PRODUCT ADVISORY NOTICE

KEEPING YOU INFORMED OF PRODUCT CHANGES

To: **All 90 Series DIP Switch Customers, Sales Representatives and Distributors**

Date: **July 20, 2014**

Subject: **Base and Cover Plastic Material Change**

This Product Advisory Notice is to alert you that there is a coming change to a series of Grayhill DIP switches and our records show 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 your organization.

Description of the Change

The thermoplastic material that is used in the base and cover piece parts is changing from 30% glass filled polyamide (PA46) to 33% glass filled polyphthalamide (PPA).

Reason for Change

The new material performs better than the current material in reflow process applications where more demanding process temperatures as used. The new material also improves the tape seal adhesion to the switches by virtue of being less susceptible to moisture absorption during processing or storage. The new material has the added benefit of being Halogen Free and of meeting all current RoHS and REACH requirements.

Effective Date

All two through eight position 90 Series DIP switches manufactured after August 30th (date code 1436 or later) may be built with either PA46 or PPA.

Part Numbers Affected

The table below lists the Grayhill part numbers included in the change notice:

2s	3s	4s	5s	6s	8s	10s	Custom	
90B02SLT	90B03ST	90B04SLT	90B05SLT	90B06ST	90B08SLT	90B10SLT	90YY2882R	90YY3143SGWR
90B02ST	90HBJ03PT	90B04ST	90B05ST	90B06T	90B08ST	90B10ST	90YY2901S	90YY3145SGWR
90HBJ02PRT	90HBW03PRT	90B04T	90HBJ05PRT	90CR06SGWRT	90GB08ST	90GB10ST	90YY2923SGWR	90YY3148SGWR
90HBJ02PT	90HBW03PT	90HBJ04PRT	90HBJ05PT	90HBJ06PRT	90HBJ08PRT	90HBJ10PRT	90YY2928SGWR	90YY3203SGWR
90HBW02PRT		90HBJ04PT	90HBW05PRT	90HBJ06PT	90HBJ08PT	90HBJ10PT	90YY3048S	90YY3205SGWR
90HBW02PT	7s	90HBW04PRT	90HBW05PT	90HBW06PRT	90HBW08PRT	90HBW10PRT	90YY3048SR	90YY3326PR
90HBW02RT	90B07ST	90HBW04PT	90HBW05T	90HBW06PT	90HBW08PT	90HBW10PT	90YY3062SR	90YY3370PR
90HBW02T	90HBW07PRT	90HBW04RT	90HGBW05PRT		90HBW08RT	90HBW08RT	90YY3111SR	90YY3371PR
	90HBW07PT	90HBW04T					90YY3142SGWR	90YY3372SGWR

Test Data Available

A summary of the tests performed on the new material is attached to this notice. The full test report is available on: http://www.grayhill.com/about-us/product-advisory-notices/

Action Required

Please forward this notification to the appropriate person(s) in your organization. No other action is required. However, if you would like to receive a free sample, please contact your Grayhill, Inc. sales associate.

Grayhill INC.
Intuitive Human Interface Solutions

Device Under Test:
90HBW08PT, 90HBW10PT, 90B08ST, 90B05ST, 90B10ST

Environmental Test:
Thermal Shock, Moisture resistance, Thermal aging, Resistance to Reflow

Physical Test:
Mechanical Life, Mechanical shock, Vibration Resistance, Terminal Strength
Flammability, Solderability, Process seal

Test Report Number:	**SM04-17**
Test Start Date:	**December 3, 2013**
Test Completion Date:	**March 14, 2014**
Test Facility:	**Grayhill, Inc.**
Test Requested By:	**Gary Dreher**
Test Performed By:	**Lakeiah Johnson** **Laboratory Technician**
Report Written By:	**Lakeiah Johnson** **Laboratory Technician**
Report Approved By:	Nicole J Jachna **Nicole Jachna** **Quality Lab Manager**

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1.0 SUMMARY

1.1. PURPOSE

To test and verify a change in the plastic resin material used for the 90 Series switch body and cover to a halogen-free grade of Amodel in place of the Stanyl material that is currently used.

1.2. REQUIREMENTS & METHODS

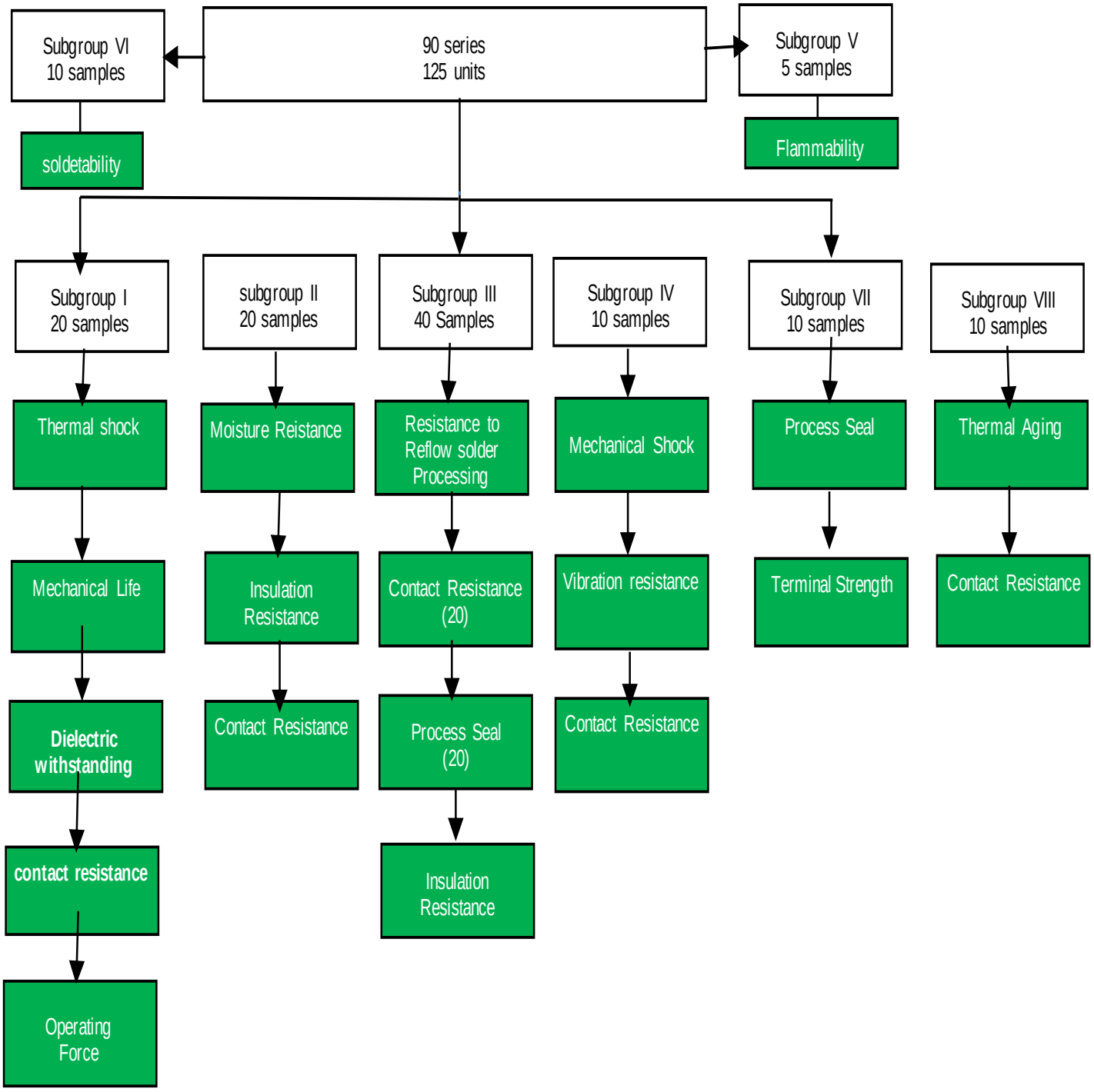
- PS90
- MIL-STD-202G
- MIL-STD-83504
- UL-94
- SVV1747
- IEC 695-11-5
- IPC J-STD-002

1.3. TEST SUMMARY

Table 1 – Test Summary

Test Description	Basic Standard	Test Results	Test Date	Test Location
Thermal shock	MIL-STD-202 Method 107G, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Mechanical Life	MIL-STD-83504/12, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Dielectric Withstand Voltage	MIL-STD-202 Method 301, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Contact Resistance	MIL-STD-202 Method 307, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Moisture Resistance	MIL-STD-202 Method 106, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Insulation Resistance	MIL-STD-202 Method 302, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Resistance to Reflow Solder Processing	PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Process Seal	MIL-STD-202 Method 112, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Mechanical Shock	MIL-STD-202 Method 213, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Vibration Resistance	MIL-STD-202 Method 204 PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Terminal Strength	MIL-STD-202 Method 211A, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Thermal Aging	MIL-STD-202 Method 108A , PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Solderability	MIL-STD-202 Method 208, PS90 – Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Flammability	IEC Standard 60695-11-5 UL-94, PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.
Operating Force	PS90 – 90 Series Product Specification	PASS	01/30/2014 To 02/24/2014	Grayhill, Inc.

2.0 FLOW CHART



3.0 CONTACT RESISTANCE

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Contact Resistance	PS90, MIL-STD-202 Method 307	90HBW08PT, 90B08ST, 90B05ST, 90B10ST	90B08ST 1-30 90B05ST 1-30 90B10ST 1-20 90HBW08PT 1-98	Grayhill Inc.	12/3/2013 to 03/03/2014

3.1. PURPOSE

The purpose of the contact resistance test is to determine the resistance offered to a flow of current during its passage between the electrical contacting surfaces of connecting components, such as plugs, jacks, connectors, and sockets, or between the electrical contacts of current controlling components, such as switches and relays. For practical reasons, lead and terminal resistances may be included in the actual measurement, as well as the contact resistance proper. In many applications it is required that the contact resistance be low and stable, so that the voltage drop across the contacts does not affect the accuracy of the general circuit conditions. If large currents are passed through high resistance contacts, excessive energy losses and dangerous overheating of the contacts may occur.

3.2. TEST SETUP DETAILS

1. Set DC power supply to test voltage 1V and 10 milliamperes.
2. Connect the affixed 4 wire test probes to DUT leads by clips
3. Take one measurement for each actuation.
4. Record data

Table 2 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT — 534	DC Power supply	GPS-4251	GWINSTEK	Verified with GT-13
GT — 13	Multimeter	87 III	Fluke	05-2014
GT— 507	Multimeter	34401A	Agilent	03-2014

3.3. TEST SETUP PHOTOS

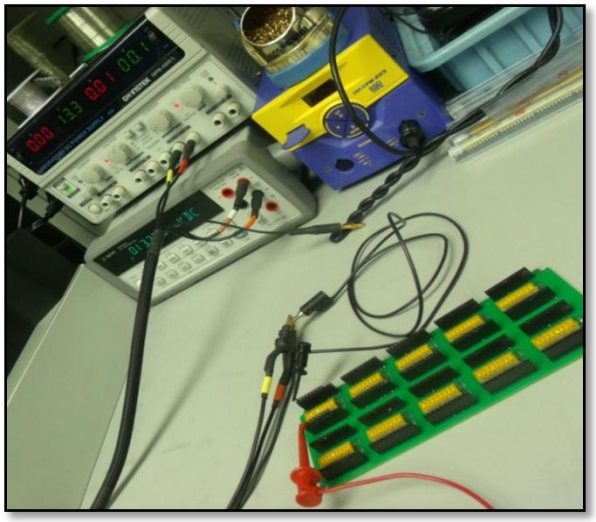


Figure 1 – Test setup

3.4. ACCEPTANCE CRITERIA

When switches are tested as specified, the contact resistance shall not exceed 20 milliohms initially or 100 milliohms after mechanical life

3.5. TEST RESULTS

After testing all switches contact resistance did not exceed 20milliohms initially of 100 milliohms after mechanical life.

Table 3 – Test Results

DUT	Part Number	Test	Specification	Pass	Test Location	Test Date
1-30	90B08ST	CR	MIL-STD-202, Method 307	PASS	Grayhill Inc.	12/03/2013 To 03/03/2014
1-30	90B05ST	CR	MIL-STD-202, Method 307	PASS	Grayhill Inc.	12/03/2013 To 03/03/2014
1-20	90B10ST	CR	MIL-STD-202, Method 307	PASS	Grayhill Inc.	12/03/2013 To 03/03/2014
1-98	90HBW08PT	CR	MIL-STD-202, Method 307	PASS	Grayhill Inc.	12/03/2013 To 03/03/2014

4.0 INSULATION RESISTANCE

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Insulation Resistance	PS90 MIL-STD 202, Method 302	90HBW08PT, 90B08ST, 90B05ST, 90B10ST	90B08ST 1-30 90B05ST 1-30 90B10ST 1-20 90HBW08PT 1-98	Grayhill Inc.	12/4/2013 To 03/03/2014

4.1. 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

4.2. TEST SETUP DETAILS

1. Visual Inspection of the unit 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. Repeat 2-3 for all points of application.

Table 4 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-76	Megaohm-Meter	1865 Megaohm-Meter	Quad Tech	10-2014

Table 5 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	All
Operational Mode		Unpowered
Temperature	°C	24.4
Humidity	%h	16.9
Points of Application		Across open contacts and between adjacent closed contacts

Note: Due to all contact being sealed a measurement between only adjacent close contacts can be done.

4.3. TEST SETUP PHOTOS

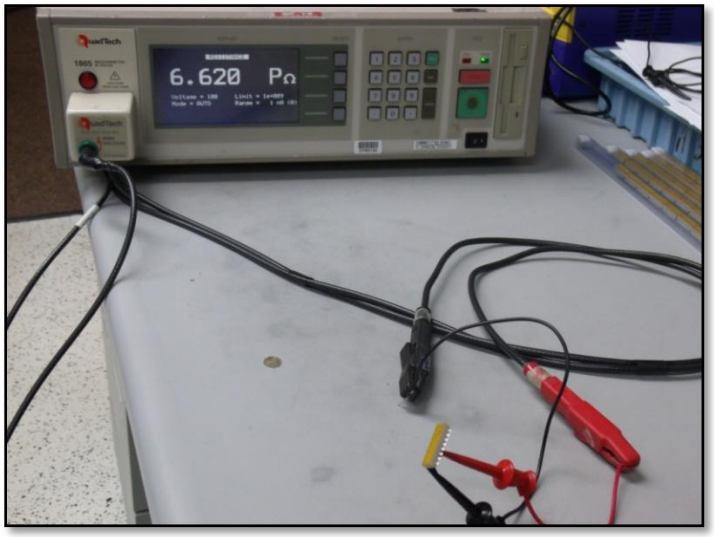


Figure 2 – Test setup photo

4.4. ACCEPTANCE CRITERIA

The insulation resistance shall not be less than 5,000 Megaohms initially or 1,000 Megaohms after mechanical life.

4.5. TEST RESULTS

All DUT were not less than 5,000 Megaohm initially or less than 1,000 Megaohm after mechanical life testing

Table 6 – Test Results

DUT	Part Number	Test	Specification	Pass	Test Location	Test Date
1-30	90B08ST	Insulation Resistance	MIL-STD-202, Method 302	**PASS**	Grayhill Inc.	12/03/13 To 02/24/2014
1-30	90B05ST	Insulation Resistance	MIL-STD-202, Method 302	**PASS**	Grayhill Inc.	12/03/13 To 02/24/2014
1-20	90B10ST	Insulation Resistance	MIL-STD-202, Method 302	**PASS**	Grayhill Inc.	12/03/13 To 02/24/2014
1-98	90HBW08PT	Insulation Resistance	MIL-STD-202, Method 302	**PASS**	Grayhill Inc.	12/03/13 To 02/24/2014

5.0 FLAMMABILITY

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Flammability	IEC Standard 60695-11-5 UL-94	90HBW08PT	42,64,65,66,67	Grayhill Inc.	12/27/2013

5.1. PURPOSE

This test is performed to determine the flammability of a part exposed to an external flame. Flammability can be determined by the time it takes a part to become self-extinguishing after exposure to an external flame. Typical environmental effects of this test are changes in physical properties of materials resulting in:

- Fire
- Explosive type fire
- Continued self-ignition of material

5.2. TEST SETUP DETAILS

1. Visual Inspection of the unit is to be performed before and after testing.
2. Place and setup the torch in the chamber. See table below for flame length.
3. Expose the unit under test to the flame impingement point in the orientation specified below.
4. Expose the unit for the specified exposure time.
5. Remove the unit form the flame and document results.
6. Perform the Visual Check after exposure.

Table 7 – Test Conditions

Test Condition	Units	Parameters
Quantity		5
Chamber		Chemical Fume hood
Flame orientation		Vertical
Exposure time	seconds	30
Fuel type		Propane
Nozzle type		See UL-94 &IEC 60695
Allowable burn time	seconds	3
Mating Connector Attached		No
Operational Mode		Non-Operating
Temperature	°C	24.1
Humidity	RH%	15.5

5.3. TEST SETUP PHOTOS

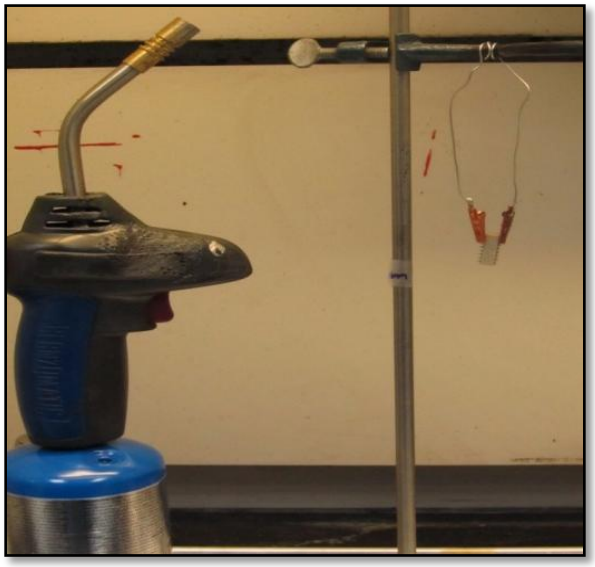


Figure 3 – Flammability Test Setup

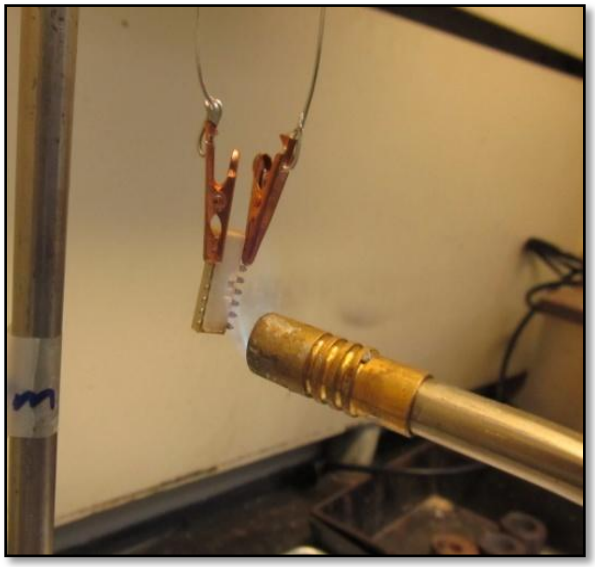


Figure 4 – Flammability Test Setup

5.4. ACCEPTANCE CRITERIA

There shall be less than 3 seconds of continuous flaming after removal of burner, and falling burning drops shall not ignite the cheese cloth underneath.

5.5. TEST RESULTS.

All switches had a continuous flame after removing the burner for less than 3 seconds and the burning drops did not ignite the cheese cloth underneath.

Table 8 – Test Results

DUT	Test	Specification	Pass/Fail	Test Location	Test Date
42	Flammability	MIL STD 202G Method 111A	PASS	Grayhill Validation Lab	12/27/2013
64	Flammability	MIL STD 202G Method 111A	PASS	Grayhill Validation Lab	12/27/2013
65	Flammability	MIL STD 202G Method 111A	PASS	Grayhill Validation Lab	12/27/2013
66	Flammability	MIL STD 202G Method 111A	PASS	Grayhill Validation Lab	12/27/2013
67	Flammability	MIL STD 202G Method 111A	PASS	Grayhill Validation Lab	12/27/2013

6.0 SOLDERABILITY

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Solderability	MIL-DTL-9419G Method 4.7.19	90HBW08PT	32-41	Grayhill Inc.	2/06/2013

6.1. PURPOSE

The purpose of this test method is to determine the solderability of all terminations, which are normally joined by a soldering operation. This determination is made on the basis of the ability of these terminations to be wetted by solder and predictability of a suitable fillet resulting from solder application. These procedures will verify will verify that the pre-assembly lead finish provides a solder able surface of sufficient quality to enable satisfactory soldering.

6.2. TEST SETUP DETAILS

1. While running this test specimen should follow MIL-STD-202G and condition table.
2. Visual inspection of the unit is to be performed before and after testing.
3. All terminals of the DUT are to be tested
4. Dipping device: Need not be used.
5. Examination of terminations: Method for evaluation of lugs and tabs shall apply.
6. Preparation of terminations and aging shall be as specified in ANSI/J-STD-002
7. Flux shall be applied by a suitable method (e.g., brush) and allowed to drain for 5 to 20 seconds.
8. Solder in shall be applied to the terminal along with the clean solder coated tip of an iron (unless otherwise specified in the individual specification, iron temperature shall be 350°C) to a point ¼ inch from the nearest insulating material or ½ the exposed length of the terminal.
9. The termination shall be positioned so that the iron can be applied to the test surface in a horizontal position.
10. Prior to examination, flux residue shall be removed from the terminations by cleaning in a suitable solvent.
11. Terminations shall be examined as specified in ANSI/J-STD-002.

Table 9 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-530	Steamage	N / A	Mountian gate Engineering	01-2015
GT-302	Solder Iron	FM-202	Hakko	09-2014

Table 10 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	10
8 Hours Steamage	NA	Yes
Water Type for Steamage		Ionized
Solder	NA	63% Sn / 37%Pb
Solder Pot Temperature	°C	250
Time on Solder Iron	Sec	5-20
Temperature	°C	24.1
Humidity	RH%	15.5
Flux		182

6.3. TEST SETUP PHOTOS

Figure 5 – Test Setup

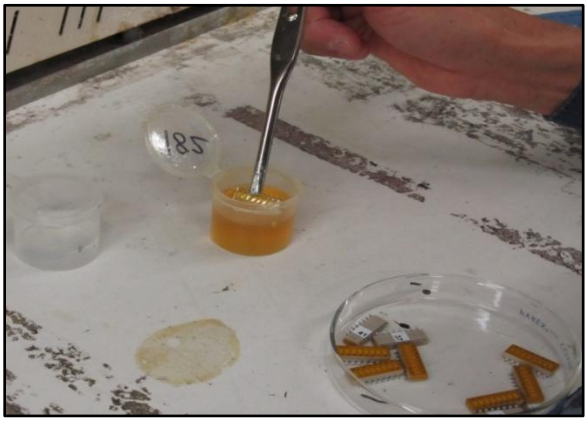


Figure 6 – Test Setup

Figure 7 – Test setup

6.4 ACCEPTANCE CRITERIA

All terminations shall exhibit a continuous solder coating free from defects for a minimum of 95% of the critical area of any individual termination. Anomalies other than dewetting, nonwetting, and pin holes are not cause for rejection

6.5 TEST RESULTS

After testing all terminations showed a continuous solder coating free from defects for a minimum of 95% of the critical area.

Table 11 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
32-41	Solderability	MIL-DTL-9419G Method 4.7.19	PASS	Grayhill, Inc	2/06/2013

7.0 DIELECTRIC WITHSTAND TEST

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Dielectric Withstand Test	PS90- 90 series product specification	90HBW08PT, 90B08ST, 90B05ST, 90B10ST	90B08ST 1-30 90B05ST 1-30 90B10ST 1-20 90HBW08PT 1-98	Grayhill Inc.	12/05/2013 To 03/03/2014

7.1 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

7.2 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 (if specified) for the specified duration time between terminals.
3. Monitor faults indicator and record reading.

Table 12 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT - 63	Dielectric Withstand Tester	Hypot III	Associated Research, Inc.	12-2014

Table 13 – Test Conditions

Test Condition	Units	Parameters
Quantity	Assemblies	All
Voltage Level	VAC	500
Period of Application	Seconds	5
Maximum Leakage Current	µA	100
Points of Application		between adjacent closed contacts

Note: Only measurement between adjacent close contacts were measured due to contacts being sealed in closed position

7.1. TEST SETUP PHOTOS

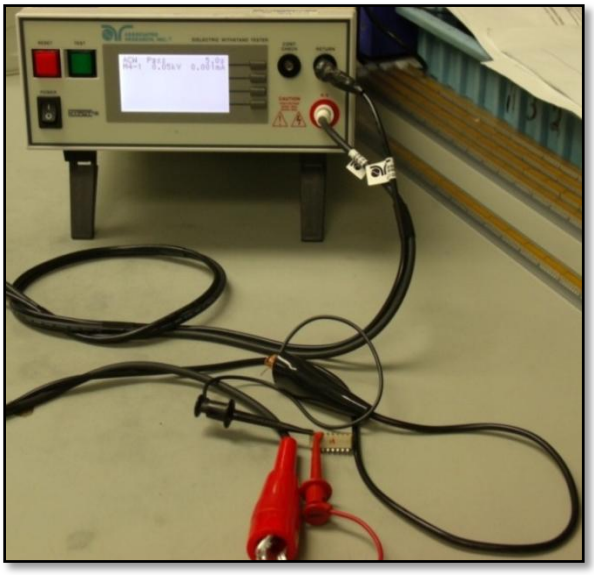


Figure 8 – Test setup

7.2. ACCEPTANCE CRITERIA

There shall be no arcing, flashover, breakdown of insulation, or damage, and the leakage current shall be no greater than 100 micro amperes.

7.3. TEST RESULTS

All DUT passed Dielectric Withstanding.

Table 14 – Test results

DUT	Part Number	Test	Specification	Pass	Test Location	Test Date
1-30	90B08ST	Dielectric Withstanding	MIL-STD-202, Method 301	PASS	Grayhill Inc.	12/03/13 To 02/24/2014
1-30	90B05ST	Dielectric Withstanding	MIL-STD-202, Method 301	PASS	Grayhill Inc.	12/03/13 To 02/24/2014
1-20	90B10ST	Dielectric Withstanding	MIL-STD-202, Method 301	PASS	Grayhill Inc.	12/03/13 To 02/24/2014
1-98	90HBW08PT	Dielectric Withstanding	MIL-STD-202, Method 301	PASS	Grayhill Inc.	12/03/13 To 02/24/2014

8.0 MECHANICAL LIFE TEST

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Mechanical Life Test	MIL-STD-83504/12	90B08ST 90B05ST 90B10ST	1-20 1-20 1-20	Grayhill Inc.	01/31/2014 To 02/07/2014

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. Perform initial Functional Test.
2. Visual Inspection of DUTs is to be performed before and after testing.
3. Mount DUT on test fixture.
4. Set Tester speed to achieve 10 cycles per minute for a total of 2000 cycles.
5. Perform dielectric and contact resistance testing.

Table 15 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-532	Accelerometer	M-350A04	PCB Piezotronics	04-2014
GT-141	Mechanical Shock Table	M-RAD 1616(100)PA-MP	MRAD	verified by controller's software & GT-534
GT-554	Power supply	GWinstek	GPS-3030DD	Verified with GT-13
GT-13	Multimeter	87III	Fluke	5-2014

Table 16 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	60
Test Voltage	Vdc	5
Test current	mA	10
Total Actuations	Actuations	2000
Actuator Speed	CPM	10
Temperature	°C	24.5
Relative Humidity	%	27.9

8.3. TEST SETUP PHOTOS

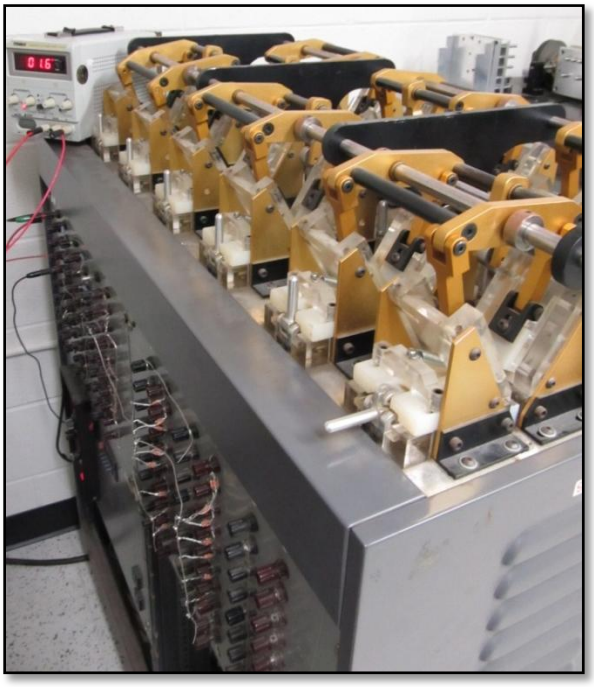


Figure 9 – Mechanical Life Test Setup

8.4. ACCEPTANCE CRITERIA

DUT should be electrically and mechanically operative with no evidence of broken, deformed, displaced, or loosened parts. The contact resistance shall not exceed 100 milliohms. The dielectric withstand voltage shall be no arcing, flashover, breakdown of insulation, or damage, and the leakage current shall be no greater than 100 microamps.

8.5. TEST RESULTS

After completing testing there was no sign of broken, deformed, displaced or loosened parts. The contact resistance did not exceed 100 milliohms and the leakage current was not greater than 100 micro amps.

Table 17 – Test Results

DUT	Part Number	Test	Specification	Pass	Test Date
1-20	90B08ST	Mechanical Life	MIL-STD-83504/12	**PASS**	01/31/2014
1-20	90B05ST	Mechanical Life	MIL-STD-83504/12	**PASS**	02/07/2014
1-20	90B10ST	Mechanical Life	MIL-STD-83504/12	**PASS**	02/07/2014

9.0 OPERATING FORCE

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Operating Force	PS90	90B08ST 90B05ST 90B10ST	1-20 1-20 1-20	Grayhill Inc.	02/27/2014

9.1. PURPOSE

To verify the value of force needed to actuate the DUT from open to close and close to open.

9.2. TEST SETUP DETAILS

1. Mount DUT onto test fixture
2. At approximately a 45° angle apply compressive force to switch to activate from open to close and close to open.
3. Record data

Table 18 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
LT-05	Dip switch holder	NA	Grayhill	N/A
PAL- 13	Digital Force Gauge	143986	IMADA	11-2014

Table 19 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	60
Points of measurements		close to open/ open to close
Temperature	°C	27.2
Min force	oz	1
Max. force	oz	32
Humidity	%RH	12.6

9.3. TEST SETUP PHOTOS

Figure 10 – Test **setup**

9.4. ACCEPTANCE CRITERIA

When switches are tested using a suitable means, the value of force to actuate the switch from open to close and close to open shall be 1 ounces minimum and 32 ounces maximum after mechanical life .

9.5. TEST RESULTS

All Switches actuation force did not exceed the maximum of 32 ounces.

Table 20 – Test Results

DUT	Part Number	Specification	Pass	Test Location	Test Date
1-20	90B08ST	PS90	PASS	Grayhill Inc.	02/27/2014
1-20	90B05ST	PS90	PASS	Grayhill Inc.	02/27/2014
1-20	90B10ST	PS90	PASS	Grayhill Inc.	02/27/2014

10.0 MOISTURE RESISTANCE

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Moisture Resistance	MIL-STD-202, METHOD 106G	90HBW08PT	68-87	Grayhill Inc.	02/19/2014 To 03/02/2014

10.1. PURPOSE

The moisture resistance test is performed for the purpose of evaluating, in an accelerated manner, the resistance of component parts and constituent materials to the deteriorative effects of the high-humidity and heat conditions typical of tropical environments. Most tropical degradation results directly or indirectly from absorption of moisture vapor and films by vulnerable insulating materials, and from surface wetting of metals and insulation. These phenomena produce many types of deterioration, including corrosion of metals, physical distortion and decomposition of organic materials, leaching out and spending of constituents of materials; and detrimental changes in electrical properties. This test has proven reliable for indicating those parts, which are unsuited for tropical field use.

10.2. TEST SETUP DETAILS

1. While running the test specimen should follow MIL-STD-202G and test condition table.
2. Visual inspection of the unit is to be performed before and after testing**.**
3. Mounting: Switches shall be mounted on a corrosion-resistant metal panel with the shaft in a horizontal position.
4. At the end of the drying period, dielectric-withstanding voltage shall again be measured as specified in 4.8.12, unless otherwise specified.
5. Examinations during final measurement and after test: Switches shall be examined for evidence of corrosion, breaking, cracking, or spalling.
6. Within 24 hours after the test, switches shall be examined for evidence of corrosion, breaking, cracking, spalling, or loosening of terminals.
7. Perform Insulation Resistance and Dielectric Withstanding Voltage after completion of test.

Table 21 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-1006	Temperature Chamber	SMS-8-3800	Thermotron	07-2014

Table 22 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	20
Duration	Hours	24
Cycles		11
Operational Mode		unpowered
Temperature	°C	26.6
Humidity	%RH	28.5

10.3. TEST SETUP PHOTOS

Figure 11 – Test setup

10.4. ACCEPTANCE CRITERIA

There shall be no evidence of corrosion and the insulation resistance shall be no less than 10 Megaohms. At the end of the drying period the insulation resistance shall no less than 5,000 megaohms

10.5. TEST RESULTS

After testing there was no signs of corrosion and the insulation resistance were greater than 10 Megaohms and after drying period IR was not less than 5000 Megaohm

Table 23 – Test Results

DUT	Specification	Pass	Test Location	Test Date
68-87	MIL-STD-202, METHOD 106G	PASS	Grayhill Inc.	02/19/2014 To 03/03/2014

11.0 RESISTANCE TO REFLOW SOLDER PROCESSING

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Resistance to Reflow Solder Processing	PS90—90 series product specification	90HBW08PT 90HBW10PT	11-31, 43-63,98-107 1-10	Grayhill Inc.	12/10/2013

11.1. PURPOSE

To determine whether wires and other components can withstand the effects of heat which they will be subjected during the soldering process, (solder iron, solder wave, solder reflow or solder dip).

11.2. TEST SETUP DETAILS

1. Visual inspection
2. DUT should be mounted on mounting board
3. Set oven to test setup profile shown in figure 12
4. Allow oven to stabilize to temperature profile
5. Place DUT onto conveyor belt
6. DUT should be visually examined after process
7. Take (20) twenty DUT and record CR
8. Take the other (20) DUT and take them for process seal testing
9. Allow DUT to soak in process seal for a minimum of 20 seconds.
10. Record data

Table 24 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
16-1749-62H	Solder Reflow Oven	Isotherm 500	Vitronics	08-2014

Table 25 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	40
Duration	Min	7
Solder Temperature	°C	270
Temperature	°C	23.7
Humidity	%RH	17.3

11.3. TEST SETUP PHOTOS

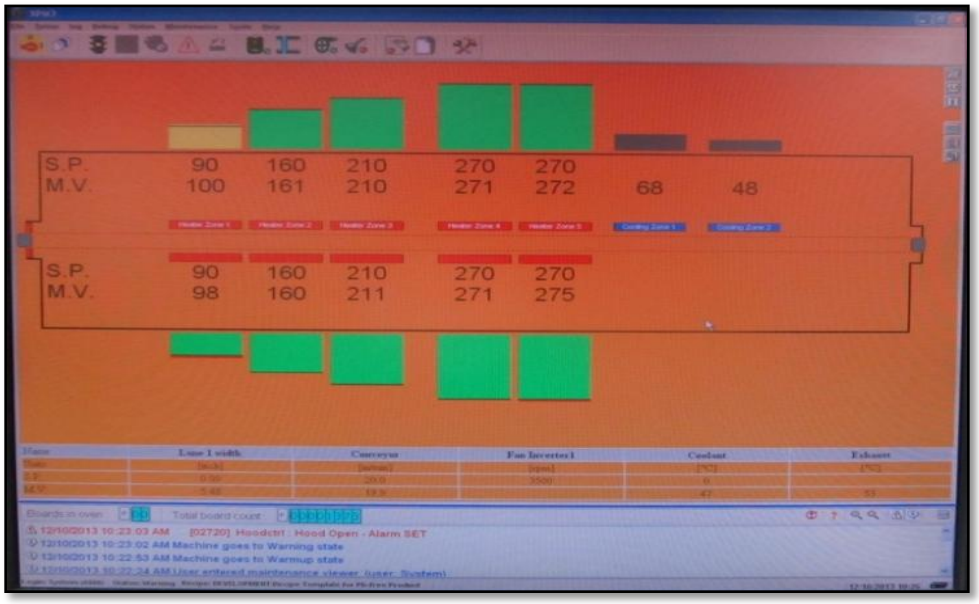


Figure 12 – Profile

11.4. ACCEPTANCE CRITERIA

There should be no evidence of physical or electrical damage. Contact Resistance shall not be more than 50% of initial. When tested for process there shall not be no continuous streams of large bubbles for more than 20 seconds.

11.5. TEST RESULTS

All DUT showed no evidence of physical or electrical damage, with the exception of DUT 26 & 27 which failed reflow testing due to lifting of seal on one end of switch after Reflow testing. A retest was done due to failures on an additional twenty (20) switches which all passed and showed no evidence of physical or electrical damage.

Table 26 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
11 - 63	Reflow Oven	PS90	**(2) failed**	Grayhill Inc.	12/10/2013
Retest	Reflow Oven	PS90	**PASS**	Grayhill Inc	03/11/2014

Note: DUT 26 & 27 had lifting of seals after oven reflow testing

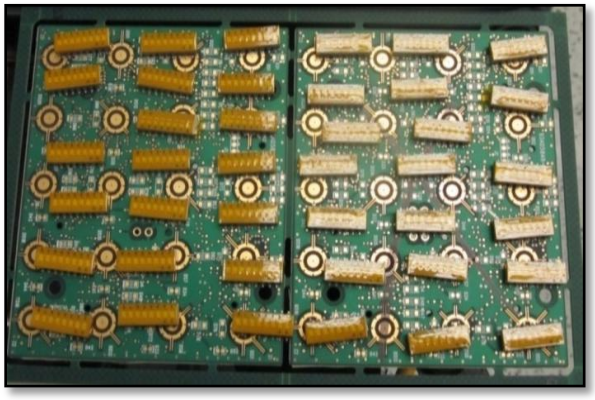


Figure 13 – Test results

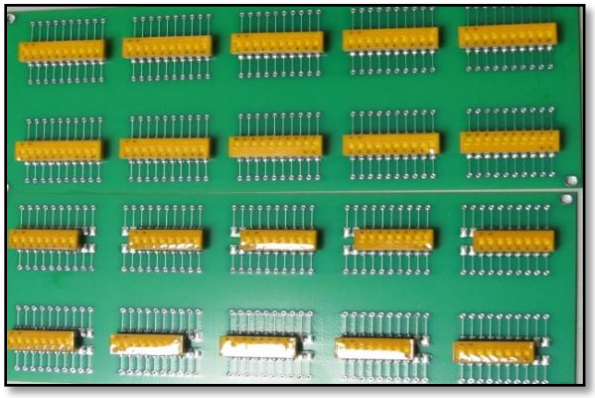


Figure 14 – Retest Results

12.0 PROCESS SEAL

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Process Seal	MIL-STD-202, Method 112	90HBW08PT 90B08ST	11-43 21-30	Grayhill Inc.	12/10/2013 To 01/13/2014

12.1. PURPOSE

The purpose of this test is to determine the effectiveness of the seal in a component part which has an internal cavity which is either evacuated or contains air or gas. A defeat in any portion of the surface area of a seal part can permit entrance of damaging containments which will reduce its effective life.

12.2. TEST SETUP DETAILS

1. Visual inspection
2. Mount DUT onto to fixture to hold them in fluid
3. Allow fluid to reach a temperature of 125 °C ± 5°C
4. Immerse DUT into fluid to a minimum depth of 2 inches below the surface
5. Observe the DUT against a dull non-reflective black background through a magnifier
6. Observe DUT from instant of immersion until 30 seconds after immersion
7. Leakers are identified by a stream of large bubbles or a single bubble
8. Record results

Table 27 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-	Heat fluid container	NA	Trio Tech International	N/A

Table 28 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	25
Duration	seconds	30
Temperature	°C	27.2
Humidity	%RH	12.6

12.3. TEST SETUP PHOTOS

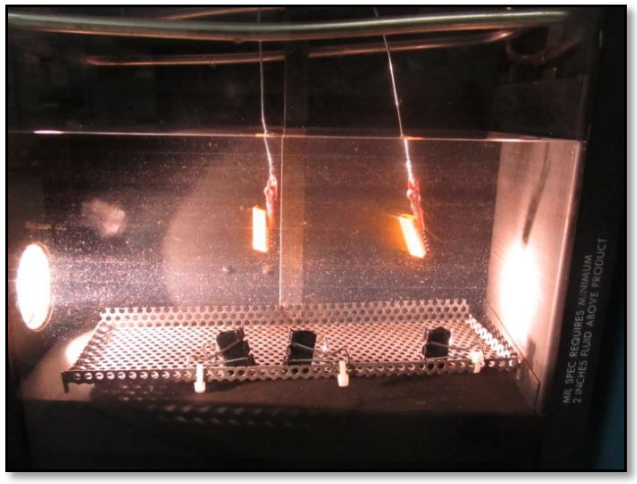


Figure 15 – Test setup

12.4. ACCEPTANCE CRITERIA

When DUT are tested as specified in MIL-STD-202, Method 112, there shall be no steady stream of large bubbles continuously coming from the switch.

12.5. TEST RESULTS

All DUT passed process seal testing acceptance criteria.

Table 29 – Test Results

DUT	Part Number	Specification	Pass	Test Location	Test Date
11-43	90HBW08PT	PS90 MIL-STD-202, Method112	**PASS**	Grayhill Inc.	12/10/2013
21-30	90B08ST	PS90 MIL-STD-202, Method112	**PASS**	Grayhill Inc.	01/13/2014

13.0 MECHANICAL SHOCK

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Mechanical Shock	MIL-STD-202, Method 202 MIL-STD-202, Method 313	90HBW08PT	88-97	Grayhill Inc.	02/25/2014

13.1. 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

13.2. 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. Monitor DUT outputs, using GT-68 chatter box.
6. Test product for specified shocks/axis.
7. Repeat until all DUT have completed their total shocks/unit.
8. Perform the Visual Examination and Functional Check after the test.

Table 30 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-532	Accelerometer	M-350A04	PCB Piezotronics	04-2014
GT-141	Mechanical Shock Table	M-RAD 1616(100)PA-MP	MRAD	Calibration at use (verified by controller's software & Accelerometer GT-534)
GT-68	Chatter box	NA	NA	6-2014

Table 31 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	10
Operational Mode		Unpowered
Pulse Type		Half Sine
Acceleration	G	1000
Pulse duration	msec.	0.5
Direction		3 Orthogonal Planes and Upside down

13.3. TEST SETUP PHOTOS

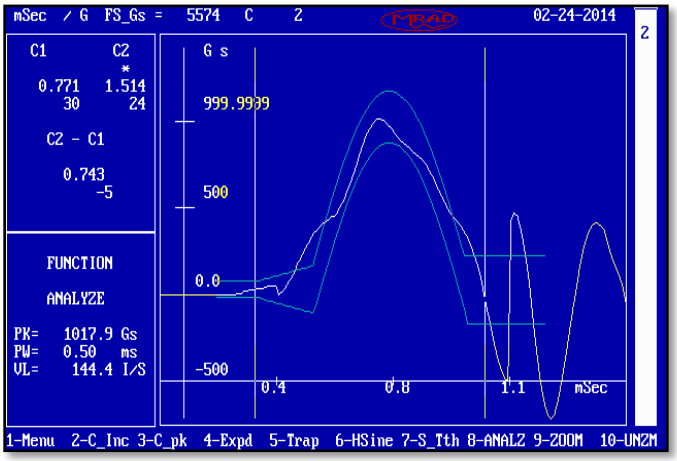


Figure 16 – Test Profile

Figure 17 – Test setup

13.4. ACCEPTANCE CRITERIA

When switches are tested as specified in MIL-STD-202, Method 213, with all contacts continuously monitored in accordance with method 310 of MIL-STd-202. There shall be no opening of closed contacts or closing of open contacts in excess of 10 microseconds. Contact resistance shall be 100 milliohms maximum after life testing.

13.5. TEST RESULTS

After Mechanical shock testing there were no openings of closed contacts or closed contacts in excess of 10 microseconds and contact resistance did not exceed 100 milliohms

Table 32 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
88-97	Mechanical Shock	MIL-STD-202, Method 213	**PASS**	Grayhill Inc.	02/24/2014

14.0 VIBRATION RESISTANCE

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Vibration Resistance	MIL-STD-202, Method 204 MIL-STD-202, Method 310	90HBW08PT	88-97	Grayhill Inc.	03/03/2014 To 03/06/2014

14.1. PURPOSE

The vibration test is performed for the purpose of determining the effect on component parts of vibration in the frequency ranges of 10 to 500 hertz (Hz), 10 to 2,000 Hz or 10 to 3,000 Hz, as may be encountered in aircraft, missiles, and tanks. The choice of test condition A, B, C, D, E, F, G, or H should be based on the frequency range and the vibration amplitude dictated by the applications of the component under consideration, and the state of the component part in relation to resistance-to-vibration damage.

14.2. TEST SETUP DETAILS

1. Visual Inspection of the DUT is to be performed before and after testing
2. Attach characterization sample(s) to the test fixture on the test table in specified orientation.
3. Characterize set-up conditions.
4. Attach DUT in specified orientation.
5. Attach connector(s) and tie down wire harness(es) at appropriate lengths, if required.
6. Power and monitor DUT output.
7. Apply vibration, temperature and voltage per specified levels and verify operation, if required.
8. Vibrate the DUT for specified duration.
9. Subject DUT to conditions in Test Checkpoint Table.
10. Repeat steps D thru I until all DUT have been tested for their total duration.
11. Perform the Visual Examination and Functional Check after the test.

Table 33 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-354	Shaker Amp	SA-30	Dynamic Solutions	Not Required
GT-353	Shaker Table	US-11000VH/17-50	Dynamic Solutions	Not Required

Table 34 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	10
Duration	Hours	4
Operational Mode		Unpowered
Applicable Axes	3	Longitudinal, Transverse, and Vertical
Acceleration Level(s)	G	15
Lower Limit Frequency	Hz	10
Upper Limit Frequency	Hz	2000
Mating Connector / Harness Attached	Y/N	Yes
Pass/Fail Criteria		See below

14.3. TEST SETUP PHOTOS

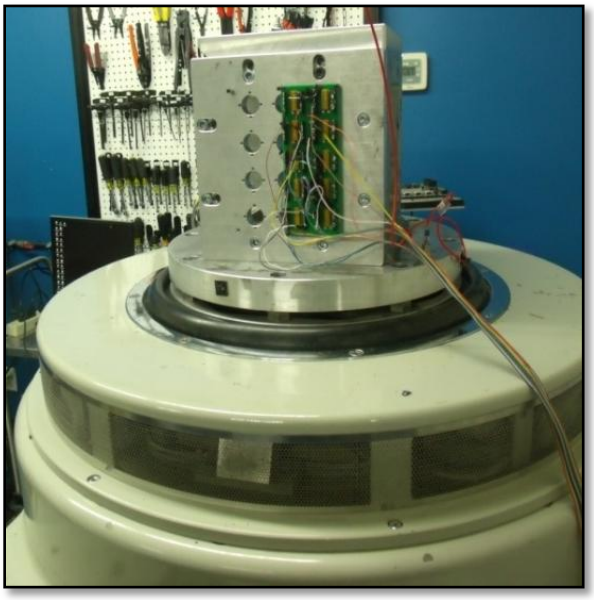


FIGURE 18 – TEST SETUP

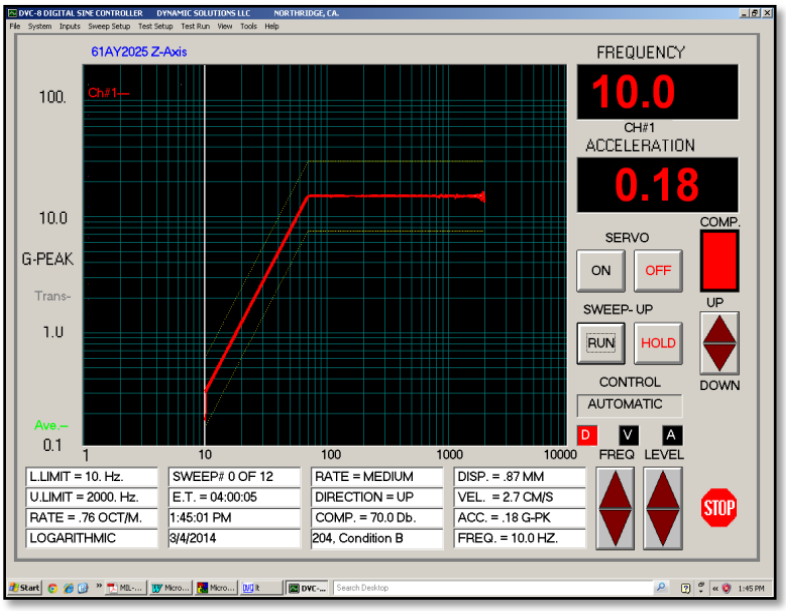


Figure 19 – Test profile

14.4. ACCEPTANCE CRITERIA

When switches are tested as specified in MIL-STD-202 Method 204, there should be no opening of closed contacts or closing of open contacts in excess of 10 microseconds and there shall be no evidence of broken, loose, deformed or displaced parts.

14.5. TEST RESULTS

After completing testing there weren't any closing of open contacts or opening of closed contacts and no evidence was found of broken, loose or displaced parts.

Table 35 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
88-97	Resistance to vibration	MIL-STD-202, Method 204B	PASS	Grayhill Inc.	03/03/2014 To 03/06/2014

15.0 TERMINAL STRENGTH

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Terminal Strength	MIL-STD-202G Method 211A	90B08ST	21-30	Grayhill Inc.	01/13/2014

15.1. PURPOSE

This test is performed to determine whether the design of the terminals and their method of attachment can withstand one or more of the applicable mechanical stresses to which they will be subjected during installation or disassembly in equipment. These stresses must be withstood by the component part without sustaining damage, which would affect either the utility of the terminals or the operation of the component part itself. The forces applied consist of direct axial, radial or tension pulls, twist, bending torsion, and the torque exerted by the application of nuts or screws on threaded terminals.

15.2. TEST SETUP DETAILS

1. After completing Process seal
2. Mount DUT in a metal plate using the specified maximum mounting torque.
3. Apply a tensile force (5Lbs) in the direction of the axis of the cable or terminal.
4. Perform visual check.
5. Repeat steps until all DUT are tested

Table 36 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-230	Push / Pull Tester	UTSM	Chatillon	NA
GT-132	Force Gauge	MG 500	MARK - 10	

Table 37 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	10
Operational Mode		unpowered
Temperature	°C	25.6
Humidity	%RH	19.5

15.3. TEST SETUP PHOTOS

Figure 20 – Test setup

15.4. ACCEPTANCE CRITERIA

There shall be no evidence of mechanical distortion, cracking of the switch body, breaking of the seal or changes in the electrical characteristics

15.5. TEST RESULTS

All DUT showed no sign of distortion, cracking of the switch body or breaking of the seal after 5lbs of tensile force was applied.

Table 38 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
21-30	Terminal Strength	MIL-STD-202G	**PASS**	Grayhill Inc.	01/13/2014

16.0 THERMAL AGING TEST

Test	Specification	DUT Part Number	DUT Serial Number	Test Location	Test Date
Thermal Aging	MIL-STD-202, METHOD 108A	90HBW08PT	1 — 10	Grayhill Inc.	12/2/2013 To 12/27/2013

16.1. PURPOSE

This is conducted for the purposes of determining the effects on electrical and mechanical characteristics of a part, resulting from exposure of the part to an elevated ambient temperature for a specified length of time, while the part is performing its operational function. Evidence of deterioration resulting from this test can at times be determined by visual examination; however, the effects may be more readily ascertained by measurements or test prior to, during, or after exposure.

16.2. TEST SETUP DETAILS

1. Visual examination of the DUT with special attention to stress areas such as corners of molded housing and document the results.
2. Take picture of the DUT.
3. Set Temperature Chamber as specified in the test conditions.
4. Maintain the test temperature for a period as specified in the test plan.
5. Adjust Temperature Chamber to maintain standard ambient, until the DUT has achieved temperature stabilization.
6. Conduct a complete visual examination of the DUT and document the results.
7. Compare these data with the initial visual examination.
8. Perform contact resistance after 500hrs and 100hrs.

Table 39 – Equipment List

Equipment ID	Equipment Type	Model Number	Manufacturer	Calibration Due Date
GT-92	Temperature chamber	752-02-10V	Tenny Environmental	07-2014

Table 40 – Test Conditions

Test Condition	Units	Parameters
Quantity	DUT	10
Duration	Hours	1000
Operational Mode		Unpowered
Test Temperature	°C	125
Temperature	°C	26.1
Humidity	%RH	17.4

16.3. TEST SETUP PHOTOS

Figure 21 – Test Setup

16.4. ACCEPTANCE CRITERIA

DUT should be electrically and mechanically operative and the contact resistance shall not change by more than 50% over the duration of the test.

16.5. TEST RESULTS

Contact Resistance did not change by more than 50% and all switches were electrically and mechanically operative.

Table 41 – Test Results

DUT	Test	Specification	Pass	Test Location	Test Date
1—10	Thermal Aging	MIL-STD-202, METHOD 108A	PASS	Grayhill Inc.	12/27/2013