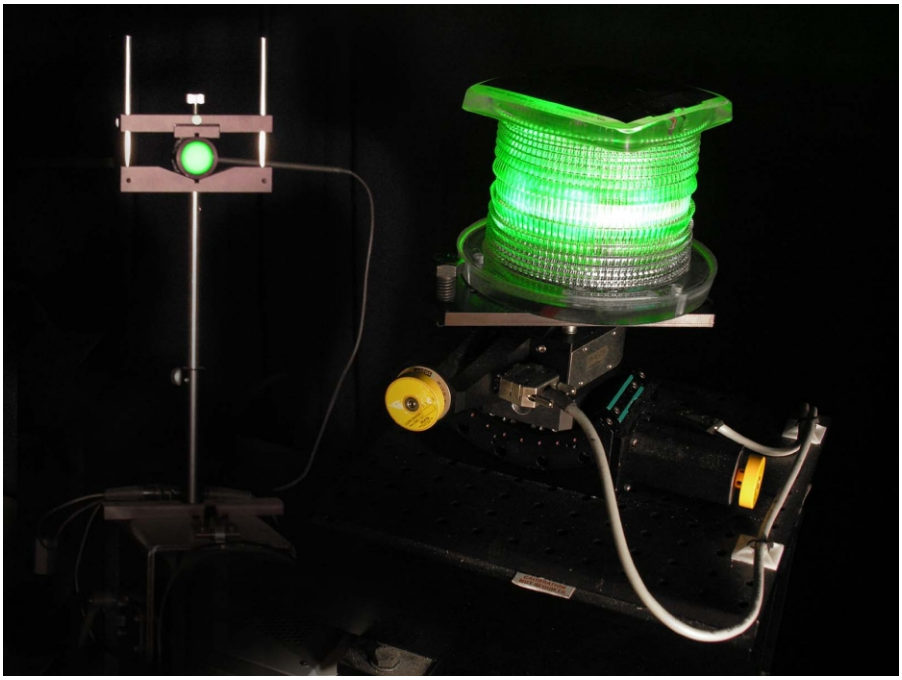
Carmanah®

Carmanah's Optical Testing Practices



Model M601 lantern installed in Carmanah's industry-standard optical test facility.

Carmanah Technologies employs state-of-the-art in-house testing equipment and established testing procedures to ensure that its products meeting or exceed the published optical specifications for each class of marine aid-to-navigation. In addition, Carmanah Technologies Corp. is proud to be an ISO 9001:2000 registered company.

Testing Equipment
Carmanah's photometric test equipment is based on the use of a UDT S-370 optometer and a UDT 268P silicone detector incorporating a cosine corrected diffuser and a photopic (human eye response) filter. The detector/optometer pair is calibrated as a unit at the factory to measure in lux, (lux times the square of the distance to the sensor = candela) and the calibration is NIST traceable.

Our Goniometer incorporates a Micos PRS-110 360 degree continuous rotation stage mounted on top of a Micos WT-90 goniometric stage. The rotation stage incorporates 12,500 steps/degree or better that 0.3 arc seconds resolution. The WT-90 is capable of +/- 45 degrees from level and incorporates 50,000 steps/degree or better that 0.08 arc seconds resolution. The Goniometer stages are controlled via a National Instruments 7344, 4 axis stepper controller.

The photometric and goniometric systems are controlled via custom software written by Carmanah Technologies. The software was created using the National Instruments "Labview" TM, G programming language.

Measurements are made by placing the detector in a fixed location in the far field and rotating the lantern with respect to the detector. Alignment between the detector and the goniometric stages are maintained and confirmed before each use with laser levels and custom alignment tools. All lights are tested at full power, 100% duty cycle and are allowed to thermally stabilize for a minimum of 2 minutes prior to beginning measurements. This data is then arithmetically scaled via Schmidt-Clausen etc. (as below) to determine the effective intensity for the particular flash code of interest. This method ensures that Carmanah does not over report the intensity as effectively the LEDs are operating in their least efficient region as the harder you drive an LED the less efficient it becomes in terms of lumens/watt.

The test lab, where the measurements are made, has been designed to virtually eliminate any possibility of stray light (direct or indirect) from contaminating the measurement.

Carmanah follows the IALA document AISM E-122 with respect to the rated and effective intensities of the lights. i.e. rated is the value met or exceeded by 90% of the measurements. Focal plane is with respect to the base of the lantern and all measurements are carried out in the far field as defined by AISM E-122. The Schmidt-Clausen method is used to determine the effective intensity of flashing lights, and incorporates the Talbot Plateau Law to account for the fast flicker fusion frequency of human eye response. Allard's Law is used to determine the effective range in NM.

Carmanah's In-Process Testing Inspections
Carmanah's manufacturing practices for all lanterns include the following in-process inspections:

- 100% functional testing on every printed circuit board prior to assembly.
- Operational checks on each unit, including LEDs and batteries prior to final assembly.
- A final functional and programming check before the unit is packaged for shipment.
- Carmanah's optical test laboratory tests and monitors a minimum of 5% of our daily production to ensure that our manufacturing processes remain in control with respect to specified lantern performance.