

THERMAL  
ELECTRICAL  
MECHANICAL  
PHOTOMETRIC  
OPTICAL

CREE SERVICES  
**TEMPO TESTING  
AND EVALUATION**

September 9, 2013

Title:

**Spot B**

Prepared for:

**Differential Energy Global LTD**

Prepared by:

**Cree Durham Technology Center**

Ticket Number:

**14110-G**

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NVLAP lab code 500070-0

The Cree Durham Technology Center (NVLAP lab code 500070-0) has been accredited by NVLAP to satisfy the requirements of ISO/IEC 17025:2005, IES LM-79-08.

**This report was generated for:**

Differential Energy Global LTD  
1540 Leader International Drive  
Port Orchard, Washington  
USA

**This report was generated by:**

The Cree Durham Technology Center  
4600 Silicon Dr  
Durham, NC 27703

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## Incoming Inspection

All samples are subjected to a visual, physical inspection to ensure that the product was not damaged during shipping.

One sample was received, which is shown in Figure 1. The optics on the sample was secured with tape to hold the optic in place as shown in Figure 2. The unit was powered up and appeared to be operating normally.

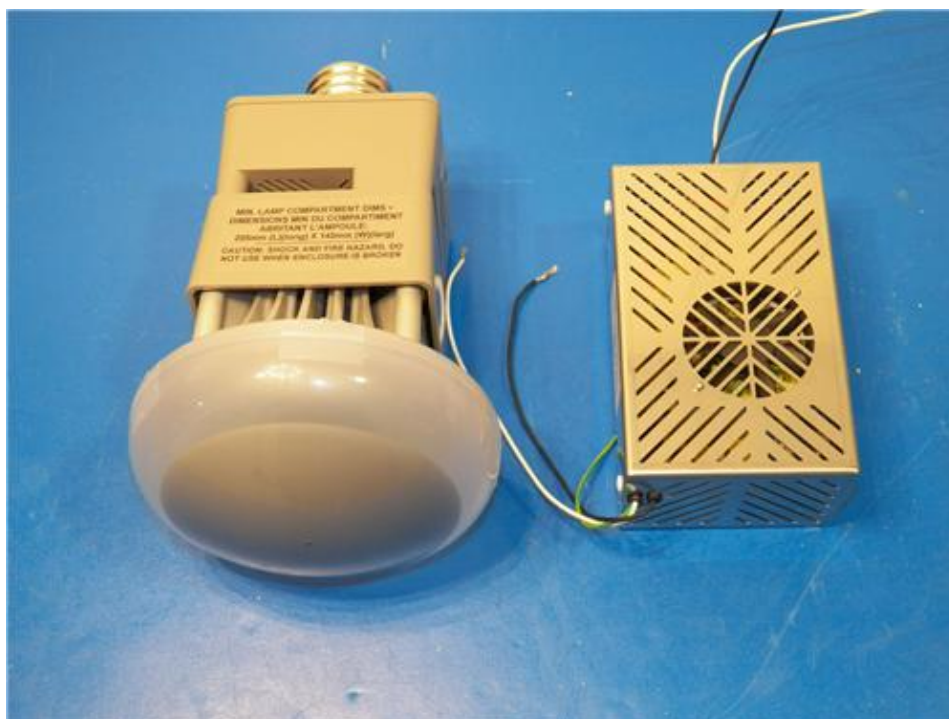


Figure 1: As-Received Picture #1



Figure 2: As-Received Picture #2

## Photometric Testing

Luminaire evaluation on a goniophotometer system was performed at Cree's photometric testing lab in Durham, NC on a type C goniophotometer. This goniophotometer is a UL/Lighting Sciences Inc. model 6440T utilizing, an Inphora photocell (model PDET 11), an AC power supply (or DC supply when applicable) and a power meter. A Gooch & Housego spectroradiometer (model 770VIS/NIR) also allows for spectral irradiance data to be measured.

The illuminance calibration on the type C goniophotometer is performed utilizing 3 STD-EHD Lamps with a 500 Watt rating. The initial values for illuminance are measured with a Spectroradiometer, STS Certificate of Calibration #2082. The lamp serial numbers are: 12C066, 12C067 and 12C068. The lamps that are utilized at Cree were generated on 11, February 2013.

To calibrate color on the Type C goniophotometer, a single STD-EHD 120V spectral irradiance calibration lamp with a 500 Watt rating is used. The lamp (Serial Number: 13C072) is positioned with the serial number facing away from the spectroradiometer just like the intensity standards. This lamp must operate base down and at the specified amperes noted on STS Certificate of Calibration #2084. Figure 3 is a photograph of a fixture under test on this type C Goniophotometer.

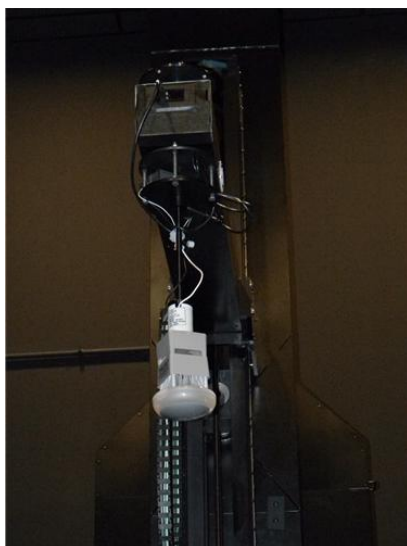


Figure 3: Sample Mounted on Type C Goniophotometer

Tests	Date	Ambient Temp. (°C)	Input Voltage (Volts AC)	Frequency (Hz)
Luminous Intensity	06-Sep-2013	25	120	60

Table 1: Photometric Test Conditions

## Data Summary

Luminaire Type: HI-BAY  
Model Number: DEG-325400 - 20-LED HI-BAY  
LEDs: 20 XM-L  
Stabilization Time: 30 minutes

Characteristics	Result
CIE Class	Semi-Direct
Cutoff Class	Noncutoff
Luminaire Lumens	5472.6
Input Wattage	139.3
Luminaire Efficacy Rating	39
Max. Candela	898.3
Max. Candela Angle	0H 55V

*Table 2: Data Summary*

## IES File Header

IESNA:LM-63-2002  
[TEST]14110-G  
[TESTLAB]Cree Inc. - Durham Technology Center  
[ISSUE DATE] 9/ 8/2013  
[MANUFACTURER]Differential Energy Global LTD  
[LUMEN CATEGORY]HI-BAY DEG-325400  
[LUMINAIRE] High bay with aluminum finned heat sink and diffused optic  
[LAMP]20 Cree Xlamp XM-L LEDs  
[LAMP CATEGORY]LED. LUMINAIRE OUTPUT = 5468 LMS.  
[OTHER]Tested at 120 VAC and 139.6 W

## Polar Graph

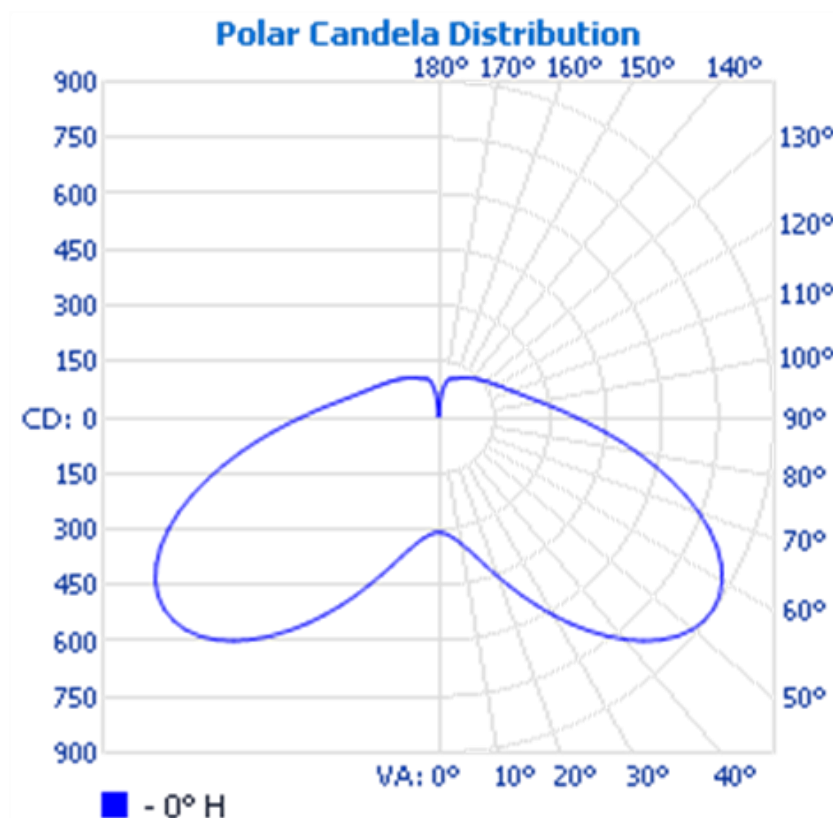


Chart 1: Intensity Distribution



## Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	390.1	7.1
0-40	829.6	15.2
0-60	2280.8	41.7
60-90	1981.1	36.2
70-100	1510.8	27.6
90-120	778.7	14.2
0-90	4262	77.9
90-180	1210.7	22.1
0-180	5472.6	100

Table 3: Zonal Lumen Summary

## Lumens per Zone

Zone	Lumens	% Total
0-10	31.1	0.6
10-20	112.3	2.1
20-30	246.6	4.5
30-40	439.4	8
40-50	651	11.9
50-60	800.2	14.6
60-70	811.3	14.8
70-80	678.5	12.4
80-90	491.4	9
90-100	340.9	6.2
100-110	247.5	4.5
110-120	190.2	3.5
120-130	148.3	2.7
130-140	113.3	2.1
140-150	81.7	1.5
150-160	53.8	1
160-170	29.6	0.5
170-180	5.2	0.1

Table 4: Lumens per Zone, 10 degrees

## Illuminance

The sample was measured on a type C goniophotometer and illuminance measurements were calculated from the IES-63 electronic file using Photometrics Pro software. The results are shown in Charts 2 and 3.

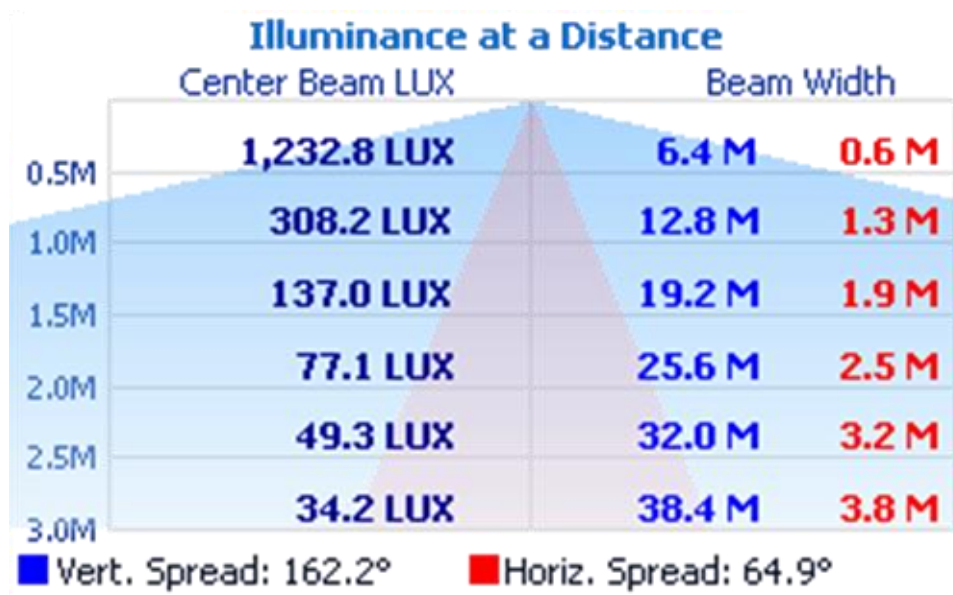


Chart 2: Isolux Plot

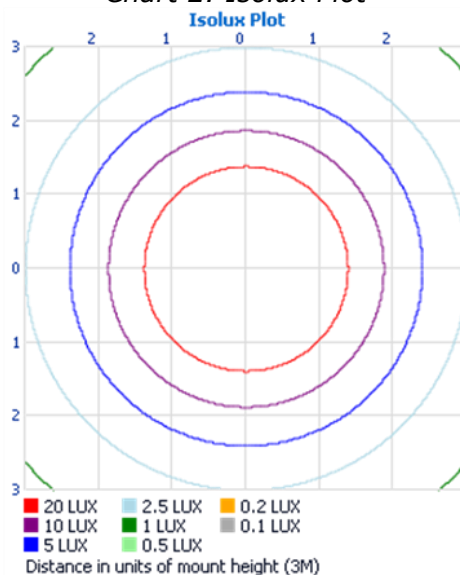


Chart 3: Isolux Plot

## Measurement Uncertainty

Measurement Parameter	Type C Goniophotometer (+/- %)
Total Luminous Flux	1.52
Electrical	0.06
Temperature	1.28

*Table 5: System Measurement Uncertainty*

## Equipment List

Using calibrated, state-of-the-art equipment at Cree Technology Centers across the world, Cree Services reports provide measurements you can trust. Below is a list of manufacturers and equipment that allows Cree to evaluate important aspects of your LED system design and examine areas critical to certifications, as well as cover areas not currently tested by regulatory bodies but vital to quality LED system design. That's lighting-class.

Equipment Used	Manufacturer	Model
Software	Instrument Systems	SpecWin Pro Version 1.4.1.414
Software	Lighting Analysts, Inc.	Photometric Toolbox Pro. Ed.
Software	jSolutions, Inc.	Photometrics Pro Version 1.3.14
AC Power Supply	Adaptive Power Sys.	FC210
Type C Goniophotometer	LSI / UL	6440T
Software	LSI / UL	Photometric Suite
Power Meter	Yokogawa	WT210

*Table 6: List of Equipment Used in Testing*

## Report Review

**This report has been reviewed by:**



Date: 9/9/2013

Robert Higley for Shawn Keeney  
Manager, Cree Durham Technology Center

If there are any questions or concerns on the information or content of this report, please contact your Cree sales representative or your local Cree field application engineer. If you do not know these points of contacts or require additional assistance, please contact Cree Product Support.

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