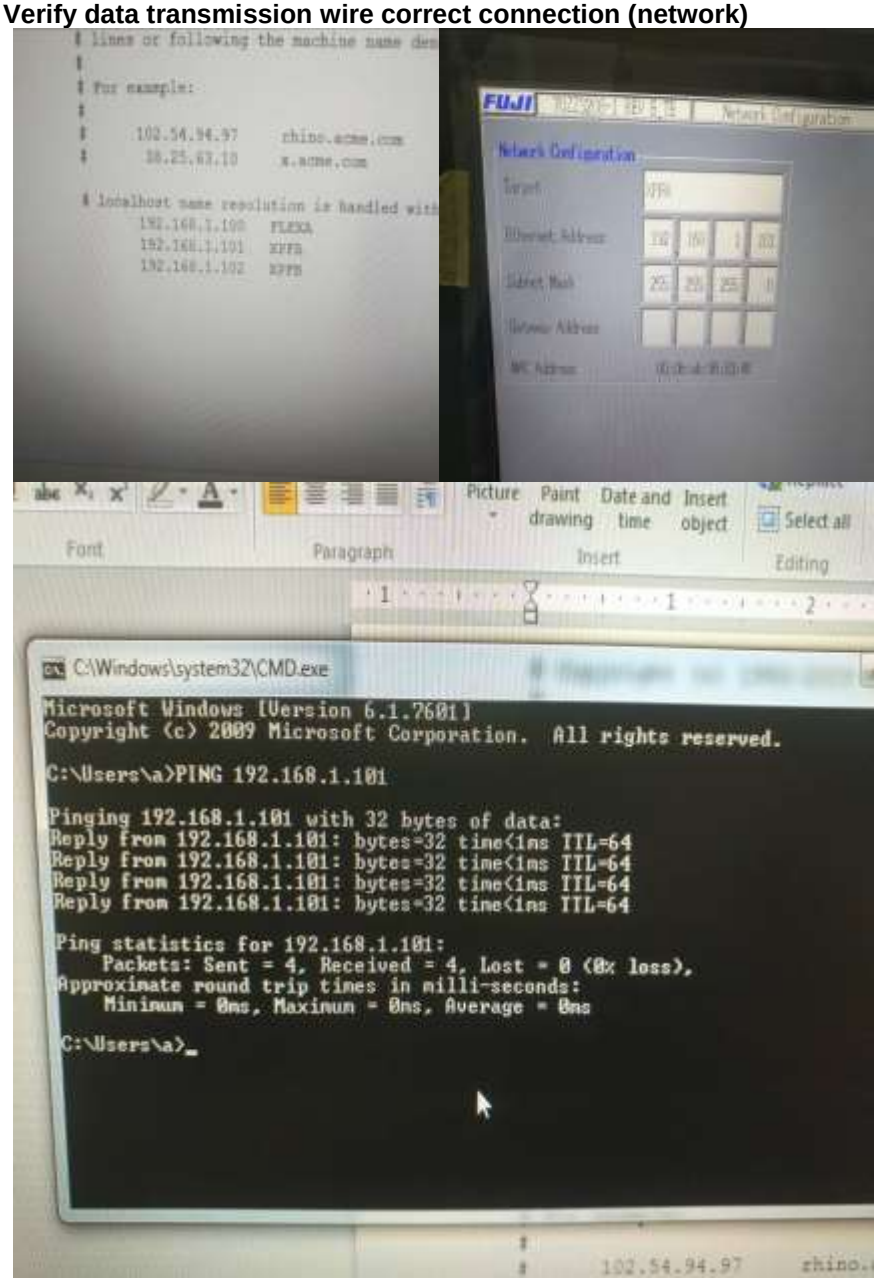
☒ **Verify power is available for 200V, 50 or 60 Hz, 3 Phase 30 AMPS**



☒ **Verify a pneumatic supply of clean, non lubricated air which should maintain :**

Air supply 0.5MPa

☒ **Verify data transmission wire correct connection (network)**

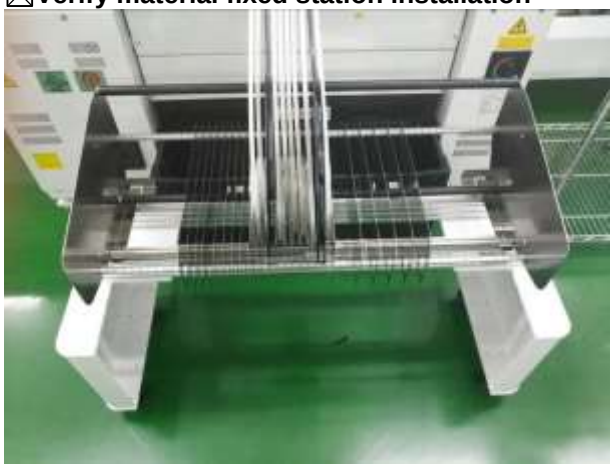


☒ **Verify the PCB handling I/F transmitting signal connection**

☒**Verify the MFU materials plate bracket installation.**

☒**Verify the height of MFU, adjust the height of the MFU: 23 mm**

☒**Verify material fixed station installation**



☒**Machine preparation transit brackrts and screws removal**

☒ **Verify emergency Stop buttons function**

3.2. Operational Qualification Results

Operational testing will qualify system hardware and software functionality

☒ **Verify the following:**

Placement capability: 25000 components/hr
Placement tact time: 0.144 seconds/component
Placement Accuracy: Chips ±0.050mm
Leaded parts ±0.040mm
Conveyor loading time: 1.8 sec

☒ **Verify the Nozzles fit correctly and tape feeder handles reel size**

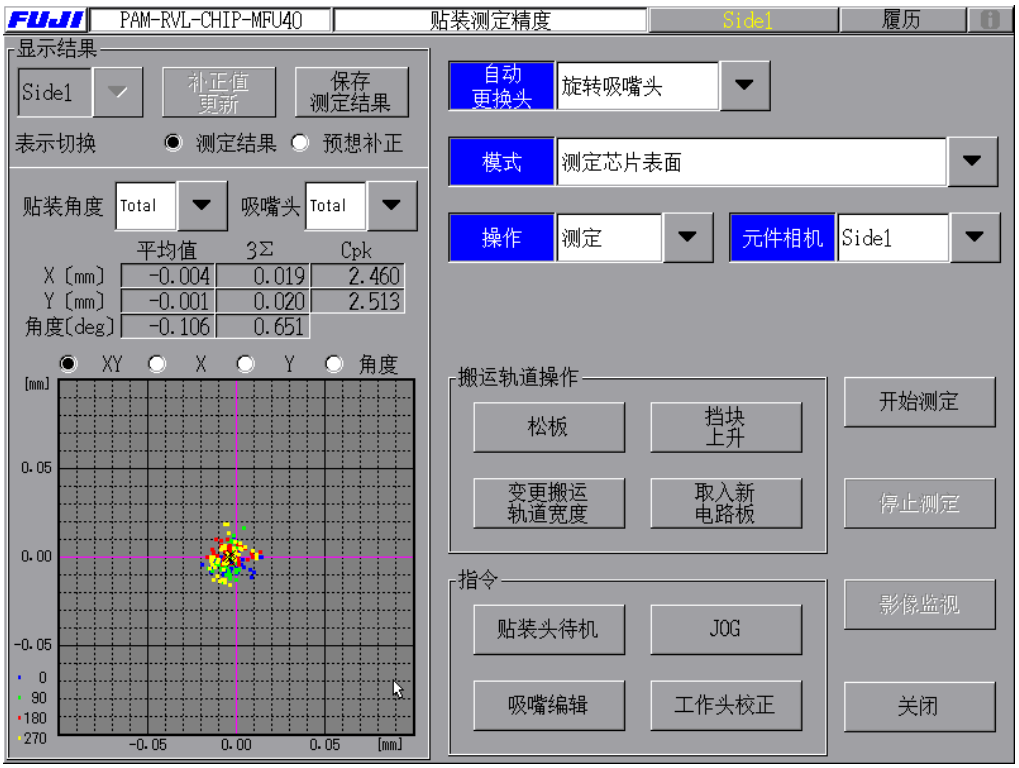
☒ **Verify width capability as follows:**

Board Specifications

		Metric
Width (XPF-L)	**Min**	**50*50**mm
	Max	***457*356****mm*

☒ **Verify XPF-L I/O diagnostic capability**

☒ **Verify XPF-L the placement accuracy test**



☒ **Training**

The following associates have been properly trained.

_Franky tang_____

_Pen Huihua_____

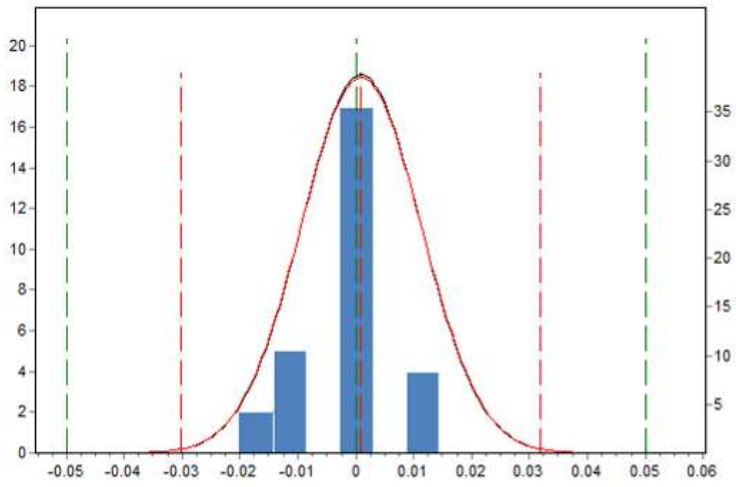
_Wang guangquan_____

3.3. Performance Qualification Results

Ran one representative PCBA order of 88 pieces through all processing following the pick and place operation. Placement of the components on the PCBA's were visually inspected with no abnormalities. Assemblies using these PCBA's were built and tested with no electrical issues.

CpK data collected for location of components.

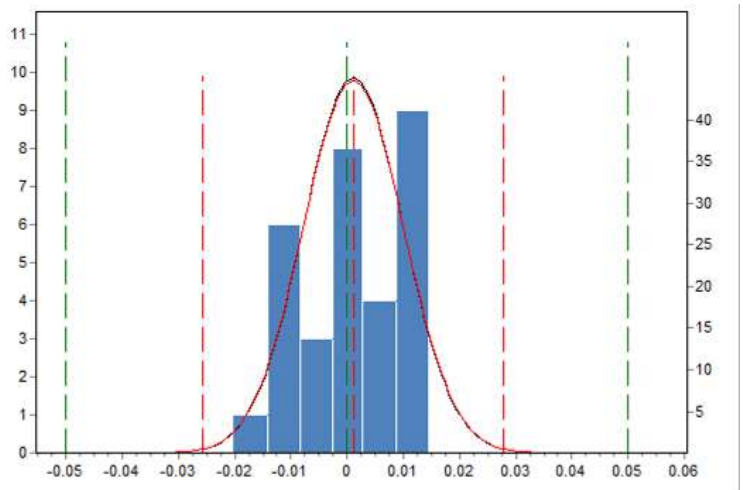
FUJI XPF-L chip shooter X-Direction CPK:1.57



总样本数	32		子组大小	32		
平均值	0.0009		最大值	0.02	最小值	-0.02
上规格	0.05		目标值	0	下规格	-0.05
+3Sigma	0.032		-3Sigma	-0.03		

	组内	整体	实测		
STDEV	0.010356	0.010273			
CPK	1.579	1.592			

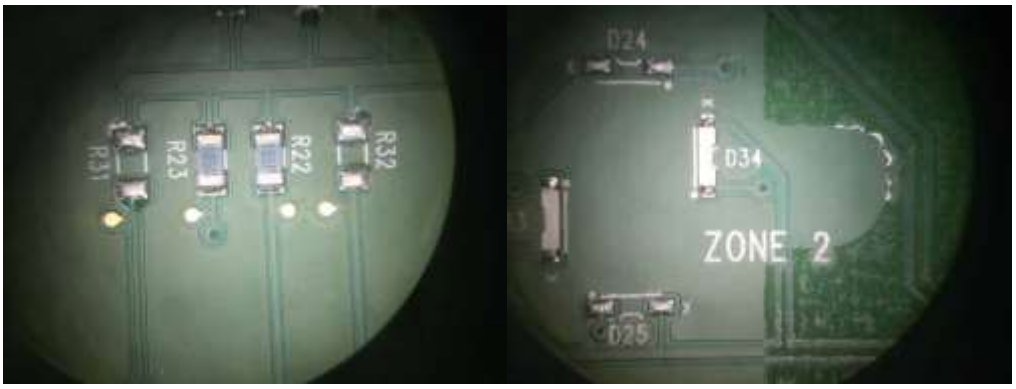
FUJI XPF-L chip shooter Y-Direction CPK:2.20



总样本数	32		子组大小	32		
平均值	0.0011		最大值	0.02	最小值	-0.02
上规格	0.05		目标值	0	下规格	-0.05
+3Sigma	0.028		-3Sigma	-0.026		

	组内	整体	实测		
STDEV	0.008937	0.008866			
CPK	1.824	1.839			

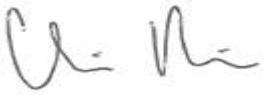
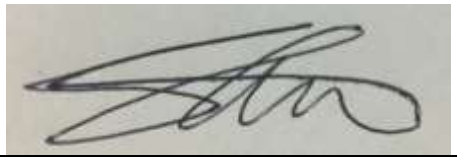
Verified the placement and quality following reflow.



4. Conclusion

Following installation of the new XPF-L high speed placement machine, all functions of the were found to be normal and production utilizing this equipment was found to be without error.

Approvals

	VP – Global Quality	October 17, 2016	Date
	Project Manager	October 17, 2016	Date
	Operations BUL/VP	October 17, 2016	Date

Equipment Validation Plan/Results

Project:	Flexible Placement SMD System Installation - China
Part Numbers/ Products that will use this equipment:	Various
Equipment/Process to be Validated:	Fuji Model XPF-L with Multi-Purpose Placement Nozzles
Process/Product ECN Number:	N/A
Date Required:	11/1/2016
Project Manager(s):	Jamie Dobravec / Alfred Sham
Team Member(s):	Matthew Wong, Michael Yip, Franky Tang, Lina Yan

This form is used to approve new equipment for product. This form is provided as a base to describe "what" and "how" of the validation. Sections may be added at the discretion of the project manager or engineer.

1. Introduction

A new FUJI XPF-L / Multi-Purpose Placement Nozzle flexible SMD Placement System machine has been purchased to assist in the production of the various PCBA's at Grayhill's Shenzhen facility. This plan will aid in the proper installation and validation of the new equipment.

1.1. Objective

Receive, install, and qualify the new placement machine for use in all China PCBA assembly.

1.2. Reference Documents

- FUJI XPF-L Installation Documentation
- FUJI XPF-L Operator Manual
- FUJI XPF-L Technical Manual

2. Validation Plan

2.1. Installation Qualification Plan

The machine was delivered to the Shenzhen, China facility on 2016.08.29. An electrician wired the machine before Grayhill's installation team arrived on 2016.09.01. The electricity run to the breaker box next to the machine will able to produce 200 VAC, 3 phase, 50-60Hz power. Operating conditions will be between 20 and 30C.

2.2. Operational Qualification Plan

After the machine is completely installed, all specifications located in the user manual will be verified. A representative sample of placement programs will be loaded and run to ensure proper positioning of surface mount components. The Fuji XPF-L machine will be added to eMaint for preventative maintenance.

2.3. Performance Validation/Qualification Plan

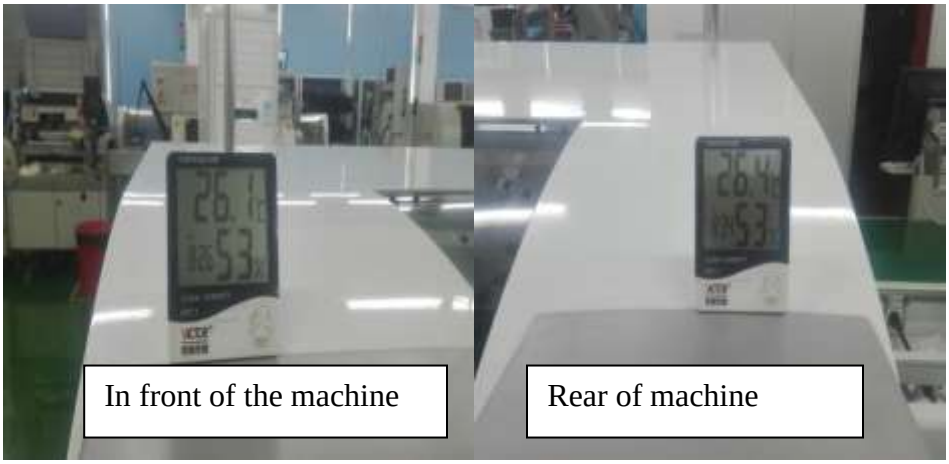
A representative sample PCBA will be processed through the placement equipment. Nominal settings to ensure a good process will be used. After placement of the components, location of components to nominal will be measured on a minimum sample of 32 pieces. Cpk values should be in the acceptable range (>1.33) for the process.

3. Results

3.1. Installation Qualification Results

☒ **Verify Environmental requirements:**

20 – 30C
30 – 80% Humidity
60 – 80 Decibels



☒ **Ensure floor is capable of holding 1500kg and level level**

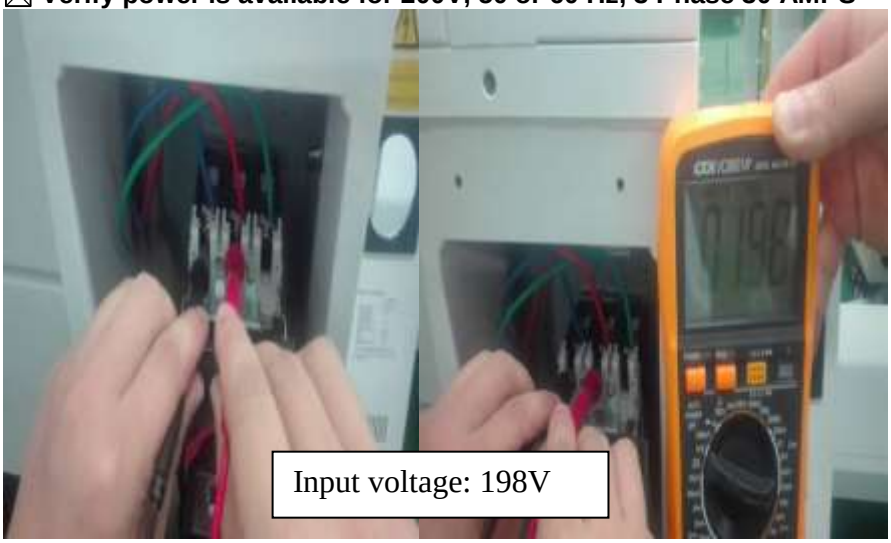
Equipment Validation Plan/Results

☒ **Ensure space is capable of supporting System**

Length	Depth	Height
1500mm	1607.5mm	1419.5mm

☒ **The environment is clean**

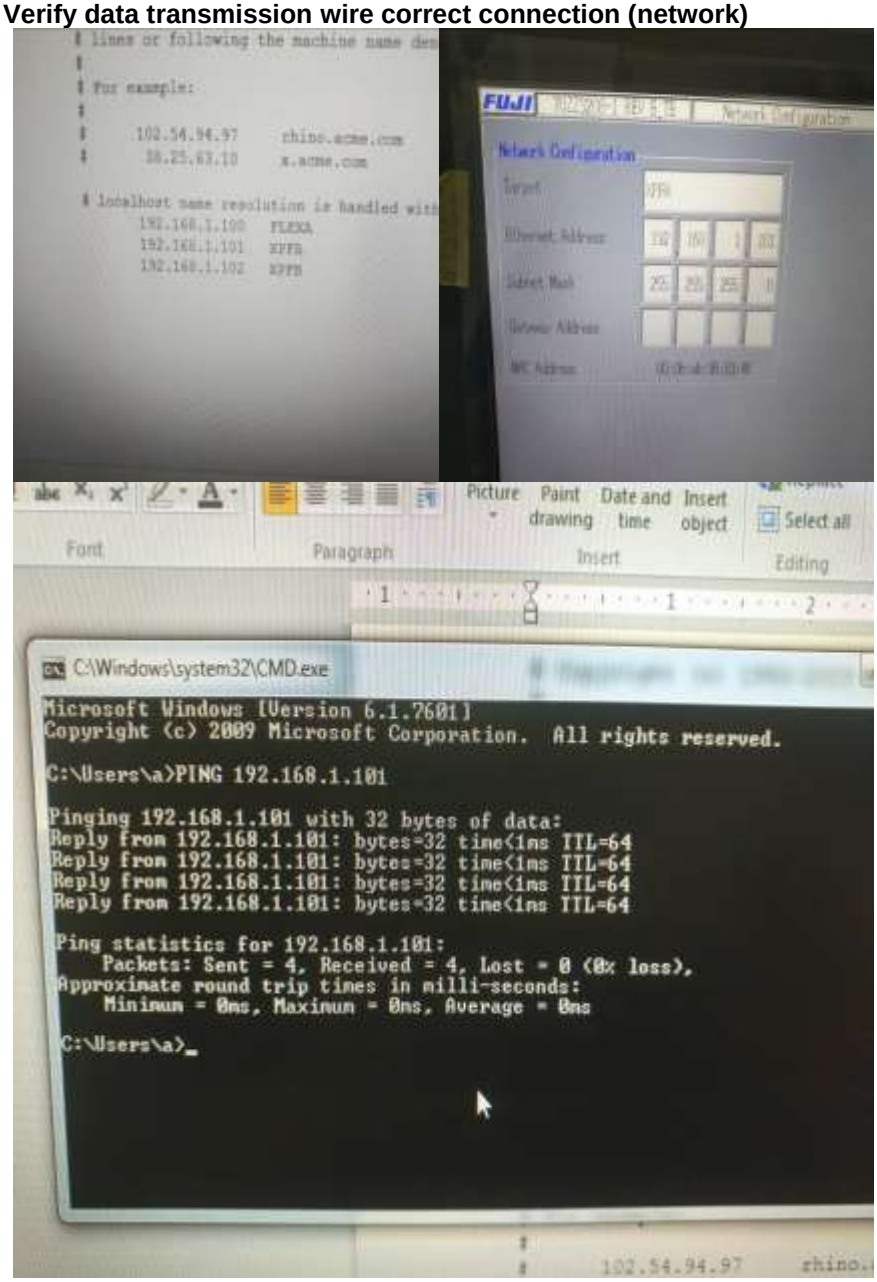
☒ **Verify power is available for 200V, 50 or 60 Hz, 3 Phase 30 AMPS**



☒ **Verify a pneumatic supply of clean, non lubricated air which should maintain :**

Air supply 0.5MPa

☒ **Verify data transmission wire correct connection (network)**

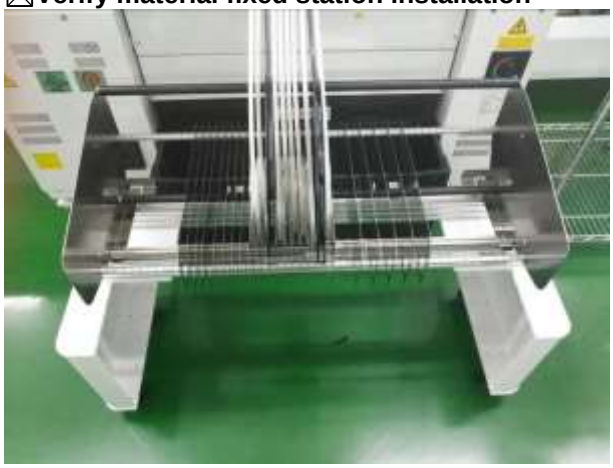


☒ **Verify the PCB handling I/F transmitting signal connection**

☒**Verify the MFU materials plate bracket installation.**

☒**Verify the height of MFU, adjust the height of the MFU: 23 mm**

☒**Verify material fixed station installation**



☒**Machine preparation transit brackrts and screws removal**

☒ **Verify emergency Stop buttons function**

3.2. Operational Qualification Results

Operational testing will qualify system hardware and software functionality

☒ **Verify the following:**

Placement capability: 25000 components/hr
Placement tact time: 0.144 seconds/component
Placement Accuracy: Chips ±0.050mm
Leaded parts ±0.040mm
Conveyor loading time: 1.8 sec

☒ **Verify the both high speed and flexible nozzles fit correctly and tape feeder handles reel size**

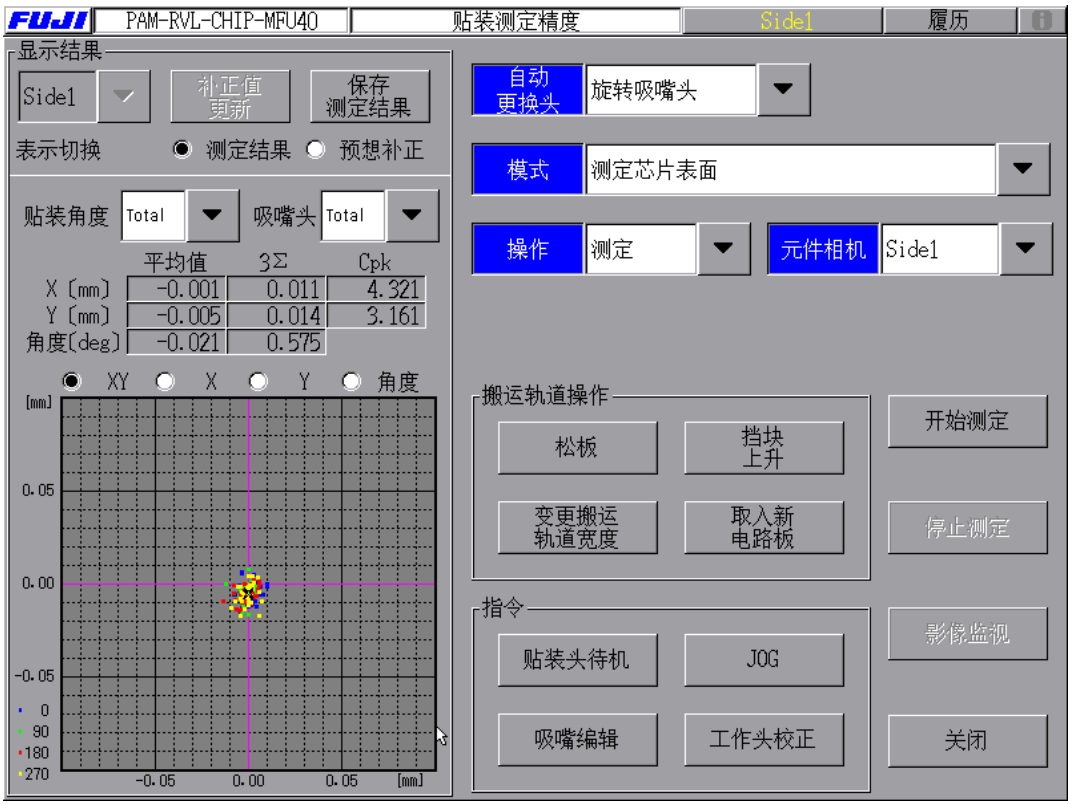
☒ **Verify width capability as follows:**

Board Specifications

		Metric
Width (XPF-L)	**Min**	**50*50**mm
	Max	***457*356****mm*

☒ **Verify XPF-L I/O diagnostic capability**

☒ **Verify XPF-L the placement accuracy test**



☒ **Training**

The following associates have been properly trained.

_Franky tang_____

_Pen Huihua_____

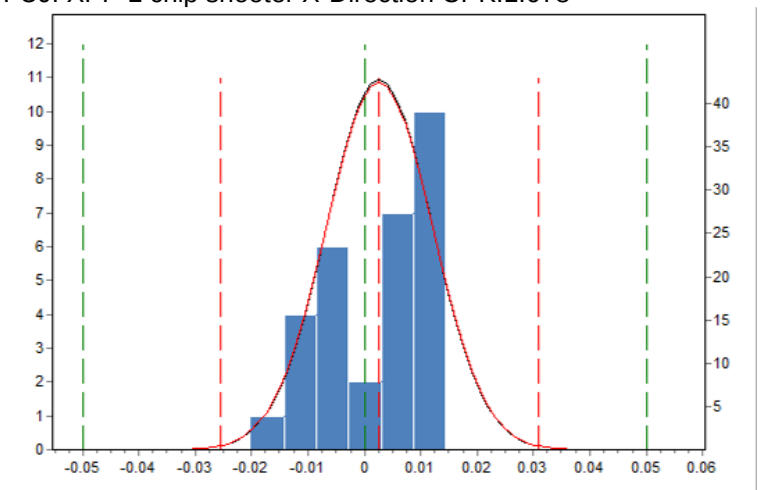
_Wang guangquan_____

3.3. Performance Qualification Results

Ran one representative PCBA order of 88 pieces through all processing following the pick and place operation. Placement of the components on the PCBA's were visually inspected with no abnormalities. Assemblies using these PCBA's were built and tested with no electrical issues.

CpK data collected for location of components.

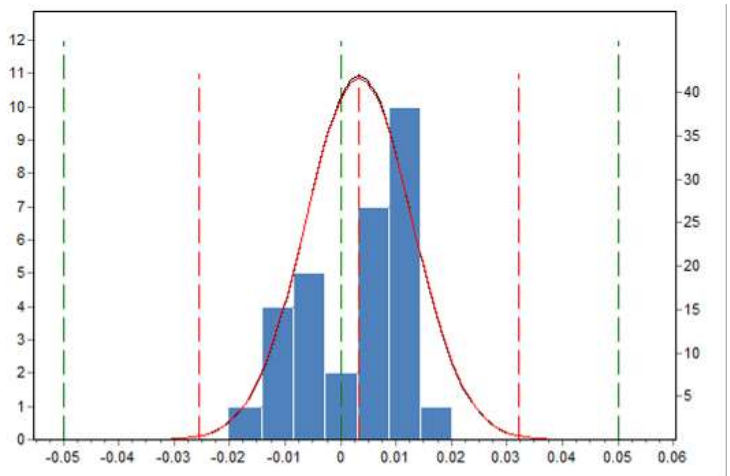
FUJI XPF-L chip shooter X-Direction CPK:1.678



总样本数	32		子组大小	32		
平均值	0.0027		最大值	0.02	最小值	-0.02
上规格	0.05		目标值	0	下规格	-0.05
+3Sigma	0.031		-3Sigma	-0.026		

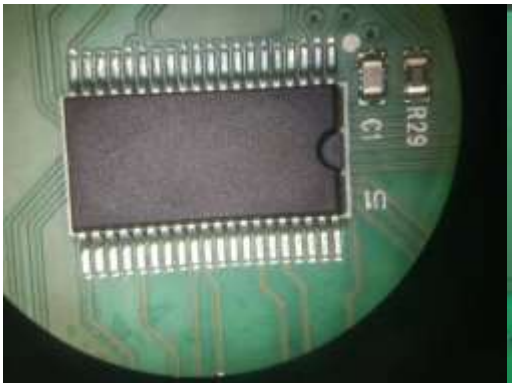
	组内	整体	实测		
STDEV	0.009406	0.009331			
CPK	1.678	1.691			

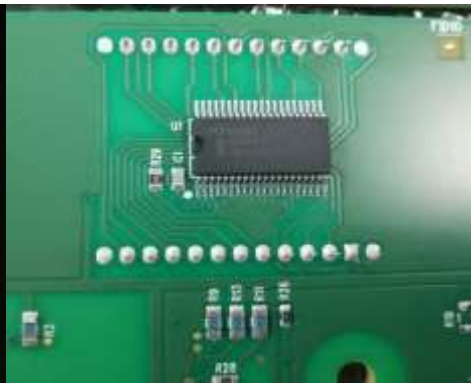
FUJI XPF-L chip shooter Y-Direction CPK:2.20



总样本数	32		子组大小	32		
平均值	0.0033		最大值	0.02	最小值	-0.02
上规格	0.05		目标值	0	下规格	-0.05
+3Sigma	0.032		-3Sigma	-0.025		

	组内	整体	实测		
STDEV	0.0096	0.009523			
CPK	1.62	1.633			

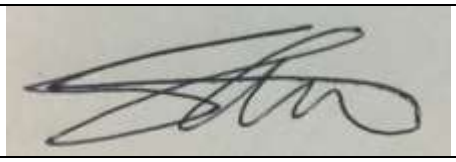




4. Conclusion

Following installation of the new XPF-L machine with flexible placement nozzles, all functions of the were found to be normal and production utilizing this equipment was found to be without error.

Approvals

	VP – Global Quality	October 17, 2016	Date
	Project Manager	October 17, 2016	Date
	Operations BUL/VP	October 17, 2016	Date