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Test Plan
 for
Searchlight
(S50)

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Optispike S50 Test Instruction

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1 SCOPE

This document contains the test procedures that will be performed on the S50 to verify that the component parts of the system, as well as the assembled system configuration, meet the performance and system characteristic requirements of the S50 specification.

2 APPLICABLE DOCUMENTS

The following specifications and standards form a part of the Product Specification for the S50 to the extent specified herein and are only to serve as a guide for the test plan.

STANDARDS	
MIL-STD-810G	Environmental Test Methods and Engineering Guidelines
ANSI/PLATO FL 1-2016	Flashlight Basic Performance Standard
NEMA IP67	National Electronics Manufacturer' s Association (NEMA) Commercial standard

3 SAFETY/RESPONSIBILITY

Product Assurance Quality Engineers or Environmental Lab personnel will utilize the procedures to demonstrate and document, and to ensure continued compliance of the S50 to the specification requirements. Use extreme caution when operating the S50.

4 ENVIRONMENTAL TEST PROCEDURES

The following tests contain the procedures used to validate the S50 meets the Performance Specification requirements. The test procedures of this document are used to verify that the S50 system meets the environmental requirements and continues to meet the environmental requirements and conformance throughout the production phase of the product.

4.1 Low Temperature

Operating Temperature Requirement: The S50 shall not be damaged when operated over a temperature range of -20 °C to +50 °C, and at temperatures reached when the sight is under solar load conditions as identified below when tested in accordance with MIL-STD-810G, Methods 501.5 and 502.5.

Storage Temperature Requirement: The S50 shall not be damaged or suffer degradation of performance after being stored in temperatures from -30 °C to +70 °C, when tested in accordance with MIL-STD-810G, Methods 501.5 and 502.5.

Test Method: MIL-STD-810G Method 502.5 Procedures I and II

Unique to this Method: Generally apply the low temperature test early in the test sequence. In order to disclose synergetic effects, low temperature testing should follow dynamic tests, such as vibration and shock.

Test Equipment:

- a. Chamber
- b. On-board computerized control system that provides Insight with an efficient means of programming, monitoring, and controlling the Temperature Chamber with the on-board circular graphic plotter providing real-time written documentation of the test.
- c. K6 battery bank

Procedure:

1. Verify the operation of S50 for all power levels prior to conducting the Low Temperature test. Record results on the test data record.
2. S50s to be tested will be examined externally for evidence of discolorations, imperfections, or other preconditions, which could be later mistaken for damage from Low Temperature testing. Record results on the test data record.
3. Enter the serial numbers of the S50s under test, and place them in the chamber. Program in the Low Temperature test sequence. Ramp temperature no faster than 3 °C per minute.
4. Begin the Low Temperature test sequence. Using the computer controller, test the S50s to the following sequence:

- a. Lower the internal chamber temperature to -30 °C.
 - b. Maintain the internal chamber at -30 °C (± 2 °C) for three hours before proceeding. Increase the chamber temperature to -20 °C (± 2 °C) and maintain the temperature for one hour before continuing.
 - c. Raise the chamber temperature to ambient conditions.
 - d. Open the chamber door and verify S50s. Record results on the test data record.
5. Verify the operation of the S50 and inspect for damage. Record results on the test data record.
 6. Perform Group A tests.

Test Data: Test data will consist of log sheets showing the chamber temperature and the operational status of the S50s, test start date, serial numbers, and the Low Temperature test data record. Failure at pre-test, Low Temperature, or post tests constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 1, LOW TEMPERATURE

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail				
		SN:	SN:	SN:	SN:	SN:
Pre-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
Pre-test Check	No Damage	P/F	P/F	P/F	P/F	P/F
Low temperature Operation	Function	P/F	P/F	P/F	P/F	P/F
After-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
After-test Check	No Damage	P/F	P/F	P/F	P/F	P/F

Remark:

4.2 High Temperature

Operating Temperature Requirement: The S50 shall not be damaged when operated over a temperature range of -20 °C to +50 °C, and at temperatures reached when the sight is under solar load conditions as identified below when tested in accordance with MIL-STD-810G, Methods 501.5 and 502.5.

Storage Temperature Requirement: The S50 shall not be damaged or suffer degradation of performance after being stored in temperatures from -30 °C to +70 °C, when tested in accordance with MIL-STD-810G, Methods 501.5 and 502.5.

Test Method: MIL-STD-810G Method 502.5 Procedures I and II

Unique to this Method: Generally apply the low temperature test early in the test sequence. In order to disclose synergetic effects, low temperature testing should follow dynamic tests, such as vibration and shock.

Test Equipment:

- a. Chamber
- b. On-board computerized control system that provides Insight with an efficient means of programming, monitoring, and controlling the Temperature Chamber with the on-board circular graphic plotter providing real-time written documentation of the test.
- c. K6 battery bank

Procedure:

1. Verify the operation for all power levels prior to conducting the High Temperature test. Record results on the test data record.
2. The systems to be tested will be examined externally for evidence of discolorations, imperfections, or other preconditions, which could be later mistaken for damage from High Temperature testing. Record results on the test data record.
3. Enter the serial numbers of the S50s under test, and place them in the chamber. Program in the Low Temperature test sequence. Ramp temperature no faster than 3 °C per minute.
4. Begin the Low Temperature test sequence. Using the computer controller, test the S50s to the following sequence:

- a) Lower the internal chamber temperature to 70 °C.
 - b) Maintain the internal chamber at 70 °C (± 2 °C) for three hours before proceeding. Increase the chamber temperature to 50 °C (± 2 °C) and maintain the temperature for one hour before continuing.
 - c) Open the chamber door and connect the K6 battery bank with the S50s and verify operation. Record results on the test data record.
 - d) Raise the chamber temperature to ambient conditions.
 - e) Open the chamber door and verify the S50s operate. Record results on test data record.
5. Verify the operation of the S50 and inspect for damage. Record results on the test data record.
 6. Perform Group A tests.

Test Data: Test data will consist of log sheets showing the chamber temperature and the operational status of the S50s, test start date, serial numbers, and the High Temperature test data record. Failure at pre-test, High Temperature, or post tests constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 2, HIGH TEMPERATURE

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail				
		SN:	SN:	SN:	SN:	SN:
Pre-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
Pre-test Check	No Damage	P/F	P/F	P/F	P/F	P/F
High temperature Operation	Function	P/F	P/F	P/F	P/F	P/F
After-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
After-test Check	No Damage	P/F	P/F	P/F	P/F	P/F

Remark:

4.3 Immersion (Non-Operational)

Requirement (Non-operational): The S50 shall not be damaged after being immersed to a depth of 1 meters for a minimum of 30 minutes when tested to Method 512.5, Procedure I of MIL-STD-810G.

Unique to this Method: Generally apply the immersion test prior to most other climatic tests. To maximize the likelihood of disclosing sequential problems, consider the immersion test both before and after structural tests such as shock and vibration.

Test Equipment:

- a. Pressurized immersion tank with regulated air supply and gauge capable of registering pressures to at least 3 psig. (pounds per square inch, gauge) , 1Psi = 0.00689Mpa , 1Mpa = 145Psi)
- b. Temperature Chamber. Thermotron Model F-12-CHV-5-5-CO2 or other chamber capable of warming to 50°C (±2°C).
- c. K6B battery bank

Procedure:

1. Verify the operation of all power levels prior to conducting the Immersion test. Record results on the test data record.
2. The systems to be tested will be examined externally for evidence of discolorations, imperfections, or other preconditions, which could be later mistaken for damage from immersion testing. Record results on the test data record.
3. Fill the immersion tank with distilled water to a height sufficient to cover the system under test. Stabilize the water at +23°C (±5°C).
4. Warm the system to +50°C (±2°C) for one hour.
5. Verify that the connecting compartment is securely tightened.
6. As quickly as possible while the system is still at +50°C (±2°C), immerse the system in the tank and seal the tank. Pressurize to a level of 1.4 psig, corresponding to 1 meters depth. Maintain this pressure for a minimum period of 30 minutes.
7. De-pressurize the tank, remove the systems from the immersion tank and dry the external surfaces.

8. Examine the system with special attention to the lens area for signs of water leakage. Inspect the connecting compartment for leakage. Record the results on the test data record.
9. Verify system operation and record results on the test data record.
10. Perform the Group A tests.

Test Data: Test data will consist of start date, serial numbers, and the Immersion test data record. Failure to meet the Immersion requirement constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 3, IMMERSION

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail				
		SN:	SN:	SN:	SN:	SN:
Pre-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
Pre-test Check	No Damage	P/F	P/F	P/F	P/F	P/F
After-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
After-test Check	No Damage	P/F	P/F	P/F	P/F	P/F

Remark:

4.4 RANGE:

Requirement: In a dark environment where the ambient conditions are determined to be less than 0.5 lux in the entire test area, the S50 center has a illumination data $2500 \pm 10\%$ Lx at 50 meters away from the system.

Test Method: ANSI/PLATO FL1 peak beam intensity (may be divided among up to five samples of the same test item in any combination).

Unique to this Method: Generally, schedule peak beam intensity early in the test sequence, but after any vibration and thermal tests.

Test Equipment:

- a. Luxmeter, multimeter, range finder

Procedure:

1. Confirm the test point where is 50 meters away from the S50 by range finder then prepare the record table;
2. Fix the S50 in the test table.
3. Turn on the switch and adjust the facula to the most focused state
4. Record the data from the luxmeter.
5. Perform the Group A tests.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 4, RANGE

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail				
		SN:	SN:	SN:	SN:	SN:
Lux at 50 meters	100% power					
Range	100% power					
After-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
After-test Check	No Damage	P/F	P/F	P/F	P/F	P/F

Remark:

4.5 Packaging drop

Requirement: (Unpackaged) The S50 with the package shall be fully operational after being subjected to six drops from 76 cm on each face of the assembly onto 20 mm plywood backed by concrete when tested to Method 516.6, Procedure IV of MIL-STD-810G.

Test Method: MIL-STD-810G Method 516.6, Procedure II, 6-drop requirement (may be divided among up to two samples of the same test item in any combination).

Unique to this Method: Generally, schedule shock tests early in the test sequence, but after any vibration and thermal tests.

Test Equipment:

- a. Packaging drop equipment

Procedure:

1. Verify the operation for all power levels prior to conducting the Transit Drop test.
2. The system to be tested will be examined externally for evidence of damage, imperfections, or other preconditions, which could be later mistaken for effects of Transit Drop damage.
3. Hold the package of S50 with each face to the floor and 76 cm meter above it, and release. Toppling of the item following impact will occur in the field and, therefore, toppling of the test item following its initial impact should not be restrained as long as the test item does not leave the required drop surface. Inspect the S50 after each test and record results on the test data record. Periodically power up the S50 to verify functionality .

NOTE: Minor damage to the S50 body does not constitute failure of this test so long as the system passes the operational test. Drop the S50s in any order.

- Front 1 Drops = Sample 1, 2
- Back 1Drops = Sample 1, 2

- Top 1 Drops = Sample 1, 2
- Bottom 1 Drops = Sample 1, 2
- Left Side 1 Drops = Sample 1, 2
- Right Side 1 Drops = Sample 1, 2

4. Verify post test operation.
5. Inspect for damage and record results on the test data record.
6. Perform Group A tests.

Test Data: Test data will consist of test date, serial numbers, the Transit Drop test data record, and a log sheet detailing the test, damage, etc. Failure at the Transit Drop test or post tests constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 5, PACKING DROP

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail (P/F)				
		SN:	SN:	SN:	SN:	SN:
Pre-test operation	Operation	P/F	P/F			
Pre-test check	No-damage	P/F	P/F			
Front	1 drop	Pass / Fail	Pass / Fail			
Back	1 drop	Pass / Fail	Pass / Fail			
Top	1 drop	Pass / Fail	Pass / Fail			
Bottom	1 drop	Pass / Fail	Pass / Fail			
Left side	1 drop	Pass / Fail	Pass / Fail			
Right side	1 drop	Pass / Fail	Pass / Fail			
After-test operation	Operation	P/F	P/F	P/F	P/F	P/F
After-test check	No-damage	P/F	P/F	P/F	P/F	P/F

Remark:

4.6 Salt Fog

Requirement: The S50 shall not be damaged when exposed to salt fog in accordance with MIL-STD-810G, Method 509.5.

Test Equipment:

- a. Salt Fog chamber

Procedure:

1. Verify the operation for all power levels prior to conducting the Salt Fog test. Record results on the test data record.
2. The system to be tested will be examined externally for evidence of damage, imperfections, or other preconditions, which could be later mistaken for effects of Salt Fog damage.
3. The systems will be tested to 48 hours of salt fog exposure then 48 hours of dry time.
4. To aid in corrosion inspection, use a gentle wash in warm running water at ambient conditions. Inspect the S50s for physical damage other than cosmetic. Record results on the test data record.
5. Verify the Post Test operation of the S50.
6. Perform the Group A tests.

Test Data: Test data will consist of log sheets showing the chamber temperature, Salt concentration, test start date, serial numbers, inspection report, and the Salt Fog test data record. Failure at pre-test or post tests constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 6, SALT FOG

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail				
		SN:	SN:	SN:	SN:	SN:
Pre-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
Pre-test Check	No Damage	P/F	P/F	P/F	P/F	P/F
After-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
After-test Check	No Damage	P/F	P/F	P/F	P/F	P/F

Remark:

4.7 Vibration

Requirement: In the environment of room temperature 25°C and humidity at 60%, The samples were fixed on the shaking table according to three axes respectively. The vibration frequency was 10-55 Hz and the amplitude was 1 mm. After 60 minutes of vibration, the samples should work normally

Test method : MIL-STD-810G Method 514.6 Figure 514.6C-2 – Category 4 – Composite two-wheeled trailer vibration exposure

Unique to this Method:

Simulate the actual use of the equipment on the vehicle

Test equipment:

Vibration equipment

Procedure:

1. Fix the product on the shaking table
2. Set up monitoring points, head and tail on the product
3. Input the vibration parameters and start the XYZ vibration in three directions in turn.
4. Measure whether the vibration parameters of the product reach the specified value before the end of each direction test.
5. Record data in turn
6. After each direction test, check whether each lighting mode of the lamp is working properly, and check whether the structural part of the lamp is damaged or broken.
7. Stops caused by any exceptions in the process should be documented in detail in the test report. Non-product problems
8. Detection and recording results

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 7, Vibration

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail				
		SN:	SN:	SN:	SN:	SN:
Pre-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
Pre-test Check	No Damage	P/F	P/F	P/F	P/F	P/F
After-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
After-test Check	No Damage	P/F	P/F	P/F	P/F	P/F

Remarks:

4.8 Weight

Requirement: The S50 shall have a maximum weight of 3500 g with handle and K6 battery bank

Test Equipment:

- a. Digital scale

Procedure:

1. Set the scale to display weight in grams. Zero the scale.
2. Place the system on the scale. Record the total weight on the test data record.

Test Data: Test data will consist of the Weight test data record. Failure to meet the specification requirements above constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 8, Weight

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Data				
	SN:	SN:	SN:	SN:	SN:
Weight:					

Remark:

4.9 Dimension

Requirement: The S50 shall have a length, bezel diameter, and housing diameter for the following configurations"

Length	267 mm (± 1 mm)
Bezel diameter	106 mm(± 1 mm)

Test Equipment:

- a. Vernier

Procedure:

1. Set the Vernier to display size in mm. Zero the Vernier.
2. Measure the length, width, and height of the system. Record the results on the test data record.

Test Data: Test data will consist of the Size test data record. Failure to meet the specification requirements above constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 9, Dimension

Date: _____

Test Performed By: _____

Test Verified By: _____

Serial Number	Data (mm)		Pass/Fall
	Length	Bezel diameter	P/F
			P/F
			P/F
			P/F
			P/F
			P/F

Remark:

4.10 Dust test

Requirement: There is no dust getting into the S50 after tested

Unique to this Method: Generally apply the dust test prior to most other climatic tests. To maximize the likelihood of disclosing sequential problems, consider the immersion test both before and after structural tests such as shock and vibration.

Test Equipment:

- a. Dust test equipment
- b. K6B battery bank

Procedure:

1. Put the sample into a dust box that can control the pressure after inspection
2. Check whether the pressure equipment is in normal working condition
3. Close the dust box, and increase the dust air pressure pump to 20mbar within one hour (after 40-60 times of gradual pressurization)
4. Turn off the dust pump after 8 hours
5. Unpack and take out the sample, check whether there is dust in the sample and whether it can work normally.
6. Check and record test results of samples

Test Data: Test data will consist of start date, serial numbers, and the dust test data record. Failure to meet the dust requirement constitutes failure of this test.

S50 ENVIRONMENTAL TEST DATA RECORD

TEST 10,Dust test

Date: _____

Test Performed By: _____

Test Verified By: _____

Parameter	Specification	Pass/Fail				
		SN:	SN:	SN:	SN:	SN:
Pre-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
Pre-test Check	No Damage	P/F	P/F	P/F	P/F	P/F
After-test Operation	Operational	P/F	P/F	P/F	P/F	P/F
After-test Check	No Damage	P/F	P/F	P/F	P/F	P/F

Remark: