



IESNA LM79-2008 Test Report

TÜV SÜD America

Photometric Testing and Evaluation in Accordance with LM79-2008

Report Prepared for:

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Sample Tested: DFN A19 60WE SLP 120
Manufacturer: Lighting Science Group Corporation

Technical Report Number: JI1309364-LM79
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Summary of Key Test Results

Model# **DFN A19 60WE SLP 120**
 Manufacturer **LSGC**
 TÜV Sample# **944-1**
 Date of Test **September 19th 2013**



Notes:

Tested in LBU orientation (Lamp-Base-Up)



| Parameter | Measured Result |
|-----------------------------|--------------------------|
| Luminous Flux | 799.3 Lumens |
| Input Power | 11.43 Watts |
| Efficacy | 69.94 Lumens/Watt |
| C.C.T. | 2527 K |
| C.R.I. (R _a) | 78.7 |
| Stabilization Time | 60 minutes |
| In-Situ Temp Test (ISTMT)** | Not tested |

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



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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 | DFN A19 60WE SLP 120 | |
|---|----------------------|-----------------|
| | Integrating Sphere | Goniophotometer |
| Total Luminous Flux (Lumens) | 799.3 | 802.2 |
| Luminous Efficacy (Lumens/Watt) | 69.94 | 70.87 |
| Total Radiant Flux (Watts) | 2.6 | - |
| Correlated Color Temperature (CCT) | 2527 | - |
| Color Rendering Index (CRI – R _a) | 78.7 | - |
| R ₉ Value | 4.4 | - |
| Chromaticity (Chroma x / Chroma y) | 0.4720 / 0.4094 | - |
| Chromaticity (Chroma u / Chroma v) | 0.2710 / 0.3525 | - |
| Chromaticity (Chroma u' / Chroma v') | 0.2710 / 0.5287 | - |
| D _{uv} Value | -0.00129 | - |

| Electrical Results | DFN A19 60WE SLP 120 | |
|--------------------------|----------------------|-----------------|
| | Integrating Sphere | Goniophotometer |
| Input Power (Watts) | 11.43 | 11.32 |
| Input Voltage (Volts AC) | 119.97 | 119.98 |
| Input Current (Amps) | 0.099 | 0.100 |
| Power Factor | 0.996 | 0.967 |
| Input Frequency (Hertz) | 60.0 | 60.0 |
| A-THD (Current %) | 24.30 % | 23.95 % |

| Additional Parameters | DFN A19 60WE SLP 120 | |
|---|------------------------------------|-----------------------|
| | Integrating Sphere | Goniophotometer |
| Stabilization Time (Light and Power) | 60 minutes | 62 minutes |
| Test Geometry Configuration | 4π | Type C |
| Spectroradiometer | Labsphere CDS1100 | Gigahertz Optik P9801 |
| Ambient Temperature | 25.3 °C | 24.5 °C |
| ISTMT (In-Situ Temperature Measurement) | Not tested | |
| Spacing Criteria | N/A (0° – 180°) / N/A (90° – 270°) | |



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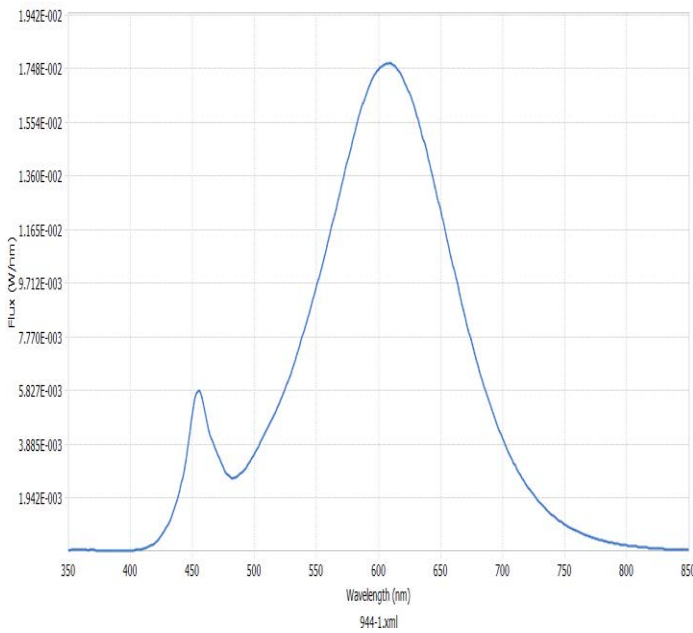
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Spectral Flux and Chromaticity Diagram

Spectral Flux

▼ SPECTRAL FLUX GRAPH:

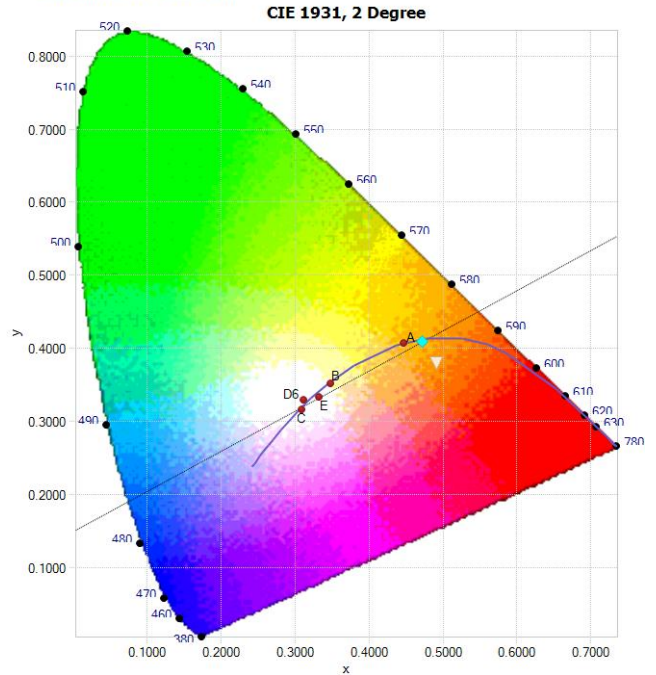


**Spectral response of the Radiant Flux
(350nm to 850nm)**

| Parameter | Stable Data |
|--------------------------|-------------|
| Peak Wavelength (nm) | 609.5 |
| Dominant Wavelength (nm) | 585.5 |

Chromaticity Diagram

▼ CHROMATICITY DIAGRAM:



Tristimulus values (from page 4):

$$x / y = 0.4720 / 0.4094$$

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

Zonal Lumen Summary

| Zone | Lumens | % Lamp / Luminaire |
|----------|--------|--------------------|
| 0 - 60 | 224.7 | 28.0 % |
| 60 - 90 | 185.5 | 23.1 % |
| 0 - 90 | 410.2 | 51.1 % |
| 90 - 180 | 392.1 | 48.9 % |
| 0 - 180 | 802.2 | 100.0 % |

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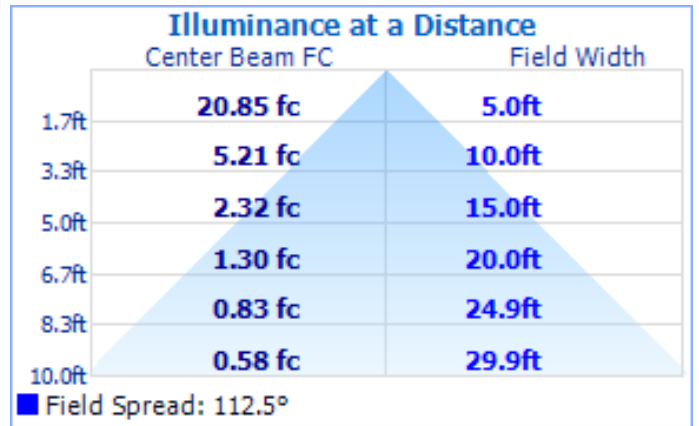
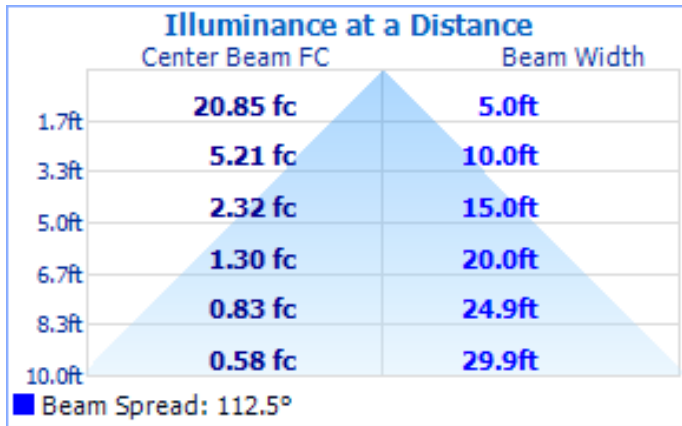
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Test Results – Illuminance Plots

The following images depict the illuminance characteristics of the luminaire.

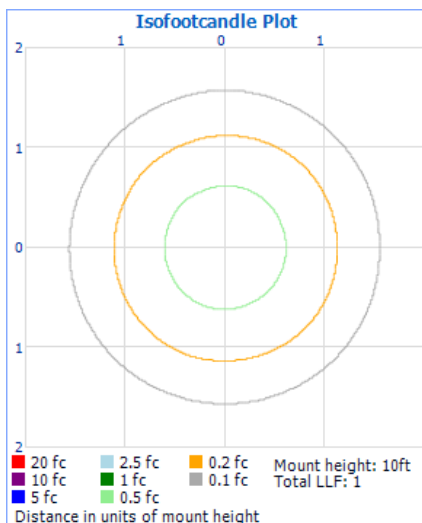


Beam Angle = 112.5°

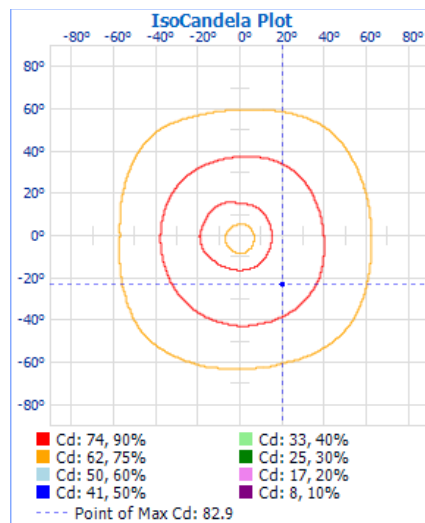
Field Angle = 112.5°

Test Results – Candela Plots

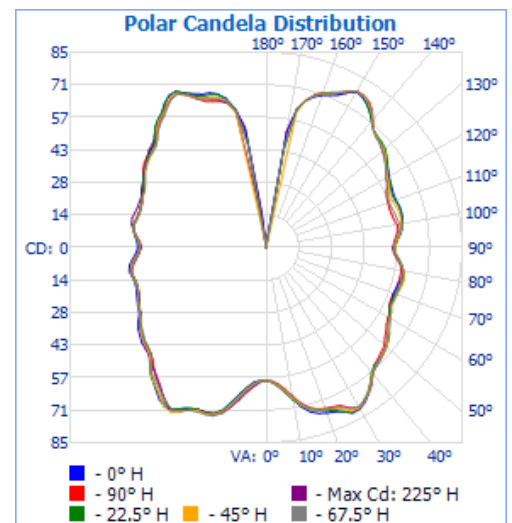
The following images depict the luminous intensity distribution characteristics of the luminaire:



Isofootcandle Plot



Isocandela Plot



Polar Candela



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Test Results – Candela Tabulation

The table below displays the tabulated Candela measurements from the IES file:

Horizontal (lateral) angles are shown in **red** across the top of the table, in increments of 22.5°.

Vertical (longitudinal) angles are shown in **blue** down the side of the table, in increments of 2.5°.

| | 0.0 | 22.5 | 45.0 | 67.5 | 90.0 | 112.5 | 135.0 | 157.5 | 180.0 | 202.5 | 225.0 | 247.5 | 270.0 | 292.5 | 315.0 | 337.5 | 360.0 |
|------|-----|------|------|------|------|-------|-------|-------|-------|-------|-----------|-------|-------|-------|-------|-------|-------|
| 0.0 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |
| 2.5 | 59 | 59 | 59 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 59 | 59 | 59 | 59 |
| 5.0 | 61 | 61 | 60 | 60 | 60 | 59 | 59 | 59 | 59 | 59 | 59 | 60 | 60 | 61 | 61 | 61 | 61 |
| 7.5 | 64 | 64 | 63 | 63 | 62 | 62 | 61 | 61 | 61 | 61 | 62 | 63 | 63 | 63 | 63 | 64 | 64 |
| 10.0 | 67 | 67 | 67 | 66 | 66 | 65 | 65 | 65 | 64 | 65 | 66 | 66 | 67 | 67 | 67 | 67 | 67 |
| 12.5 | 71 | 71 | 70 | 70 | 69 | 69 | 69 | 69 | 69 | 69 | 70 | 71 | 71 | 71 | 71 | 71 | 71 |
| 15.0 | 74 | 73 | 73 | 72 | 72 | 72 | 73 | 73 | 73 | 74 | 74 | 75 | 75 | 75 | 74 | 74 | 74 |
| 17.5 | 76 | 74 | 74 | 74 | 74 | 74 | 75 | 76 | 76 | 76 | 76 | 77 | 76 | 76 | 76 | 76 | 76 |
| 20.0 | 77 | 76 | 75 | 75 | 74 | 75 | 76 | 76 | 76 | 77 | 77 | 77 | 76 | 76 | 76 | 77 | 77 |
| 22.5 | 77 | 77 | 76 | 76 | 75 | 75 | 77 | 77 | 77 | 76 | 77 | 77 | 76 | 76 | 77 | 77 | 77 |
| 25.0 | 79 | 79 | 78 | 77 | 76 | 76 | 77 | 78 | 77 | 77 | 78 | 78 | 77 | 77 | 78 | 78 | 79 |
| 27.5 | 81 | 81 | 80 | 79 | 79 | 78 | 79 | 79 | 79 | 79 | 80 | 80 | 80 | 80 | 80 | 81 | 81 |
| 30.0 | 81 | 81 | 81 | 80 | 81 | 80 | 81 | 82 | 82 | 81 | 83 | 82 | 82 | 82 | 82 | 81 | 81 |
| 32.5 | 80 | 79 | 79 | 79 | 79 | 79 | 81 | 82 | 82 | 81 | 82 | 80 | 81 | 80 | 80 | 81 | 80 |
| 35.0 | 77 | 77 | 77 | 77 | 78 | 78 | 79 | 81 | 81 | 80 | 80 | 79 | 78 | 78 | 78 | 78 | 77 |
| 37.5 | 74 | 74 | 74 | 75 | 75 | 75 | 77 | 78 | 78 | 78 | 78 | 77 | 76 | 75 | 76 | 76 | 74 |
| 40.0 | 72 | 71 | 72 | 72 | 72 | 73 | 74 | 76 | 76 | 76 | 76 | 75 | 74 | 73 | 74 | 73 | 72 |
| 42.5 | 70 | 69 | 70 | 70 | 69 | 70 | 72 | 73 | 74 | 74 | 74 | 74 | 72 | 71 | 72 | 71 | 70 |
| 45.0 | 70 | 69 | 69 | 69 | 69 | 69 | 70 | 71 | 71 | 71 | 71 | 70 | 69 | 69 | 71 | 70 | 70 |
| 47.5 | 69 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 68 | 69 | 68 | 68 | 68 | 69 | 70 | 69 |
| 50.0 | 68 | 68 | 68 | 67 | 67 | 67 | 69 | 68 | 68 | 67 | 68 | 67 | 67 | 68 | 68 | 69 | 68 |
| 52.5 | 66 | 67 | 67 | 66 | 65 | 66 | 67 | 67 | 68 | 67 | 67 | 66 | 67 | 68 | 67 | 67 | 66 |
| 55.0 | 65 | 65 | 65 | 64 | 63 | 65 | 66 | 66 | 67 | 66 | 66 | 65 | 66 | 66 | 66 | 65 | 65 |
| 57.5 | 63 | 63 | 63 | 62 | 62 | 63 | 64 | 65 | 66 | 65 | 65 | 64 | 64 | 65 | 65 | 64 | 63 |
| 60.0 | 62 | 62 | 62 | 62 | 61 | 62 | 63 | 63 | 64 | 63 | 63 | 63 | 63 | 62 | 63 | 62 | 62 |
| 62.5 | 61 | 60 | 61 | 61 | 61 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 61 | 61 | 61 | 61 |
| 65.0 | 59 | 59 | 60 | 60 | 59 | 60 | 60 | 61 | 61 | 61 | 61 | 61 | 61 | 60 | 61 | 60 | 59 |
| 67.5 | 59 | 59 | 60 | 60 | 59 | 59 | 59 | 60 | 60 | 60 | 60 | 60 | 60 | 59 | 59 | 59 | 59 |
| 70.0 | 59 | 59 | 60 | 60 | 59 | 59 | 59 | 59 | 60 | 59 | 59 | 59 | 59 | 58 | 59 | 59 | 59 |
| 72.5 | 59 | 60 | 61 | 60 | 59 | 59 | 59 | 59 | 59 | 59 | 59 | 59 | 58 | 58 | 58 | 58 | 59 |
| 75.0 | 60 | 61 | 61 | 60 | 59 | 60 | 59 | 59 | 59 | 58 | 59 | 59 | 58 | 58 | 59 | 59 | 60 |
| 77.5 | 60 | 61 | 61 | 60 | 59 | 60 | 60 | 60 | 59 | 59 | 59 | 59 | 59 | 59 | 59 | 60 | 60 |
| 80.0 | 60 | 61 | 61 | 60 | 59 | 60 | 60 | 60 | 60 | 60 | 60 | 59 | 59 | 59 | 60 | 60 | 60 |
| 82.5 | 59 | 59 | 59 | 59 | 59 | 59 | 59 | 59 | 60 | 59 | 59 | 58 | 58 | 58 | 59 | 59 | 59 |
| 85.0 | 57 | 58 | 58 | 58 | 57 | 58 | 58 | 58 | 58 | 58 | 57 | 57 | 57 | 56 | 57 | 57 | 57 |
| 87.5 | 56 | 56 | 56 | 56 | 55 | 56 | 56 | 56 | 57 | 56 | 56 | 55 | 55 | 55 | 55 | 56 | 56 |
| 90.0 | 55 | 56 | 56 | 55 | 55 | 55 | 55 | 56 | 56 | 55 | 55 | 55 | 54 | 54 | 54 | 54 | 55 |

Maximum Candela = **82.9** at Horizontal: 225.0°, Vertical: 30.0°



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Test Results – Candela Tabulation (Continued...)

The table below displays the tabulated Candela measurements from the IES file:

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| | 0.0 | 22.5 | 45.0 | 67.5 | 90.0 | 112.5 | 135.0 | 157.5 | 180.0 | 202.5 | 225.0 | 247.5 | 270.0 | 292.5 | 315.0 | 337.5 | 360.0 |
|-------|-----|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 92.5 | 56 | 57 | 57 | 56 | 55 | 56 | 55 | 56 | 56 | 56 | 55 | 55 | 55 | 55 | 55 | 55 | 56 |
| 95.0 | 58 | 58 | 58 | 57 | 56 | 56 | 56 | 57 | 57 | 57 | 57 | 57 | 56 | 56 | 57 | 57 | 58 |
| 97.5 | 59 | 59 | 59 | 59 | 58 | 57 | 57 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 59 | 59 |
| 100.0 | 60 | 60 | 60 | 59 | 58 | 57 | 57 | 57 | 58 | 59 | 58 | 58 | 58 | 58 | 59 | 59 | 60 |
| 102.5 | 61 | 60 | 60 | 58 | 57 | 57 | 56 | 57 | 57 | 58 | 57 | 58 | 58 | 58 | 60 | 60 | 61 |
| 105.0 | 61 | 60 | 60 | 58 | 56 | 56 | 56 | 56 | 57 | 57 | 57 | 57 | 57 | 58 | 59 | 60 | 61 |
| 107.5 | 61 | 60 | 59 | 57 | 56 | 56 | 56 | 56 | 57 | 57 | 57 | 57 | 57 | 57 | 59 | 60 | 61 |
| 110.0 | 60 | 60 | 58 | 57 | 56 | 57 | 57 | 57 | 57 | 57 | 57 | 57 | 58 | 58 | 58 | 59 | 60 |
| 112.5 | 60 | 59 | 58 | 57 | 57 | 57 | 57 | 57 | 58 | 58 | 58 | 58 | 58 | 58 | 59 | 59 | 60 |
| 115.0 | 60 | 60 | 59 | 57 | 58 | 58 | 58 | 58 | 59 | 59 | 58 | 58 | 59 | 59 | 60 | 60 | 60 |
| 117.5 | 61 | 61 | 60 | 59 | 60 | 60 | 60 | 59 | 60 | 60 | 59 | 59 | 60 | 60 | 60 | 61 | 61 |
| 120.0 | 62 | 61 | 61 | 60 | 60 | 61 | 61 | 61 | 62 | 61 | 61 | 61 | 62 | 61 | 61 | 61 | 62 |
| 122.5 | 63 | 62 | 62 | 61 | 61 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 63 | 63 | 62 | 63 |
| 125.0 | 64 | 64 | 63 | 63 | 63 | 63 | 63 | 63 | 64 | 64 | 63 | 63 | 65 | 63 | 64 | 64 | 64 |
| 127.5 | 65 | 66 | 65 | 65 | 65 | 65 | 64 | 64 | 65 | 65 | 64 | 64 | 65 | 64 | 65 | 65 | 65 |
| 130.0 | 66 | 67 | 67 | 66 | 66 | 66 | 65 | 64 | 65 | 65 | 65 | 64 | 66 | 66 | 66 | 66 | 66 |
| 132.5 | 67 | 68 | 67 | 67 | 67 | 67 | 66 | 65 | 66 | 66 | 65 | 65 | 66 | 67 | 67 | 67 | 67 |
| 135.0 | 68 | 68 | 68 | 68 | 68 | 68 | 67 | 67 | 69 | 68 | 67 | 67 | 68 | 68 | 68 | 67 | 68 |
| 137.5 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 71 | 71 | 70 | 69 | 70 | 70 | 69 | 68 | 69 |
| 140.0 | 71 | 71 | 72 | 72 | 72 | 72 | 72 | 71 | 73 | 73 | 72 | 71 | 72 | 72 | 72 | 70 | 71 |
| 142.5 | 74 | 74 | 75 | 75 | 75 | 75 | 74 | 74 | 74 | 74 | 73 | 73 | 73 | 74 | 73 | 72 | 74 |
| 145.0 | 76 | 76 | 77 | 77 | 78 | 77 | 77 | 76 | 77 | 77 | 75 | 75 | 76 | 76 | 75 | 74 | 76 |
| 147.5 | 78 | 78 | 79 | 78 | 79 | 79 | 78 | 78 | 79 | 78 | 77 | 77 | 77 | 77 | 77 | 76 | 78 |
| 150.0 | 78 | 79 | 79 | 79 | 79 | 78 | 77 | 78 | 79 | 79 | 78 | 77 | 77 | 78 | 78 | 77 | 78 |
| 152.5 | 76 | 77 | 77 | 77 | 76 | 75 | 74 | 74 | 76 | 76 | 75 | 75 | 75 | 75 | 76 | 76 | 76 |
| 155.0 | 73 | 74 | 75 | 75 | 74 | 74 | 73 | 72 | 74 | 73 | 72 | 72 | 72 | 72 | 73 | 73 | 73 |
| 157.5 | 72 | 73 | 73 | 73 | 73 | 73 | 72 | 71 | 72 | 72 | 70 | 70 | 69 | 70 | 71 | 71 | 72 |
| 160.0 | 71 | 71 | 71 | 72 | 72 | 72 | 71 | 70 | 72 | 71 | 69 | 69 | 68 | 69 | 69 | 69 | 71 |
| 162.5 | 69 | 69 | 69 | 69 | 70 | 70 | 69 | 69 | 70 | 70 | 68 | 68 | 67 | 67 | 67 | 68 | 69 |
| 165.0 | 66 | 67 | 67 | 66 | 66 | 66 | 66 | 66 | 67 | 67 | 66 | 66 | 65 | 64 | 65 | 66 | 66 |
| 167.5 | 62 | 62 | 60 | 62 | 61 | 61 | 57 | 60 | 62 | 62 | 59 | 62 | 61 | 60 | 60 | 62 | 62 |
| 170.0 | 51 | 42 | 1 | 44 | 52 | 44 | 2 | 41 | 53 | 46 | 3 | 45 | 52 | 44 | 18 | 50 | 51 |
| 172.5 | 5 | 0 | 0 | 1 | 3 | 4 | 0 | 3 | 14 | 1 | 0 | 2 | 16 | 6 | 0 | 8 | 5 |
| 175.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 177.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 180.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



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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 = 28.0 Volts DC

Wattage = 75.0 Watts

Calibration Current = 2.679 Amperes

Luminous Flux = 1685 Lumens

Calibration Date = 2-17-2011 (calibrated by Labsphere – NIST traceable).

Continued.....

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TÜV SÜD Photometric Testing Information (continued)

Goniophotometer

The Goniophotometer is a 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: 105-A
- Voltage: 16.71 Volts DC
- Wattage: 150.0 Watts
- Calibration Current: 4.847 Amperes
- Luminous Intensity: 166.3 Candelas
- Calibration Date: 11-07-2011 (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 | SPH003 | weekly |
| Spectroradiometer | Labsphere CDS1100 | ATLE0048 | 9/7/2016 |
| Power Analyzer | Yokogawa WT210 | ATLE0058 | 3/7/2014 |
| Power Source | Chroma 61602 | AC003 | N/A |
| Thermometer | Fluke 52-II | ATLE0008 | 11/17/2013 |
| TÜV SÜD Goniophotometer System – contains the following: | | | |
| Goniophotometer | M.E. GONC01 | GON001 | weekly |
| Spectroradiometer | Gigahertz Optik P9801 | GIG001 | weekly |
| Power Analyzer | Yokogawa WT210 | ATLE0031 | 11/16/2013 |
| Power Source | Chroma 61602 | AC006 | N/A |

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