



## Grayhill Inc. Quality Assurance Lab's On-Site Testing Capability & Equipment

Environmental Tests		
Test Name	Specification/Method	Description
<b>Salt Spray (corrosion)</b>	MIL-STD-202F/Method 101D IEC 68-2-11	Test specimens are subjected to a fine mist of salt solution for a specified period of time.
<b>Humidity (steady state)</b>	MIL-STD-202F/Method 103B IEC 68-2-3	The specimens are placed in a chamber and subjected to a high relative humidity and temperature for a specified period for time.
<b>Immersion</b>	MIL-STD-202F/Method 104A IEC 144	A liquid bath under ambient air pressure is used to determine the effectiveness of the seal component parts.
<b>Barometric Pressure (reduced)</b>	MIL-STD-202F/Method 105C IEC 68-2-13	Specimens are placed inside a chamber where all entrapped air is escaped according to specified test procedures.
<b>Moisture Resistance</b>	MIL-STD-202F/Method 106F IEC 68-2-38	In an accelerated manner, the resistance of component parts and constituent materials is evaluated after the deteriorative effects high humidity and heat conditions typical of tropical environments
<b>Thermal Shock</b>	MIL-STD-202F/Method 107G IEC 68-2-14	Specimens are subjected to cold temperature for a specified time then hot temperature for a specified time to complete 1 cycle. The number of cycles is specified.
<b>Flammability (external flame)</b>	MIL-STD-202F /Method 111A UL-94VO	A flame is applied to the specimen for a specified time. Upon removal of the flame, the time of burning of visible flame on the specimen is recorded.
<b>Seal</b>	MIL-STD-202F /Method 112E NEMA 4 NEMA 12 IEC 144 (IP Rating)	This test method determines the effectiveness in a liquid bath under low air pressure of the seal of a component part, which has an internal cavity, which is either evacuated or contains air or gas.



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<b>Physical Characteristic Tests</b>		
<b>Test Name</b>	<b>Specification/Method</b>	<b>Description</b>
<b>Vibration</b>	MIL-STD-202F/Method 204D IEC 68-2-6	Specimens are vibrated on 3 planes, (x,y,z), for a specified time per plane
<b>Mechanical Shock (specified pulse)</b>	MIL-STD-202F/Method 213B IEC 68-2-27	The suitability of parts and subassemblies of electronic components to shocks, typical of rough handling and transportation, is determined.
<b>Life (rotational)</b>	MIL-STD-202F/Method 206	The rotational life expectancy is verified by a specified number of cycles. A cycle consists of rotation of the shaft from one stop position to the other stop position and return to the original position
<b>Solderability</b>	MIL-STD-202F/Method 208H IEC 68-2-54	Flux is applied by a suitable method and allowed to drain. The specimens' terminals are dipped in molten solder for a specified time.
<b>Resistance To Soldering Heat</b>	MIL-STD-202F/Method 210E IEC 68-2-20	It is determined whether wire and other components can withstand the effects of heat they are subjected to during the soldering process.
<b>Terminal Strength</b>	MIL-STD-202F/Method 211A IEC 68-2-21	Terminals are tested by methods specified, pull test, terminal bend, lead bend test, twist test, and torque test. Test conditions to perform the terminal-strength test depend on the type of terminal to be used.
<b>Resistance to Solvents</b>	MIL-STD-202F/Method 215J	Specimens are immersed in solution for a specified period of time. Each specimen is brushed with normal hand pressure in a forward motion for ten strokes. After brushing, the above procedure is repeated two more times.



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<b>Electrical Characteristic Tests</b>		
<b>Test Name</b>	<b>Specification/Method</b>	<b>Description</b>
<b>Dielectric Withstanding Voltage</b>	MIL-STD-202F/Method 301 UL 508	Specimens are subjected to a test voltage of the magnitude and nature specified. Voltage shall be maintained for a specified time.
<b>Insulation Resistance</b>	MIL-STD-202F/Method 302	Insulation resistance is measured between mutually insulated points or between insulated points and ground.
<b>Contact Resistance</b>	MIL-STD-202F/Method 307	The resistance offered to a flow of current, during its passage between the electrical-contacting surfaces of the connecting components, is determined.
<b>Contact-Chatter Monitoring</b>	MIL-STD-202F/Method 310	Monitoring is conducted for detecting contact-chatter in electrical and electronic components having movable electrical contacts.
<b>Life (Low-Level Switching)</b>	MIL-STD-202F/Method 311	Each pair of contacts is operated for the number of cycles specified at the specified cycling rate with the required applied test load.
<b>EMC Testing</b>	Emissions: Mil-STD-461D EN 50081-2 CISPR11 Pre-Compliance & Conducted Emissions EN 55011	It is verified that the device's generated Electro-magnetic interference does not exceed a specified level over various frequency ranges
	Immunity: EN 50082-2 EN61000-4-4 Fast Transients EN 61000-4-8 Magnetic Field EN 61000-4-2 Electrostatic Discharge (ESD) ENV 50140 ENV 50204 ENV 50141 IEC-1000-4-3 IEC-1000-4-8 Radiated Magnetic Field	It is verified that the device is functional to a specified level of received Electro-magnetic interference

- Quality Assurance Laboratory has Reliability software including, Reliasoft's Alta (accelerated life testing) and Weibull++ (life data analysis).
- Quality Assurance Laboratory also has automated testing capabilities that include LabVIEW, Borland C, and Visual Basic programming software.



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On-Site Testing Equipment		
Test/Testing Device	Model Number/Controller	Manufacturer
<b>Salt Spray:</b> Salt spray chamber	17920A	Associated Environmental Systems
<b>Humidity</b> (steady state): Cyclic humidity chambers	T10RC, T20RC-4	Tenny Environmental
<b>Immersion:</b> Blue M water seal chamber	MW-1110A-1	Blue M Electric Company
<b>Barometric Pressure</b> (reduced): Altitude chamber	B4805	Merium Instrument Co.
<b>Moisture Resistance:</b> Cyclic humidity chambers	T10RC, T20RC-4	Tenny Environmental
<b>Thermal Shock:</b> Temperature cycling chambers	T20C-4, TS2-02-10V	Tenny Environmental
<b>Flammability</b> (external flame)	Flame Torch	Unknown
<b>Seal:</b> Blue M water seal chamber	C10E	Blue M Electric Company
<b>Vibration:</b> Vibration machine	B4805 Controller: DVC 4000	MB Electronics
<b>Mechanical shock:</b> half-sine, sawtooth	1616 (100) PA-MP	MRAD Corp
<b>Life</b> (rotational): 40 life cycling motors	RPM: 24 Voltage: 120 Vac Current: .4A Torque: 580 oz. in. Voltage: 120 Vac Current: .4A Torque: 580 oz. in.	Superior Electronics
<b>Life</b> (high-speed rotational): 10 life cycling motors	RPM: 5 at 5K, 5 at 10K Voltage: 120 Vac	Parker Hannifin Corp
<b>Solderability:</b> Molten solder pot		
<b>Resistance To Soldering Heat:</b> Molten solder pot		
<b>Terminal Strength:</b> Chatillon force gauge	Model Number: UTSM	John Chatillon & Sons
<b>Resistance To Solvents:</b> "A" - 1 part Isopropyl Alcohol, 3 parts Mineral Spirits "C" - Bioact, EC-7R Turpene "D" - 42 parts water, 1 part Butyl Cellosolve, 1 part Monoethanolamine		
<b>Dielectric Withstanding Voltage:</b> Dielectric Hy-Pot	5560DT, 5450DT	Associated Research Lab



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<b>On-Site Testing Equipment (continued)</b>		
<b>Test/Testing Device</b>	<b>Model Number/Controller</b>	<b>Manufacturer</b>
<b>Insulation Resistance:</b> Insulation tester	1865	Quad tech
<b>Contact Resistance:</b> 30 Vdc, 3A power supplies Hewlett Packard Multimeter (34401A)		
<b>Contact-Chatter Monitoring:</b> Contact-chatter box	DCM1012	Matrons
<b>Life</b> (Low-level switching): Pushbutton actuators Dip switch actuators		Dayton Electric Manufacturing Co.
<b>EMC Testing:</b> 3-meter full anechoic chamber	Fact-3	Lindgren RF Enclosures, Inc
<b>Electrostatic Discharge:</b> 25 Kv gun	Series 2000	KeyTek
<b>Fast Transient Burst:</b> 4 Kv	PEFT-Junior	Haefely