100 Cycle Thermal Stress Test

And

Underwater Thermal Cycle Water Exclusion Test

60 Watt Power Supplies

Test Dates: 01/23 – 02/14/2013

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Reference Documents			
Document	**Revision**	**Number**	**Date Issued**
Service Proposal	B	SV3621	12/21/2012

1. 100 Cycle Thermal Stress Test

- U.U.T.s (Units Under Test) placed in HALT Chamber on Racks
- Lower Set Point: -30°C
- Upper Set Point: +125°C
- Ramp rate: 6°C per minute going hot & 8°C per minute going cold
- Dwell Time at each extreme: 55 minutes
- Temp Shock cycle length – 156 minutes
- Total Cycles: 100
- Test Duration: 11 days
- U.U.T.s – Non-Operational (Not powered)
- Failure is defined as a visible crack in solder under 20X magnification

2. Test Equipment and Setup

2.1. Test Equipment

Equipment used to conduct Temperature Testing is detailed below. Any test equipment that requires periodic calibration was in current calibration at time of test. The calibration certifications are traceable to the National Institute of Standards and Technology.

2.2. Reliant Labs Calibration Records

Table 1: Reliant Labs Calibration Records – Lab 3

Description	Manufacturer	Model Number	Serial Number	Calibration Due
HALT Chamber	Chart Industries	TVC-9	TVC9-01-ON1	03/13/2013
Data Acquisition Unit	Agilent	34970A	MY44018XXX	06/20/2013
Thermocouples	Omega	TT-T-30-SLE ROHS	N/A	N/A

Figure 1

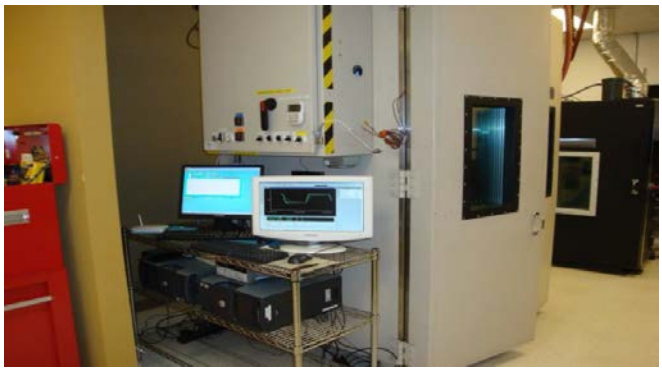

Figure 2

3. Underwater Thermal Cycle Water Exclusion Test

- U.U.T.s submerged under 75mm of water in bins
- Bins with power supplies placed in thermal cycle chamber
- Lower Set Point: -30°C
- Upper Set Point: +70°C
- Ramp rate: 0.83°C per minute going hot & cold (2 hour ramp time)
- Dwell Time at each extreme: 12 hours
- Temperature cycle length – 28 hour
- Total Cycles: 20
- Test Duration: 23.3 days
- U.U.T.s – powered – 120V AC input, 12V DC and 4.5 Amp load output
- Failure is defined as non operational and/or water seen inside when cut open

4. Test Equipment and Setup

4.1. Test Equipment

Any test equipment that requires periodic calibration was in current calibration at time of test. The calibration certifications are traceable to the National Institute of Standards and Technology.

4.2. Calibration Records

Table 2: Calibration Records

Description	Manufacturer	Model Number	Serial Number	Calibration Due
Thermal Cycle	Termatron Corp.	SM-16S Mini-Max	11618-S	01/10/14

Figure 3

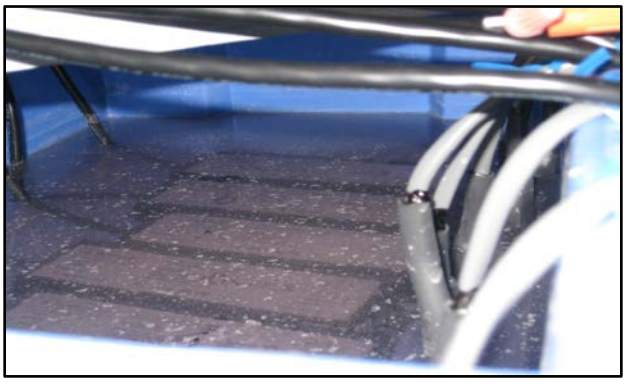

Figure 4

5. 100-Cycle Thermal Stress Test Results

The power supplies were exposed to 100 temperature cycles from -30°C to +125°C. The dwell time at each temperature extreme was 55 minutes and the thermal transition rate was set to 6°C per minute going hot & 8°C per minute going cold.

At 25, 50, and 75 cycles three samples of each model were removed from the chamber and were analyzed. Analysis consisted of powering each unit at high and low temperature with a full load, checking for proper operation. The units where then cut open, the potting compound removed from the bottom of the printed circuit board, and all solder joints where examined under a 20X microscope for cracks. One or more solder cracks resulted in a failure.

6. Underwater Thermal Cycle Water Exclusion Test Results

The power supplies were exposed to 20 temperature cycles from -30°C to +70°C while powered, fully loaded and submerged in tubs of water. The dwell time at each temperature extreme was 12 hours and the thermal transition time was 2 hours from hot to cold. After 20 cycles the samples were removed from the chamber and analyzed. If power supplies failed electrically during the test, they were recorded as failed. All power supplies where cut open and inspected for water ingress. Water seen inside the power supply was recorded as a failure.

Table 3: Test Results

Manufacturer	Underwater Thermal Cycle	Thermal Shock 25 Cycles	Thermal Shock 50 Cycles	Thermal Shock 75 Cycles	Thermal Shock 100 Cycles	Total Thermal Shock
SloanLED 701507-MODW Rev H	**100% pass**	**100% pass**	**100% pass**	**100% pass**	**90% pass**	**95% pass**
SloanLED 701507-MODW Rev F	**100% pass**	**100% pass**	**100% pass**	**100% pass**	**70% pass**	**84% pass**
Competitor "A"	0% pass	33% pass	67% pass	67% pass	60% pass	57% pass
Competitor "B"	100% pass	0% pass	0% pass	0% pass	0% pass	0% pass
Competitor "C"	80% pass	0% pass	0% pass	0% pass	0% pass	0% pass

Summary:

Qualification tests support high reliability performance for solder quality, solder joint strength and water ingress protection. The 701507-MODW power supply is a robust design able to withstand the harsh environments of its stated operational temperature range and weather exposure.