

## LM-79-08 TEST REPORT

for

### RAB Lighting INC

170 Ludlow Avenue, Northvale, New Jersey 07647 USA

### LED Tube

**Model: T5HO-9-24G-850-DIR**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,  
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

[www.ledtestlab.com](http://www.ledtestlab.com)

Report No.: HZ20090061a1

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

Review by:



Engineer: April Zou  
Oct. 26, 2020

Approved by:



Manager: Jim Zhang  
Oct. 26, 2020

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>T5HO-9-24G-850-DIR</b> |
| <b>Luminous Efficacy (Lumens /Watt)</b>       | 111.4                     |
| <b>Total Luminous Flux (Lumens)</b>           | 1272.9                    |
| <b>Power (Watts)/2</b>                        | 11.43                     |
| <b>Power Factor</b>                           | 0.9879                    |
| <b>CCT (K)</b>                                | 5077                      |
| <b>CRI</b>                                    | 84.9                      |
| <b>Stabilization Time (Light &amp; Power)</b> | 60 mins                   |
| <b>Note</b>                                   | 5000K                     |

Table 1: Executive Data Summary

### Test specifications:

**Date of Receipt** : Sep. 28, 2020

**Date of Test** : Oct. 26, 2020

**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  
ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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## SAMPLE PHOTO

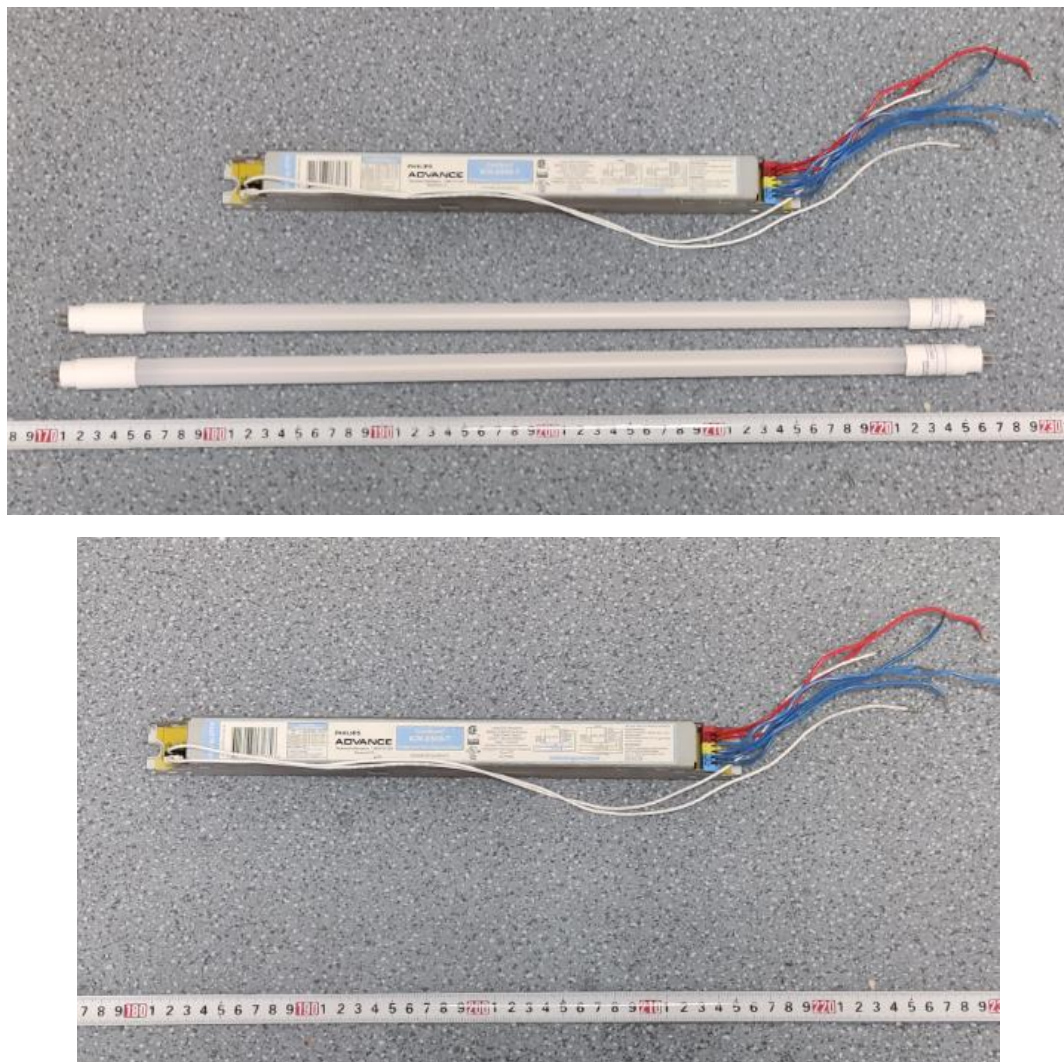


Figure 1- Overview of the sample

### Equipment Under Test(EUT)

|                            |                                                                                           |
|----------------------------|-------------------------------------------------------------------------------------------|
| <b>Name</b>                | : LED Tube                                                                                |
| <b>Model</b>               | : T5HO-9-24G-850-DIR                                                                      |
| <b>Electrical Ratings</b>  | : 120-277V, 50/60Hz                                                                       |
| <b>Product Description</b> | : 5000K<br>LED Tubes supplied by a high frequency fluorescent lamp ballast:<br>ICN-2S39-T |

## TEST RESULTS

Test ambient temperature was 26.0 °C.

Base orientation was horizontal. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 65 minutes.

### Sphere-Spectroradiometer Method

| Parameter                             | Result |        |
|---------------------------------------|--------|--------|
| Test Voltage (V)                      | 120.0  | 277.0  |
| Voltage frequency (Hz)                | 60     | 60     |
| Test Current (A)                      | 0.193  | 0.092  |
| Power Factor                          | 0.9879 | 0.9164 |
| Test Power (W)/2                      | 11.43  | 11.65  |
| THD A%                                | 11.87  | 13.07  |
| Luminous Efficacy (lm/W)              | 111.4  | 109.1  |
| Total Luminous Flux (lm)              | 1272.9 | 1270.8 |
| Color Rendering Index (CRI)           | 84.9   |        |
| R9                                    | 12.8   |        |
| Correlated Color Temperature (CCT)(K) | 5077   |        |
| Chromaticity Chroma x                 | 0.3432 |        |
| Chromaticity Chroma y                 | 0.3536 |        |
| Chromaticity Chroma u                 | 0.2094 |        |
| Chromaticity Chroma v                 | 0.3236 |        |
| Duv                                   | 0.0018 |        |
| Chromaticity Chroma u'                | 0.2094 |        |
| Chromaticity Chroma v'                | 0.4853 |        |

| Special Color Rendering Indices |      |
|---------------------------------|------|
| R1                              | 83.6 |
| R2                              | 91.5 |
| R3                              | 95.1 |
| R4                              | 83.5 |
| R5                              | 84   |
| R6                              | 86.9 |
| R7                              | 86.7 |
| R8                              | 67.9 |
| R9                              | 12.8 |
| R10                             | 79.2 |
| R11                             | 83.3 |
| R12                             | 64   |
| R13                             | 86.1 |
| R14                             | 97.8 |

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

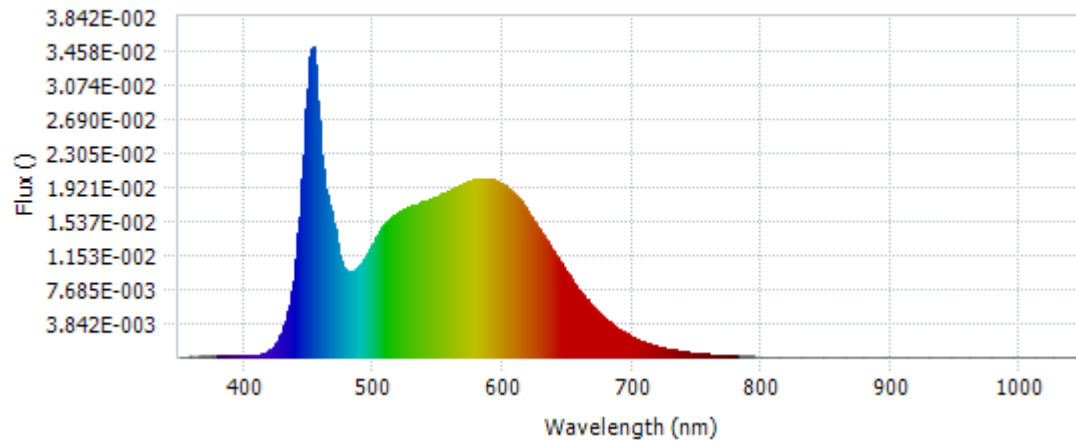
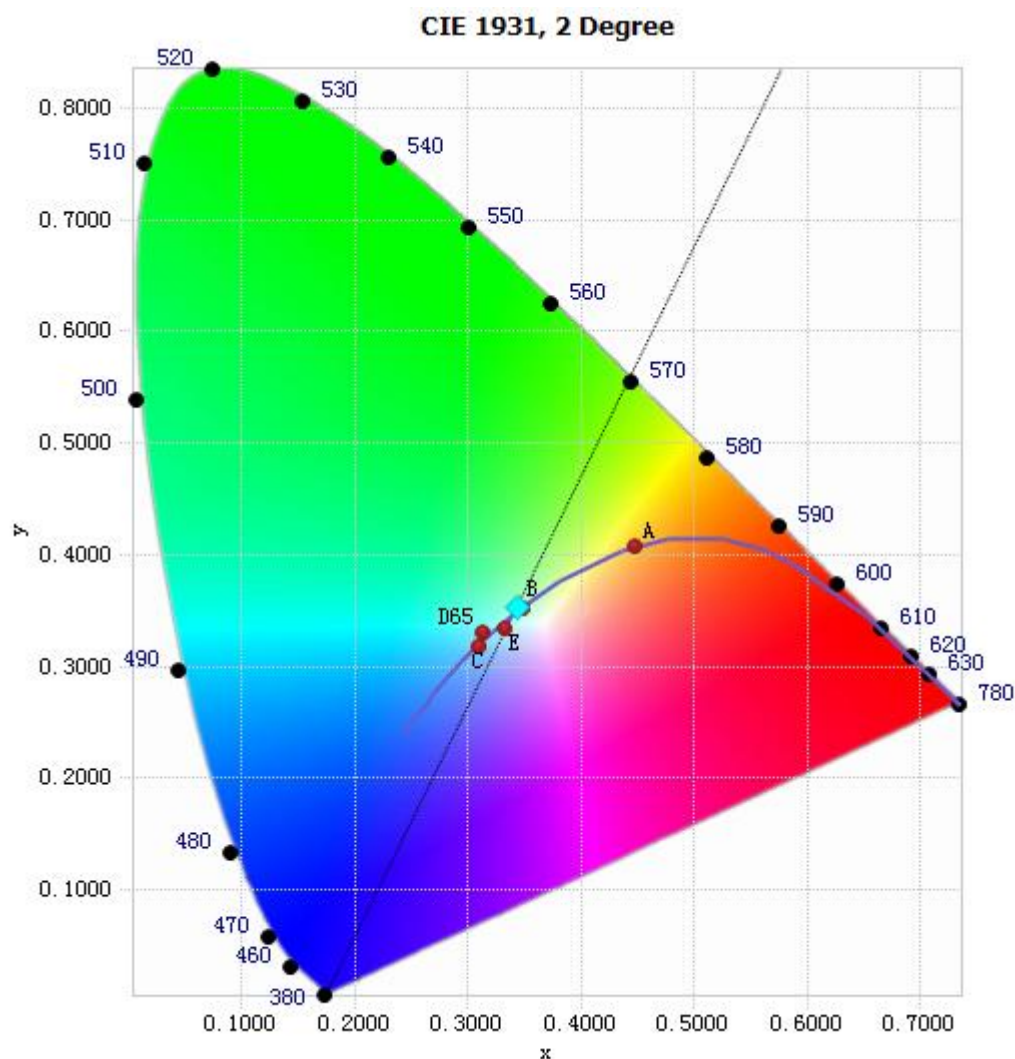


Chart 1: Spectral Power Distribution

| Spectral Distribution over Visible Wavelength |                |        |                |        |                |        |                |
|-----------------------------------------------|----------------|--------|----------------|--------|----------------|--------|----------------|
| WL(nm)                                        | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) |
| 380                                           | 1.53E-04       | 485    | 9.82E-03       | 590    | 2.01E-02       | 695    | 2.69E-03       |
| 385                                           | 1.43E-04       | 490    | 1.05E-02       | 595    | 1.99E-02       | 700    | 2.30E-03       |
| 390                                           | 1.52E-04       | 495    | 1.16E-02       | 600    | 1.96E-02       | 705    | 1.96E-03       |
| 395                                           | 1.48E-04       | 500    | 1.30E-02       | 605    | 1.90E-02       | 710    | 1.67E-03       |
| 400                                           | 1.31E-04       | 505    | 1.42E-02       | 610    | 1.82E-02       | 715    | 1.43E-03       |
| 405                                           | 1.41E-04       | 510    | 1.51E-02       | 615    | 1.74E-02       | 720    | 1.22E-03       |
| 410                                           | 2.13E-04       | 515    | 1.59E-02       | 620    | 1.64E-02       | 725    | 1.04E-03       |
| 415                                           | 3.95E-04       | 520    | 1.64E-02       | 625    | 1.52E-02       | 730    | 8.86E-04       |
| 420                                           | 8.05E-04       | 525    | 1.68E-02       | 630    | 1.41E-02       | 735    | 7.55E-04       |
| 425                                           | 1.59E-03       | 530    | 1.71E-02       | 635    | 1.29E-02       | 740    | 6.42E-04       |
| 430                                           | 3.13E-03       | 535    | 1.73E-02       | 640    | 1.17E-02       | 745    | 5.47E-04       |
| 435                                           | 5.96E-03       | 540    | 1.76E-02       | 645    | 1.05E-02       | 750    | 4.67E-04       |
| 440                                           | 1.10E-02       | 545    | 1.79E-02       | 650    | 9.39E-03       | 755    | 3.99E-04       |
| 445                                           | 2.02E-02       | 550    | 1.82E-02       | 655    | 8.32E-03       | 760    | 3.42E-04       |
| 450                                           | 3.22E-02       | 555    | 1.86E-02       | 660    | 7.36E-03       | 765    | 2.92E-04       |
| 455                                           | 3.30E-02       | 560    | 1.89E-02       | 665    | 6.45E-03       | 770    | 2.49E-04       |
| 460                                           | 2.29E-02       | 565    | 1.93E-02       | 670    | 5.63E-03       | 775    | 2.13E-04       |
| 465                                           | 1.76E-02       | 570    | 1.96E-02       | 675    | 4.90E-03       | 780    | 1.83E-04       |
| 470                                           | 1.44E-02       | 575    | 1.99E-02       | 680    | 4.24E-03       |        |                |
| 475                                           | 1.10E-02       | 580    | 2.01E-02       | 685    | 3.64E-03       |        |                |
| 480                                           | 9.58E-03       | 585    | 2.02E-02       | 690    | 3.14E-03       |        |                |

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

## Chromaticity Diagram - Sphere Spectroradiometer Method

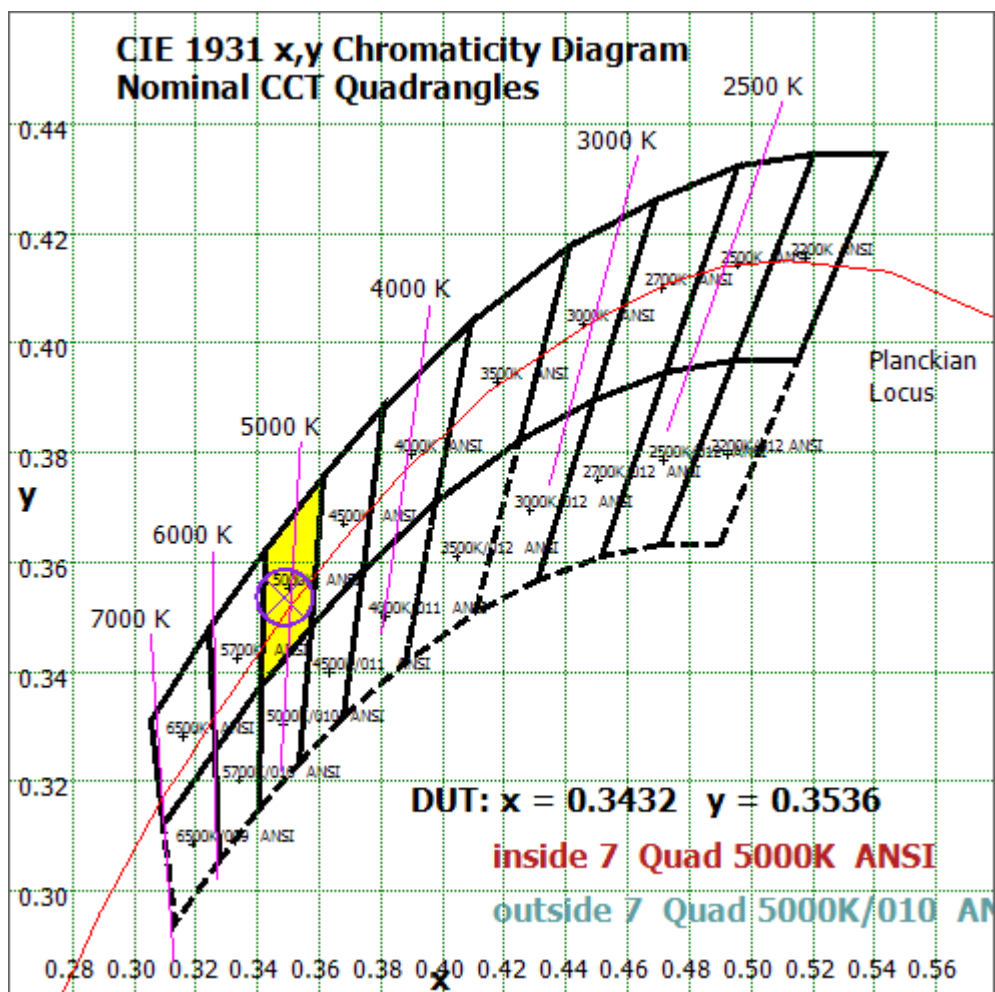


Tristimulus values(x, y): (0.3432, 0.3536)

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

# Color Rendition Report – Sphere Spectroradiometer Method

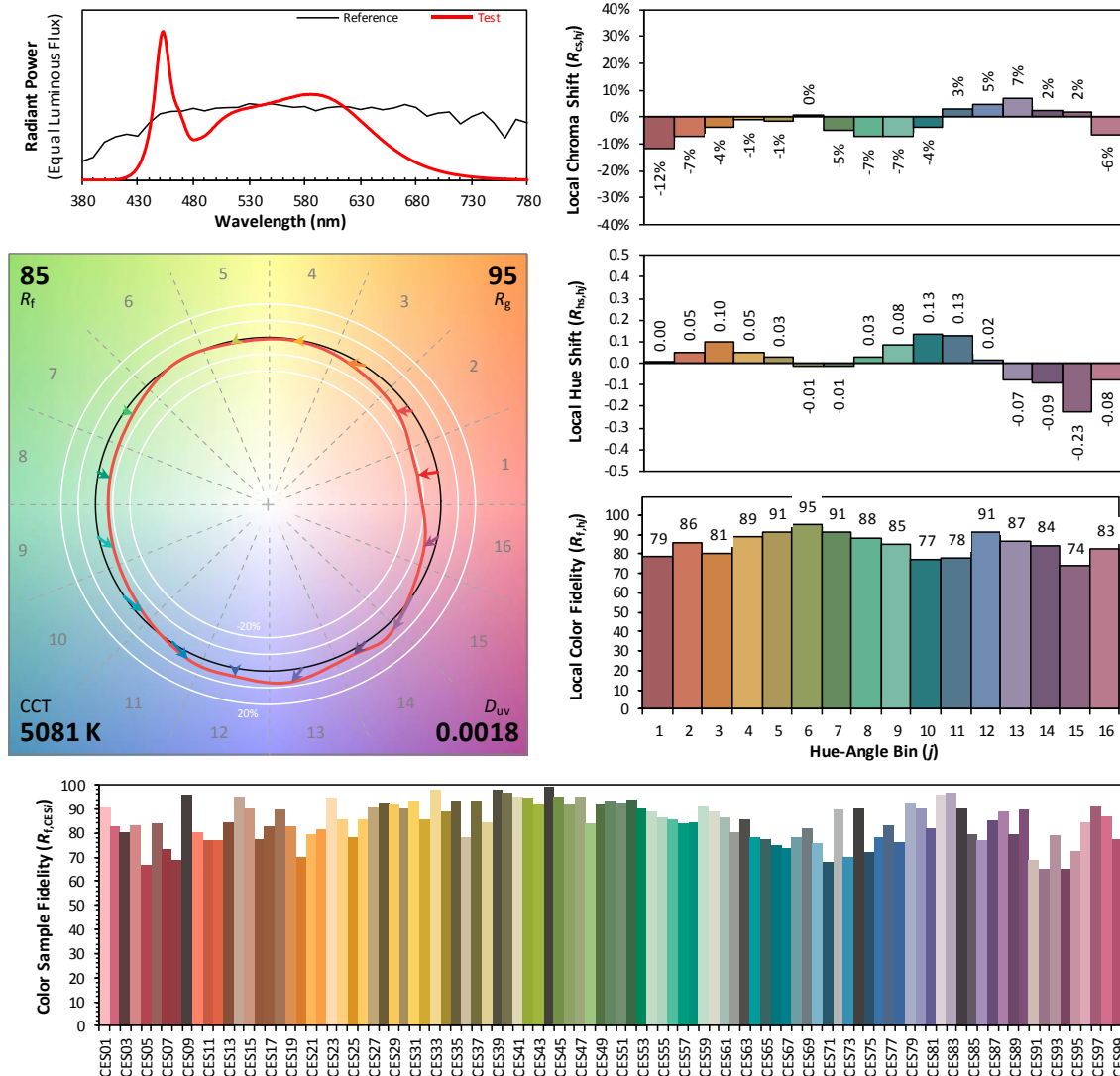
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: RAB Lighting INC

Date: 2020/10/26

Model: T5HO-9-24G-850-DIR



**Notes:** This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.3432  
 $y$  0.3536  
 $u'$  0.2094  
 $v'$  0.4853

CIE 13.3-1995  
(CRI)  
 $R_a$  85  
 $R_g$  13

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

## EQUIPMENT LIST

| Test Equipment                    | Model    | Equipment No. | Calibration Date | Calibration Due date |
|-----------------------------------|----------|---------------|------------------|----------------------|
| Integrate Sphere system           | 3M       | HZTE015-04    | Aug. 05, 2020    | Aug. 04, 2021        |
| Digital Power Meter               | WT210    | HZTE008-01    | Aug. 05, 2020    | Aug. 04, 2021        |
| AC Power Supply                   | PCR 500L | HZTE001-07    | Aug. 05, 2020    | Aug. 04, 2021        |
| DC Power Supply                   | IT6154   | HZTE004-04    | Aug. 05, 2020    | Aug. 04, 2021        |
| Temperature and humidity recorder | JR900    | HZTE018-02    | Aug. 05, 2020    | Aug. 04, 2021        |
| Standard source                   | SCL-1400 | HZTE012-02    | Aug. 05, 2020    | Aug. 04, 2021        |
| Temperature Meter                 | TES1310  | HZTE017-01    | Aug. 05, 2020    | Aug. 04, 2021        |

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 2.1% with a coverage factor  $k=2$ .

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

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