

Report of Test

LLI-14188-10D

Optolum "FineLine" Extruded Aluminum Luminaire. Cat No. FL-RD-L--358UOD-A072000.

Grey, round section aluminum housing, grey plastic end-caps (extent: 72.25" x 0.7" dia).

Curved profile opal lens forms luminous opening of 72" x 0.5" x 0.1" high.

24 x 3" long white PCBs marked "Optolum FineLine LO Rev A1", each has six SMT LEDs at 0.5" centers.

One remote "High Perfection Tech LP1090-24-GG-290 100-240Vac 47-63Hz" driver.

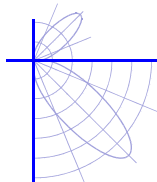
Tested horizontally in free air at 120 V, 60 Hz with beam directed to nadir.



Performance Summary

| | | | |
|--------------------|----------------|--------------------|----------------|
| Total Light Output | 555 lm | Min Power Factor | 0.56 @ 277 V |
| Luminaire Power | 15.2 W | Max THD(i)* | 27.5 % @ 277 V |
| Luminous Efficacy | 36.5 lm/W | SC along*, across* | 1.26 , 1.28 |
| CCT | 3250 K | SC Diagonal* | 1.38 |
| CIE(x,y) | (0.420, 0.397) | | |
| CRI | 85 | | |
| 0-60° Zonal Flux % | 75.0 % | | |

PREPARED FOR : Optolum Inc, Tempe AZ 85281



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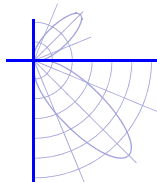
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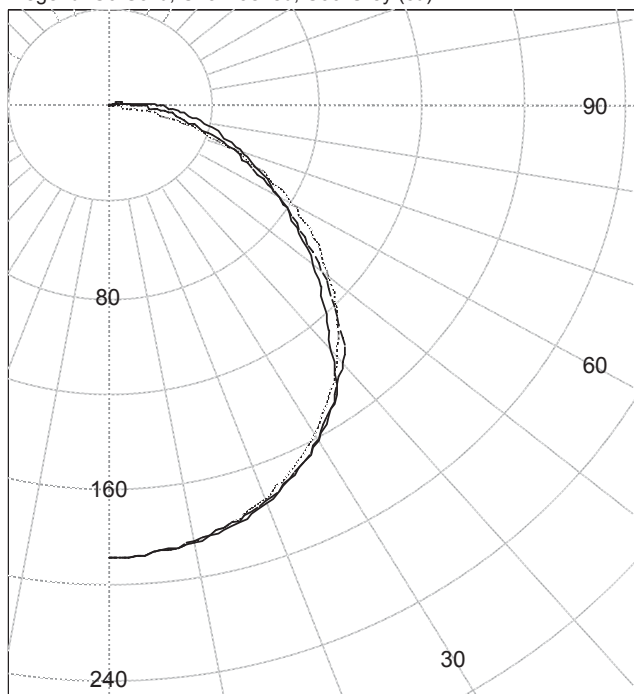
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Tested horizontally in free air at 120 V, 60 Hz with beam directed to nadir.

Legend: C0-Solid, C45-Dashed, C90-Grey (cd)



(Two plane symmetry)

C0-C90

INTENSITY SUMMARY (cd)

| Gamma | C-Plane | | | | | Flux (lm) |
|-------|---------|-------|-----|-------|-----|-----------|
| | C0 | C22.5 | C45 | C67.5 | C90 | |
| 0.0 | 188 | 188 | 188 | 188 | 188 | |
| 5.0 | 187 | 187 | 187 | 187 | 187 | 18 |
| 10.0 | 185 | 185 | 184 | 185 | 185 | |
| 15.0 | 182 | 181 | 181 | 180 | 180 | 51 |
| 20.0 | 177 | 177 | 176 | 174 | 175 | |
| 25.0 | 169 | 169 | 169 | 167 | 167 | 78 |
| 30.0 | 161 | 161 | 160 | 159 | 158 | |
| 35.0 | 151 | 151 | 150 | 149 | 148 | 94 |
| 40.0 | 133 | 136 | 140 | 138 | 137 | |
| 45.0 | 117 | 118 | 124 | 126 | 124 | 94 |
| 50.0 | 102 | 103 | 107 | 112 | 111 | |
| 55.0 | 88 | 88 | 90 | 97 | 96 | 82 |
| 60.0 | 75 | 75 | 75 | 80 | 81 | |
| 65.0 | 64 | 63 | 61 | 62 | 65 | 62 |
| 70.0 | 53 | 52 | 48 | 46 | 49 | |
| 75.0 | 44 | 42 | 37 | 32 | 32 | 40 |
| 80.0 | 35 | 33 | 27 | 20 | 17 | |
| 85.0 | 27 | 25 | 20 | 11 | 5 | 20 |
| 90.0 | 20 | 18 | 13 | 5 | 0 | |

ZONAL FLUX AND PERCENTAGES

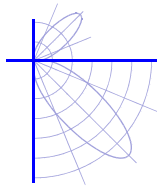
| Zone | Flux (lm) | % Lamp | % Luminaire |
|--------|-----------|--------|-------------|
| 0-30 | 146 | N / A | 26.4 |
| 0-40 | 240 | N / A | 43.3 |
| 0-60 | 416 | N / A | 75.0 |
| 0-90 | 538 | N / A | 97.0 |
| 40-90 | 298 | N / A | 53.7 |
| 60-90 | 122 | N / A | 22.0 |
| 90-180 | 17 | N / A | 3.0 |
| 0-180 | 555 | N / A | 100.0 |

Total Light Output = 555 lm

Signed:

P. Lawrance
Authorized Signatory

Date of test 25-Jul-2014
Date of report 20-Aug-2014



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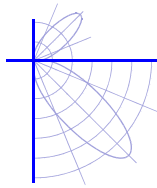
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Tested horizontally in free air at 120 V, 60 Hz with beam directed to nadir.

Intensity data (cd)

| Gamma | C-Plane | | | | |
|-------|---------|-------|-----|-------|-----|
| | C0 | C22.5 | C45 | C67.5 | C90 |
| 0.0 | 188 | 188 | 188 | 188 | 188 |
| 2.5 | 188 | 188 | 188 | 188 | 188 |
| 5.0 | 187 | 187 | 187 | 187 | 187 |
| 7.5 | 186 | 186 | 186 | 186 | 186 |
| 10.0 | 185 | 185 | 184 | 185 | 185 |
| 12.5 | 184 | 183 | 183 | 183 | 183 |
| 15.0 | 182 | 181 | 181 | 180 | 180 |
| 17.5 | 180 | 179 | 178 | 177 | 178 |
| 20.0 | 177 | 177 | 176 | 174 | 175 |
| 22.5 | 173 | 173 | 173 | 171 | 171 |
| 25.0 | 169 | 169 | 169 | 167 | 167 |
| 27.5 | 165 | 165 | 165 | 163 | 163 |
| 30.0 | 161 | 161 | 160 | 159 | 158 |
| 32.5 | 156 | 156 | 155 | 154 | 153 |
| 35.0 | 151 | 151 | 150 | 149 | 148 |
| 37.5 | 143 | 146 | 145 | 144 | 142 |
| 40.0 | 133 | 136 | 140 | 138 | 137 |
| 42.5 | 124 | 126 | 133 | 132 | 131 |
| 45.0 | 117 | 118 | 124 | 126 | 124 |
| 47.5 | 109 | 110 | 115 | 119 | 118 |
| 50.0 | 102 | 103 | 107 | 112 | 111 |
| 52.5 | 95 | 96 | 98 | 105 | 104 |
| 55.0 | 88 | 88 | 90 | 97 | 96 |
| 57.5 | 81 | 81 | 82 | 89 | 89 |
| 60.0 | 75 | 75 | 75 | 80 | 81 |
| 62.5 | 69 | 68 | 68 | 71 | 73 |
| 65.0 | 64 | 63 | 61 | 62 | 65 |
| 67.5 | 58 | 57 | 54 | 53 | 57 |
| 70.0 | 53 | 52 | 48 | 46 | 49 |
| 72.5 | 49 | 47 | 42 | 38 | 40 |
| 75.0 | 44 | 42 | 37 | 32 | 32 |
| 77.5 | 40 | 38 | 32 | 26 | 24 |
| 80.0 | 35 | 33 | 27 | 20 | 17 |
| 82.5 | 31 | 29 | 23 | 15 | 10 |
| 85.0 | 27 | 25 | 20 | 11 | 5 |
| 87.5 | 24 | 22 | 16 | 8 | 1 |
| 90.0 | 20 | 18 | 13 | 5 | 0 |





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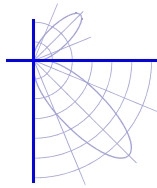
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| Gamma | C-Plane | | | | |
|-------|---------|-------|-----|-------|-----|
| | C0 | C22.5 | C45 | C67.5 | C90 |
| 90.0 | 20 | 18 | 13 | 5 | 0 |
| 92.5 | 17 | 15 | 10 | 3 | 0 |
| 95.0 | 14 | 13 | 8 | 2 | 0 |
| 97.5 | 12 | 10 | 6 | 1 | 0 |
| 100.0 | 10 | 8 | 4 | 1 | 0 |
| 102.5 | 8 | 6 | 3 | 1 | 0 |
| 105.0 | 6 | 5 | 3 | 1 | 0 |
| 107.5 | 5 | 5 | 3 | 1 | 0 |
| 110.0 | 5 | 4 | 3 | 1 | 0 |
| 112.5 | 5 | 4 | 3 | 1 | 0 |
| 115.0 | 4 | 4 | 3 | 1 | 0 |
| 117.5 | 4 | 4 | 2 | 0 | 0 |
| 120.0 | 4 | 4 | 2 | 0 | 0 |
| 122.5 | 4 | 3 | 2 | 0 | 0 |
| 125.0 | 4 | 3 | 2 | 0 | 0 |
| 127.5 | 3 | 3 | 2 | 0 | 0 |
| 130.0 | 3 | 3 | 1 | 0 | 0 |
| 132.5 | 3 | 2 | 1 | 0 | 0 |
| 135.0 | 2 | 2 | 1 | 0 | 0 |
| 137.5 | 2 | 2 | 1 | 0 | 0 |
| 140.0 | 2 | 1 | 0 | 0 | 0 |
| 142.5 | 1 | 1 | 0 | 0 | 0 |
| 145.0 | 1 | 1 | 0 | 0 | 0 |
| 147.5 | 0 | 0 | 0 | 0 | 0 |
| 150.0 | 0 | 0 | 0 | 0 | 0 |
| 152.5 | 0 | 0 | 0 | 0 | 0 |
| 155.0 | 0 | 0 | 0 | 0 | 0 |
| 157.5 | 0 | 0 | 0 | 0 | 0 |
| 160.0 | 0 | 0 | 0 | 0 | 0 |
| 162.5 | 0 | 0 | 0 | 0 | 0 |
| 165.0 | 0 | 0 | 0 | 0 | 0 |
| 167.5 | 0 | 0 | 0 | 0 | 0 |
| 170.0 | 0 | 0 | 0 | 0 | 0 |
| 172.5 | 0 | 0 | 0 | 0 | 0 |
| 175.0 | 0 | 0 | 0 | 0 | 0 |
| 177.5 | 0 | 0 | 0 | 0 | 0 |
| 180.0 | 0 | 0 | 0 | 0 | 0 |





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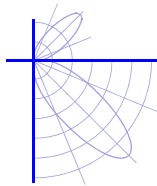
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Tested horizontally in free air at 120 V, 60 Hz with beam directed to nadir.

Coefficients Of Utilization * - Zonal Cavity Method
Effective Floor Cavity Reflectance 0.20

| RC RW | 80 | | | | 70 | | | | 50 | | | 30 | | | 10 | | | 0 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|
| | 70 | 50 | 30 | 10 | 70 | 50 | 30 | 10 | 50 | 30 | 10 | 50 | 30 | 10 | 50 | 30 | 10 | 0 |
| 0 | 118 | 118 | 118 | 118 | 115 | 115 | 115 | 115 | 109 | 109 | 109 | 104 | 104 | 104 | 99 | 99 | 99 | 97 |
| 1 | 107 | 102 | 98 | 94 | 104 | 100 | 96 | 92 | 95 | 91 | 88 | 90 | 88 | 85 | 86 | 84 | 82 | 80 |
| 2 | 98 | 89 | 82 | 76 | 95 | 87 | 80 | 75 | 83 | 77 | 73 | 79 | 75 | 71 | 76 | 72 | 69 | 66 |
| 3 | 89 | 78 | 70 | 63 | 86 | 76 | 69 | 62 | 73 | 66 | 61 | 70 | 64 | 60 | 67 | 62 | 58 | 56 |
| 4 | 81 | 69 | 60 | 54 | 79 | 68 | 59 | 53 | 65 | 58 | 52 | 62 | 56 | 51 | 60 | 54 | 50 | 48 |
| 5 | 75 | 62 | 53 | 46 | 73 | 61 | 52 | 46 | 58 | 51 | 45 | 56 | 49 | 44 | 54 | 48 | 43 | 41 |
| 6 | 69 | 56 | 47 | 40 | 67 | 55 | 46 | 40 | 53 | 45 | 39 | 51 | 44 | 39 | 49 | 43 | 38 | 36 |
| 7 | 64 | 51 | 42 | 36 | 62 | 50 | 41 | 35 | 48 | 40 | 35 | 46 | 39 | 34 | 44 | 39 | 34 | 32 |
| 8 | 60 | 46 | 38 | 32 | 58 | 45 | 37 | 32 | 44 | 36 | 31 | 42 | 36 | 31 | 41 | 35 | 30 | 29 |
| 9 | 56 | 42 | 34 | 29 | 54 | 42 | 34 | 28 | 40 | 33 | 28 | 39 | 32 | 28 | 38 | 32 | 28 | 26 |
| 10 | 52 | 39 | 31 | 26 | 51 | 38 | 31 | 26 | 37 | 30 | 26 | 36 | 30 | 25 | 35 | 29 | 25 | 23 |





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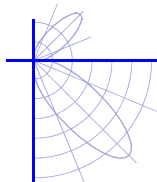
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LM-79 Performance Data

| | | | |
|-------------------|--|----------------|--------------|
| Spectral | CIE 1931 (x, y) ⁽¹⁾ | (0.420, 0.397) | |
| | CIE 1976 (u', v') ⁽¹⁾ | (0.243, 0.516) | |
| | Correlated Color Temperature (CCT) ⁽¹⁾ | 3250 K | |
| | Color Spatial Uniformity ⁽²⁾ | 0.0055 | |
| | Color Rendering Index (Ra) ⁽¹⁾ | 85 | |
| | Special CRI 9 (R ₉) ^{(1),(3)} | 28 | |
| | Distance from Planckian Locus (Duv) ^{(1),(3)} | -0.0004 | |
| | Scotopic/Photopic Ratio ^{(1),(3)} | 1.45 | |
| Electrical | Voltage | 120 V | (Setpoint 1) |
| | Frequency | 60 Hz | |
| | Current | 0.143 A | |
| | Power | 15.2 W | |
| | Power Factor | 0.89 | |
| | Current THD | 10.9 % | |
| | Voltage | 240 V | (Setpoint 2) |
| | Frequency | 60 Hz | |
| | Current | 0.122 A | |
| | Power | 16.5 W | |
| | Power Factor | 0.56 | |
| | Current THD | 27.5 % | |

Performance data in accordance with IESNA LM-79-08. Spectral calculations are for a CIE 2° observer
Photometric and spectral values were measured at Setpoint 1

- (1) Value is computed from the weighted average of the spatial measurements
- (2) Value is the maximum deviation of the spatial u' and v' measurements from the weighted average
- (3) Quantity is in addition to the scope of IESNA LM-79-08



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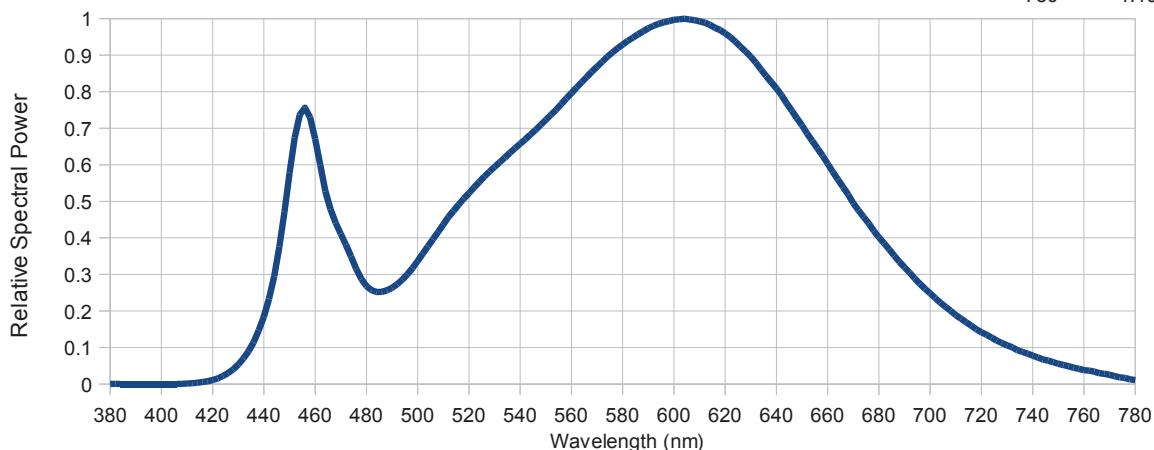
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LM-79 Performance Data

Summary Relative Spectral Irradiance Distribution (wavelength – nm, irradiance – relative to peak = 1)

| | | | | | | | |
|-----|----------|-----|----------|-----|----------|-----|----------|
| 380 | 1.80E-04 | 480 | 2.68E-01 | 580 | 9.29E-01 | 680 | 4.01E-01 |
| 385 | 1.40E-04 | 485 | 2.52E-01 | 585 | 9.53E-01 | 685 | 3.60E-01 |
| 390 | 2.31E-05 | 490 | 2.64E-01 | 590 | 9.73E-01 | 690 | 3.19E-01 |
| 395 | 1.74E-04 | 495 | 2.93E-01 | 595 | 9.88E-01 | 695 | 2.82E-01 |
| 400 | 7.79E-05 | 500 | 3.37E-01 | 600 | 9.97E-01 | 700 | 2.48E-01 |
| 405 | 7.75E-05 | 505 | 3.87E-01 | 605 | 9.99E-01 | 705 | 2.17E-01 |
| 410 | 1.22E-03 | 510 | 4.36E-01 | 610 | 9.93E-01 | 710 | 1.89E-01 |
| 415 | 4.40E-03 | 515 | 4.82E-01 | 615 | 9.79E-01 | 715 | 1.64E-01 |
| 420 | 1.10E-02 | 520 | 5.23E-01 | 620 | 9.60E-01 | 720 | 1.42E-01 |
| 425 | 2.59E-02 | 525 | 5.60E-01 | 625 | 9.30E-01 | 725 | 1.23E-01 |
| 430 | 5.35E-02 | 530 | 5.94E-01 | 630 | 8.96E-01 | 730 | 1.06E-01 |
| 435 | 1.02E-01 | 535 | 6.26E-01 | 635 | 8.52E-01 | 735 | 9.04E-02 |
| 440 | 1.84E-01 | 540 | 6.58E-01 | 640 | 8.09E-01 | 740 | 7.75E-02 |
| 445 | 3.35E-01 | 545 | 6.89E-01 | 645 | 7.58E-01 | 745 | 6.57E-02 |
| 450 | 5.78E-01 | 550 | 7.23E-01 | 650 | 7.08E-01 | 750 | 5.53E-02 |
| 455 | 7.47E-01 | 555 | 7.59E-01 | 655 | 6.55E-01 | 755 | 4.68E-02 |
| 460 | 6.71E-01 | 560 | 7.96E-01 | 660 | 6.03E-01 | 760 | 3.81E-02 |
| 465 | 5.03E-01 | 565 | 8.33E-01 | 665 | 5.49E-01 | 765 | 3.17E-02 |
| 470 | 4.11E-01 | 570 | 8.69E-01 | 670 | 4.95E-01 | 770 | 2.52E-02 |
| 475 | 3.32E-01 | 575 | 9.02E-01 | 675 | 4.49E-01 | 775 | 1.75E-02 |
| | | | | | | 780 | 1.10E-02 |



* The spectral power distribution combines the weighted spectral power distributions of all spatial measurements.



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LM-79 Performance Data

Spatial measurements (lower hemisphere)

| Vertical angle (deg) | CIE 1976 (u',v') coordinates | |
|----------------------|------------------------------|---------------------|
| | Horizontal 0 plane | Horizontal 90 plane |
| 0 | (0.244, 0.516) | (0.244, 0.516) |
| 10 | (0.244, 0.516) | (0.244, 0.516) |
| 20 | (0.244, 0.516) | (0.244, 0.516) |
| 30 | (0.244, 0.516) | (0.244, 0.516) |
| 40 | (0.244, 0.516) | (0.244, 0.517) |
| 50 | (0.240, 0.515) | (0.245, 0.517) |
| 60 | (0.238, 0.514) | (0.244, 0.517) |
| 70 | (0.238, 0.514) | (0.244, 0.517) |
| 80 | (0.239, 0.514) | I <= 10 % |
| 90 | (0.239, 0.515) | I <= 10 % |

Spatial measurements (upper hemisphere)

| Vertical angle (deg) | CIE 1976 (u',v') coordinates | |
|----------------------|------------------------------|---------------------|
| | Horizontal 0 plane | Horizontal 90 plane |
| 90 | (0.239, 0.515) | I <= 10 % |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |

Test procedure

All measurements were performed in an environmentally controlled laboratory employing suitable baffling to minimize stray light. The sample was mounted in its normal operating orientation on a rotating mirror goniophotometer and operated from a stabilized supply. The photometric output was monitored and measurements were performed once stability was achieved.

The goniophotometer was used to measure the spatial distribution of both luminous intensity and, in conjunction with a spectroradiometer, spectral irradiance. The distribution locus comprises points in two or more planes (as indicated in the table above) at no more than 10° vertical intervals. The CIE (x,y) coordinates and other derived metrics (CIE (u', v'), CCT and CRI) are calculated from the weighted sum (weighted for intensity and represented solid angle) of the measured spectral irradiances.

| | | | |
|--------------------|---------------|----------------------|-----------|
| Sample Orientation | Beam to nadir | Stabilization Time | 2.75 hour |
| | | Total Operation Time | 4.75 hour |

Equipment and uncertainties

LightLab International R80A C-gamma rotating mirror goniophotometer with a test distance of 8 m.

| | | | |
|-----------------------------|---------|-------------------|---------|
| Luminous Intensity | ± 4 % | Temperature | ± 1 °C |
| Luminous Flux | ± 4 % | Luminous Efficacy | ± 4.5 % |
| Horizontal, Vertical Angles | ± 0.25° | | |

PhotoResearch PR-670 spectroradiometer (380 - 780 nm., 2 nm. per pixel) measuring at a distance from the sample deemed greater than five times the maximum observed luminous opening dimension.

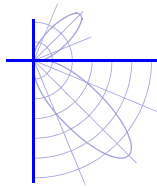
| | | | |
|--------------------------------|---------|-----------------------------|---------|
| CIE (x, y) coordinates | ± 0.003 | CCT | ± 100 K |
| CIE (u', v') coordinates | ± 0.002 | CRI (Ra) | ± 3 |
| Δ (u', v') Color difference | ± 0.001 | Scotopic / Photopic Ratio * | ± 0.02 |
| Relative Spectral Irradiance * | ± 2 % | R9 * | ± 3 |

Yokogawa WT210 power meter connected in circuit to the sample electrical supply

| | | | |
|---------------|---------|--------------|----------|
| Voltage | ± 0.5 % | Frequency * | ± 0.1 Hz |
| Current | ± 0.5 % | Power | ± 0.5 % |
| Current THD * | ± 3 % | Power Factor | ± 0.02 |

This report contains data that are not covered by the NVLAP accreditation. Quantities marked with * are not covered. IESNA LM-79-08 Calculator v4.7 (13th Sep 2013)





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Tested horizontally in free air at 120 V, 60 Hz with beam directed to nadir.

Test Distance: 8.0 metres

Test Temperature: 24.7 degrees Celsius

Significance: This laboratory has no control over the selection of samples to be tested. All testing is performed on the understanding that the significance of the report is limited to the extent that the test sample is representative of production units.

Test Procedure: Tested in accordance with the applicable sections of IESNA publication LM-79-08.

Notes: The luminous intensity values, and other derived quantities contained in this report are based on the absolute data, as tested.

Prorating the performance of the sample for the use of other component combinations (such as lamp / LED / Ballast / driver), or for use in different environmental conditions than that tested, may produce erroneous results.

This report is free of erasures and corrections.

Photometric intensity values are reported using the CIE Gamma coordinate system as defined in CIE publication number 121.

This report may contain data that are not covered by the NVLAP accreditation. Quantities marked with * are not covered.

Corrections have been applied to the photometric data to account for the sample luminous opening length exceeding 20% of the test distance.