



## LM-79-08 Test Report

for

**Four-foot Linear Replacement Lamps**

**Model: ZY-T8-18W1200 BINS 5000K**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ13080022c

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

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Aug. 23, 2013

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Aug. 23, 2013

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government

### Test Summary

<b>Model</b>	<b>ZY-T8-18W1200 BINS</b>
<b>Luminous Efficacy (Lumens /Watt)</b>	113.6
<b>Total Luminous Flux (Lumens)</b>	2033.0
<b>Power (Watts)</b>	17.9
<b>Power Factor</b>	0.9785
<b>CCT (K)</b>	5054.0
<b>CRI</b>	83.0
<b>Stabilization Time (Light &amp; Power)</b>	70 min
<b>Note</b>	5000K

Table 1: Executive Data Summary

#### Test specifications:

**Date of Receipt** : Aug. 19, 2013

**Date of Test** : Aug. 20, 2013

**Test item** : Total Luminous Flux, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

**Reference Standard** : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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### Sample Photos



Sample view

### Equipment Under Test (EUT)

<b>Name</b>	: LED TUBE
<b>Model</b>	: ZY-T8-18W1200 BINS
<b>Electrical Ratings</b>	: AC 100-277 V, 50/ 60Hz, 18W
<b>Product Description</b>	: G13 base, fixed end caps, 5000K, 4 foot tube, Clear Lens Model of LED light source: HL-A-2835DW-S1-08-HR3

**TEST RESULTS**

Test ambient temperature was 25.1°C.

Test orientation was Light down. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 70 minutes, and the total operating time including stabilization was 105 minutes.

**Sphere-Spectroradiometer Method**

Parameter	Result			Special Color Rendering Indices	
Test Voltage (V)	120.0	100.0	277.0	R1	82.8
Voltage frequency (Hz)	60	60	60	R2	86.4
Test Current (A)	0.154	0.185	0.074	R3	86.4
Power Factor	0.9785	0.9841	0.8721	R4	83.1
Test Power (W)	17.9	18.1	17.8	R5	82
THD A%	16.52	15.47	20.19	R6	79.2
Luminous Efficacy (lm/W)	113.6			R7	88.8
Total Luminous Flux (lm)	2033.0			R8	75.7
Color Rendering Index (CRI)	83.0			R9	29.9
R9	29.9			R10	65.2
Correlated Color Temperature (CCT)(K)	5054			R11	80.4
Chromaticity (Chroma x, Chroma y)	(0.3434, 0.3494)			R12	55.8
Chromaticity (Chroma u, Chroma v)	(0.2111, 0.3222)			R13	83.4
Chromaticity (Chroma u', Chroma v')	(0.2111, 0.4834)			R14	92
Duv	0.0011				

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram,  $u' = u = 4x/(-2x+12y+3)$ ,  $v' = 3v/2 = 9y/(-2x+12y+3)$ .

**Spectral Power Distribution - Sphere Spectroradiometer Method**

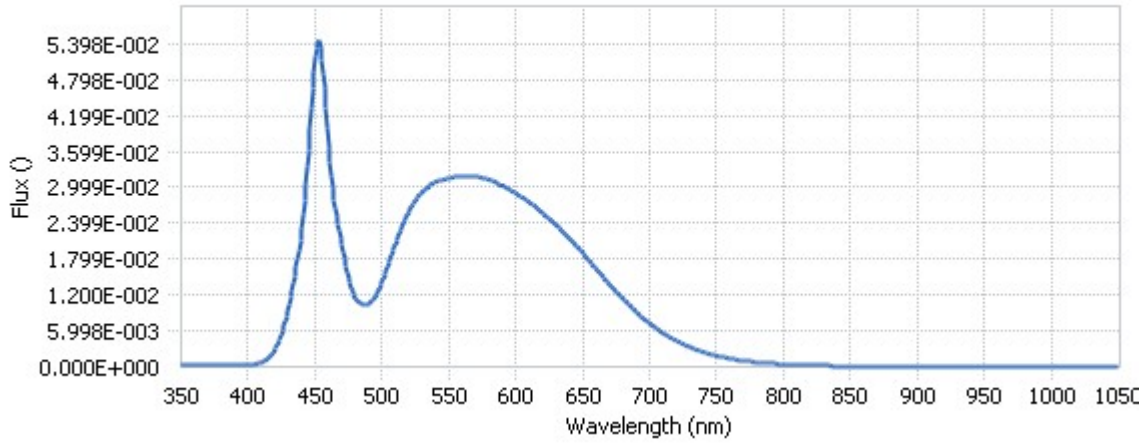
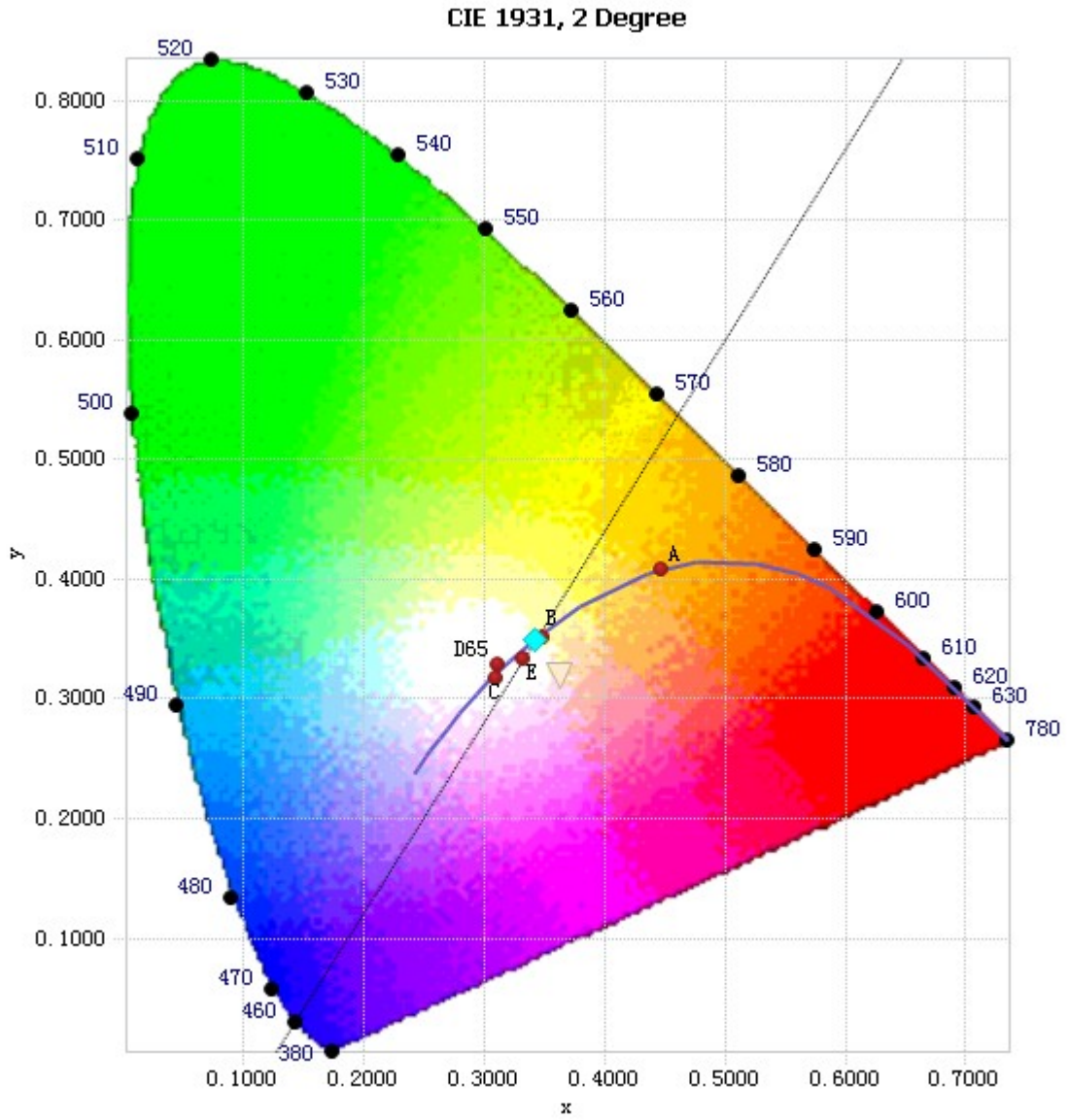


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.06E-04	485	1.04E-02	590	3.04E-02	695	8.13E-03
385	2.01E-04	490	1.05E-02	595	2.97E-02	700	7.22E-03
390	2.14E-04	495	1.18E-02	600	2.90E-02	705	6.35E-03
395	2.58E-04	500	1.43E-02	605	2.84E-02	710	5.60E-03
400	3.04E-04	505	1.73E-02	610	2.76E-02	715	4.92E-03
405	4.17E-04	510	2.06E-02	615	2.67E-02	720	4.30E-03
410	7.40E-04	515	2.35E-02	620	2.57E-02	725	3.77E-03
415	1.45E-03	520	2.59E-02	625	2.47E-02	730	3.28E-03
420	2.87E-03	525	2.77E-02	630	2.37E-02	735	2.85E-03
425	5.45E-03	530	2.91E-02	635	2.25E-02	740	2.47E-03
430	9.46E-03	535	3.01E-02	640	2.15E-02	745	2.13E-03
435	1.50E-02	540	3.09E-02	645	2.03E-02	750	1.84E-03
440	2.31E-02	545	3.12E-02	650	1.90E-02	755	1.60E-03
445	3.63E-02	550	3.15E-02	655	1.77E-02	760	1.39E-03
450	5.18E-02	555	3.17E-02	660	1.64E-02	765	1.20E-03
455	5.14E-02	560	3.18E-02	665	1.51E-02	770	1.03E-03
460	3.66E-02	565	3.19E-02	670	1.38E-02	775	8.90E-04
465	2.64E-02	570	3.17E-02	675	1.25E-02	780	7.73E-04
470	2.03E-02	575	3.16E-02	680	1.14E-02		
475	1.49E-02	580	3.13E-02	685	1.02E-02		
480	1.15E-02	585	3.09E-02	690	9.15E-03		

Table 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

**Chromaticity Diagram - Sphere Spectroradiometer Method**



Tristimulus values(x, y) : (0.3434, 0.3494)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

**Nominal CCT Quadrangles – Sphere Spectroradiometer Method**

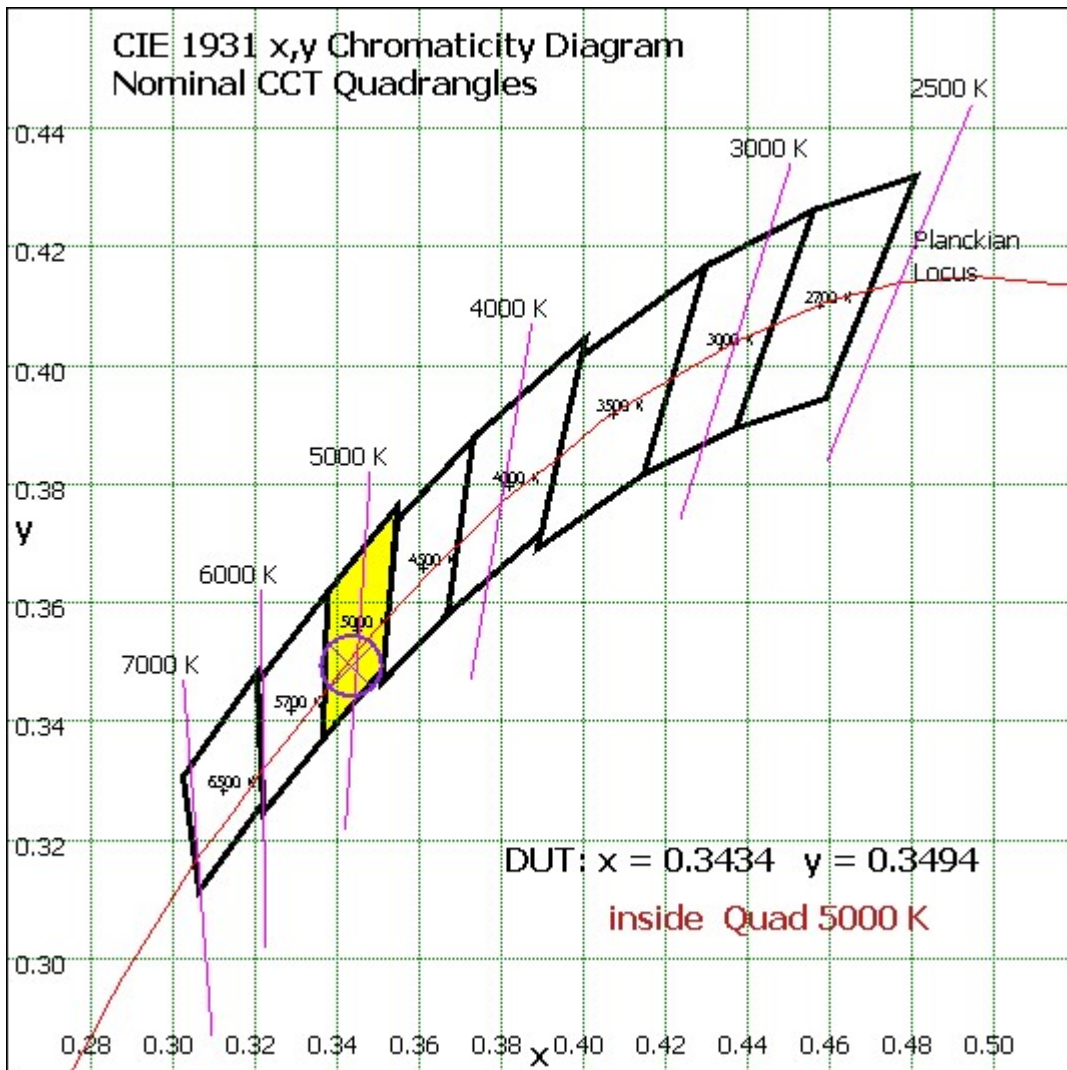


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Integrate Sphere system	2M	HZTE015-01	Sep. 18, 2012	Sep. 17, 2013
Digital Power Meter	WT210	HZTE008-01	Sep. 19, 2012	Sep. 18, 2013
AC Power Supply	PCR 500L	HZTE001-07	Sep. 19, 2012	Sep. 18, 2013
DC Power Supply	6154	HZTE004-04	Sep. 19, 2012	Sep. 18, 2013
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 19, 2012	Sep. 18, 2013
Standard source	SCL-1400	HZTE012-02	Sep. 19, 2012	Sep. 18, 2013

Table 4: Test Equipment List

## TEST METHODS

### Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

### Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is  $4\pi$ . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expended uncertainty is 1.06% with a coverage factor  $k=2$ .

### Goniophotometer Method

## Photometric and Electrical Measurements

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 1.94% with a coverage factor  $k=2$ .

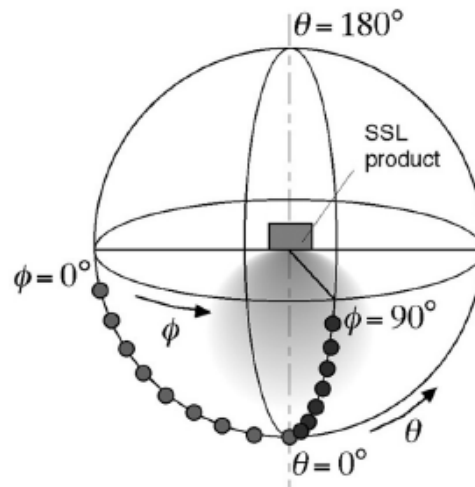
## Color Characteristics Measurements

The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

### Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ( $C=0^\circ/180^\circ$  and  $C=90^\circ/270^\circ$ ) and at  $10^\circ$  or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate was calculated from these points. The data was then analyzed to check for delta color differences of the  $u'$ ,  $v'$  chromaticity coordinates. The spatial non-uniformity of chromaticity,  $\Delta u'v'$ , is determined as the maximum deviation (distance on the CIE ( $u'$ ,  $v'$ ) diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



\*\*\* End of Report \*\*\*

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