IESNA LM79-2008 TEST REPORT

TÜV SÜD America, Inc.

Photometric Testing and Evaluation in Accordance with LM79-2008

Report Prepared for:

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Model Tested:	**HB-88W-50K-WB**
Model Description:	**HighBay Luminaire**
Manufacturer:	**RedBird LED**
Technical Report Number:	**72141753-01-LM79**
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Summary of Key Test Results

Model#	**HB-88W-50K-WB**
Manufacturer	**RedBird LED**
TÜV Sample#	**3427-1**
Date of Test	**August 17, 2018**

Notes:

Tested in Aperture Down orientation

Driver Model#

Philips XI095C275V054DNF1

Parameter	Measured Result
Luminous Flux (Lumens)	**16,949**
Input Power (Watts)	**90.24**
Efficacy (Lumens/Watt)	**188**
Color Temperature (CCT K)	**5061**
Color Rendering Index (CRI)	**85.3**
Beam Angle	**177.5° (V) / 105.3° (H)**
Stabilization Time (Min)	**60**
In-Situ Temp Test**	**40.0 °C / 44.5 °C (LED/Driver)**

The above results are recorded / derived from measurements in accordance with LM79-08

***ISTMT in accordance with "Energy Star Program Requirements for Luminaires – Version 2.1".*

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Test Results-

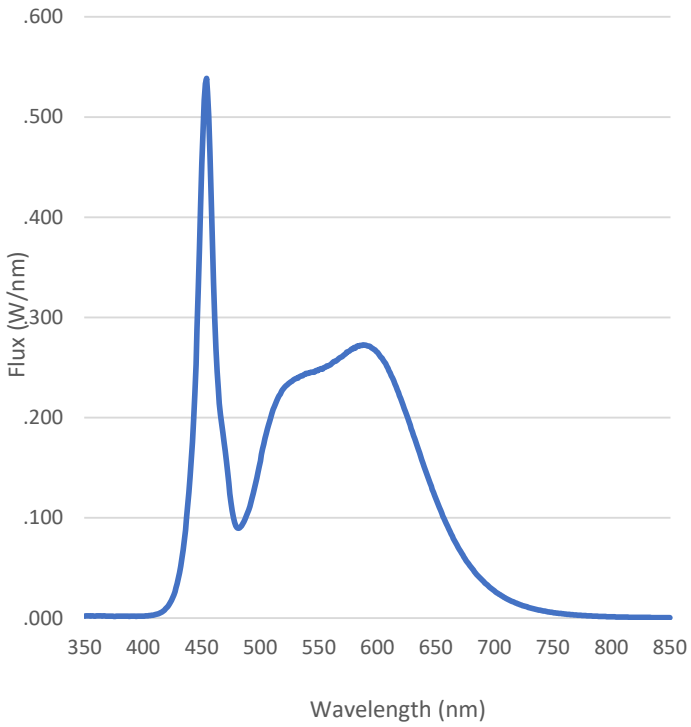
The following results were obtained after stabilization of the sample in accordance with the requirements set forth in section 5.0 of IES LM79-2008. Stability is achieved when the variation of 3 readings of light output and electrical power over a period of 30 minutes, taken 15 minutes apart, is less than 0.5%.

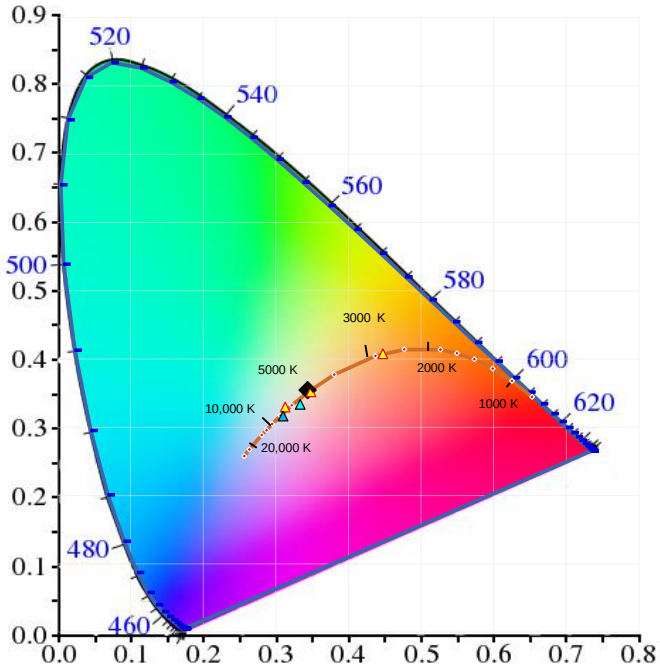
Photometric Results (120V Only)	HB-88W-50K-WB	
	Integrating Sphere	
Total Luminous Flux (Lumens)	16,949	
Luminous Efficacy (Lumens/Watt)	187.82	
Correlated Color Temperature (CCT K)	5061	
Color Rendering Index (CRI-Ra)	85.3	
R9 Value	6.1	
Total Radiant Flux (Watts)	52.8	
Chromaticity (Chroma x / Chroma y)	0.3436	0.3541
Chromaticity (Chroma u / Chroma v)	0.2095	0.3238
Chromaticity (Chroma u' / Chroma v')	0.2095	0.4857
Duv Value	0.00184	

Electrical Results	HB-88W-50K-WB	
	Integrating Sphere (120V / 277V)	
Input Power (Watts)	90.24	90.03
Input Voltage (Volts AC)	120.15	277.01
Input Current (Amps)	0.862	0.380
Power Factor	0.991	0.957
A-THD% (Current %)	9.28	12.64
Input Frequency (Hz)	60.0	60.0

Additional Parameters	HB-88W-50K-WB	
	Integrating Sphere	Goniophotometer
Stabilization Time (Light and Power)	60 Minutes	63 minutes
Test Geometry Configuration	4π	Type C
Spectroradiometer	Labsphere CDS1100	Gigahertz Optik P9801
Ambient Temperature	24.5 °C	24.5 deg C
In-Situ Temp Test (LED TMP / Driver TMP)	LED TMP 40.0 °C	DRIVER TMP 44.5 °C
Spacing Criteria	0° - 180°: 1.44	90° - 270°: 1.28

Spectral Flux and Chromaticity Diagram





Spectral response of the Radiant Flux (350nm to 850nm)

λ(Peak): **453.7 nm** **λ(Dom):** **569.9 nm**

Chromaticity Diagram, CIE 1931, 2 Degree

Tristimulus Values: x/y = 0.3436 / 0.3541

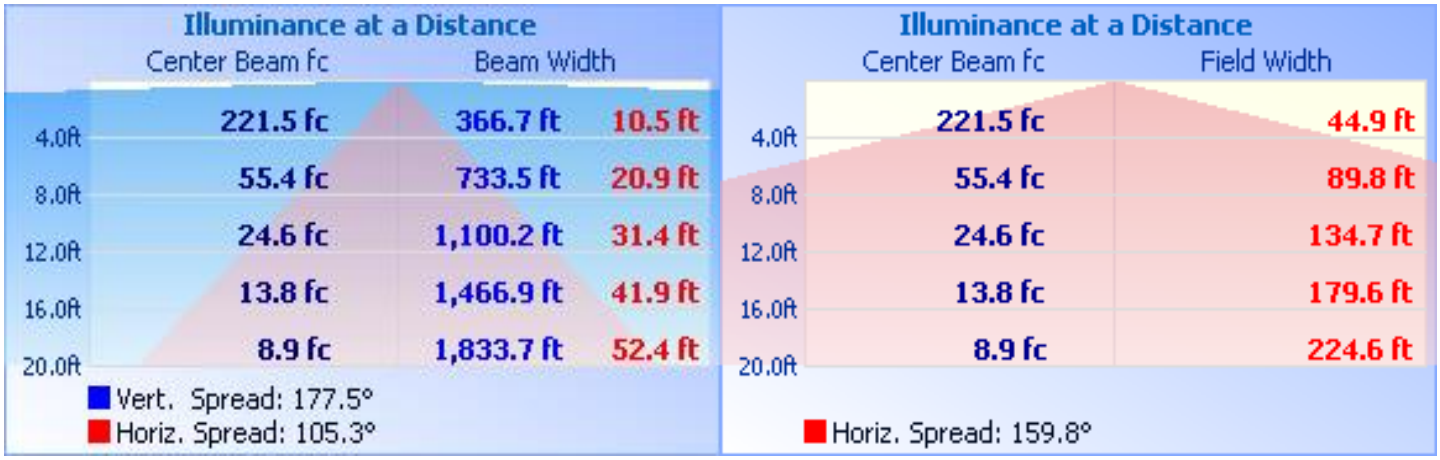
The locations on the diagram of the tristimulus coordinates are indicated by the black diamond.

Zonal Lumen Summary

Zone	Lumens	% Lamp \ Luminaire
0-60	9,979.1	58.9%
60-90	6,749.3	39.8%
0-90	16,728.4	98.7%
90-180	220.8	1.3%
0-180	16,949.2	100.0%

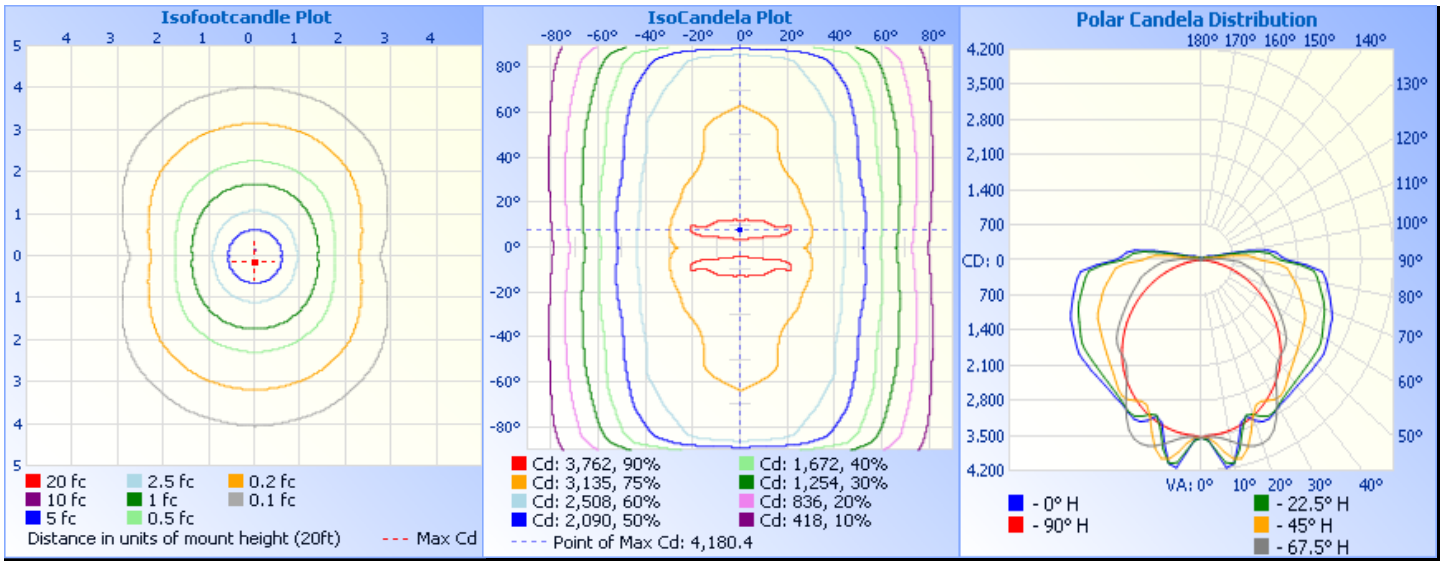
Test Results - Illuminance Plots

The following images depict the illuminance characteristics of the luminaire:



Test Results - Candela Plots

The following images depict the luminous intensity distribution characteristics of the luminaire:



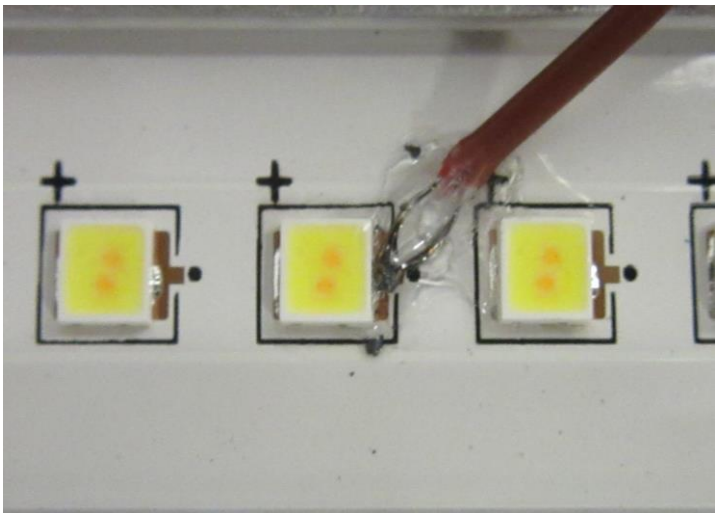
ISOfootcandle Plot ISOCandela Plot Polar Candela

Maximum Candela = **4,412.6** at Horizontal: 0.0°, Vertical: 7.5°

ISTMT Temperature Measurement

ISTMT temperature measurement at thermal stabilization (8 hours continuous operation). Thermocouple locations (shown below) are in accordance with manufacturers recommended / stated guidelines for TMP - Temperature Measurement Point.

Tc location based upon hottest LED located adjacent to the LED Driver (mounted on the rear of the fixture).

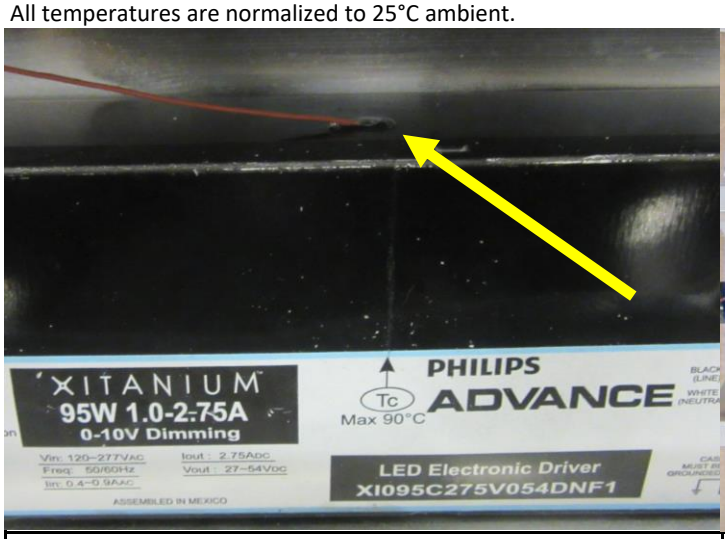


"LED" Thermocouple Location at Tc

LED Test Results for RedBird LED : HB-88W-50K-WB

LED$_{TMP}$ Temperature	40.0°C

All temperatures are normalized to 25°C ambient.



"Driver" Thermocouple Location at Tc

Sample Overview (DRIVER$_{TMP}$ Location)

Driver Test Results for RedBird LED : HB-88W-50K-WB

DVR$_{TMP}$ Temperature	44.5°C

All temperatures are normalized to 25°C ambient.

TÜV SÜD Photometric Testing Information

Testing is performed in accordance with the procedures outlined in IESNA LM79-2008. The sample is evaluated for photometric and electrical characteristics using an integrating sphere and a goniophotometer, located in an accredited, temperature and humidity-controlled, draft free photometric laboratory.

Sphere Geometry

The integrating spheres used for measurement utilize a "4π geometry" configuration in accordance with section 9 of IES LM-79-2008 and is applicable for all types of SSL products (directional and non-directional light projections). The spectroradiometer is an array-type detector manufactured and calibrated by Labsphere (Model# CDS1100).

Self-Absorption Correction

The integrating sphere uses self-absorption correction to eliminate errors due to mismatches between the standard reference lamp and the test samples being measured. This auxiliary correction lamp is a halogen type lamp powered by a calibrated Lamp Power Supply manufactured and calibrated by Labsphere (model LPS150). Ambient temperature is measured using a thermocouple located inside the integrating sphere at the same height as the sample under test (UUT) and not more than 1 meter in horizontal distance away from the sample (section 2.2 of LM79-2008). The thermocouple is located behind a baffle in order to eliminate any direct optical radiation from the sample under test.

Sample Stabilization

The sample (UUT) is placed inside the integrating sphere and powered by a regulated and conditioned alternating or direct current supply. The stabilization times shown on the results pages of this report denote the time of the 3rd measurement (of the 3 consecutive readings) since this is the minimum time that the sample is assumed to have taken to reach stabilization in accordance with section 5.0 of LM79-2008.

Sphere Calibration

The integrating sphere is calibrated using a quartzline halogen lamp with the following specifications:

Manufacturer: EYE Lighting International
Model # J94/JD28V75W
Voltage = 28 Volts DC
Wattage = 75 Watts
Calibration Current = 2.679 Amperes
Luminous Flux = 1685 Lumens
Calibration Date = 2/17/2011 Labsphere - NIST traceable

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TÜV SÜD Photometric Testing Information (continued)

Goniophotometer

The Goniophotometer is a Mirror based Type C optical measurement system in accordance with section 9.3.1 of IESNA LM79-2008.

Goniophotometer Calibration

The Goniophotometer is calibrated using a frosted tungsten filament FDS/DZE lamp with the following specifications:

Manufacturer: General Electric
Part Number: CSB-110
Lamp Number: 112-A
Voltage = 16.52 Volts DC
Wattage = 150 Watts
Calibration Current = 4.816 Amperes
Luminous Intensity = 151.5 Candelas
Calibration Date = 2/13/2011 (NIST Traceable)

TÜV SÜD Test Equipment List:

TÜV SÜD Sphere System – contains the following:			
Description	Manufacturer / Model#	TÜV SÜD Ref#	Calibration Due Date
Integrating Sphere	Labsphere LM760	SPH004	weekly
Spectroradiometer	Labsphere CDS1100	ATLE0094	09/27/18
Power Analyzer	Yokogawa WT210	ATLE0032	12/12/18
Power Source	Chroma 61602	AC009	N/A
TÜV SÜD Mirror Goniophotometer System – contains the following			
Description	Manufacturer / Model#	TÜV SÜD Ref#	Calibration Due Date
Goniophotometer	M.E. GONC02	GON002	weekly
Spectroradiometer	Gigahertz Optik P9801	GIG002	weekly
Power Analyzer	Yokogawa WT210	ATLE0057	03/27/19
Power Source	Chroma 61602	AC007	N/A
TÜV SÜD ISTMT Testing– contains the following			
Description	Manufacturer / Model#	TÜV SÜD Ref#	Calibration Due Date
Thermometer	Fluke 52-II	ATLE0118	2/27/2019