NVLAP Lab Code 500089-0

| | |
|---|---|
| **Report Number:** | PL16737-002A |
| **Model:** | CDR8-B-ALS-9ACK-10V5-xx-UNV (4000K-MEDIUM) |
| **Date:** | 03/25/2022 |

# Cree Racine Engineering Services Testing Laboratory (RESTL) Photometric Testing and Evaluation Report

**Prepared For:**

Tammy Lehrmann

Cree Lighting

9201 Washington Avenue

Racine, WI 53406

**Prepared By:**

Meranda Hubbard, Photometric Test Technician

**Approved By:**

Jonathan Vollers, Technical Manager

NVLAP Lab Code 500089-0

| Product Information | |
|---|---|
| **Manufacturer** | Cree Lighting |
| **Model Number (SKU)** | CDR8-B-ALS-9ACK-10V5-xx-UNV (4000K-MEDIUM) |
| **Serial Number** | 16737-002 |
| **LED Type** | Smalite SL-ID2835FTA-31KAG |

| Product Description |
|---|
| CDR 8" Downlight luminare, white painted reflector, selectable CCT (4000K) and lumens (MEDIUM – 1500lm) |

| Driver Information (Where Applicable) |
|---|
| Integral |

| Length | Width | Height |
|---|---|---|
| 8.25” | 8.25” | 5.50” |

**Sample**

The following sample was submitted for evaluation

CREE LIGHTING
A COMPANY OF IDEAL INDUSTRIES, INC.

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| Key Photometric Data | Sphere Output | Goniophotometer | |
|---|---|---|---|
| Luminous Flux | 1648.1 | 1663 | lm |
| Efficacy | 108.86 | 112.36 | lm/W |
| Correlated Color Temperature (CCT) | 4053 | K | |
| Color Rendering Index (CRI) | 93 | | |
| $R_9$ | 69 | | |
| Duv | 0.0028 | | |
| S/P Ratio** | 1.81 | | |
| CIE Type | Direct | | |

| | Sphere | | Goniophotometer | | |
|---|---|---|---|---|---|
| **Electrical Measurements** | **120V** | **277V** | **120V** | **277V** | |
| Input Wattage | 15.14 | - | 14.80 | 15.26 | W |
| Input Current | 0.127 | - | 0.124 | 0.057 | A |
| Input Voltage | 120.10 | - | 120.16 | 277.37 | V |
| Power Factor | 0.996 | - | 0.995 | 0.960 | |
| Off-State Power | 0 | - | 0 | 0 | W |
| Total Harmonic Distortion (Voltage) | 0.16 | - | 0.17 | 0.10 | % |
| Total Harmonic Distortion (Amperage) | 5.91 | - | 5.94 | 14.24 | % |

**Note:** All photometric measurements taken at 120VAC.

| Key Test Parameters | Sphere Output | Goniophotometer | |
|---|---|---|---|
| Stabilization Time | 49 | 30 | min |
| Total Operating Time (Stabilization + Test) | 59 | 50 | min |
| Ambient Temperature | 24.28 | 24.4 | ˚C |

**Spacing Criteria**

| | |
|---|---|
| **Spacing Criterion (0 - 180)** | 1.18 |
| **Spacing Criterion (90 - 270)** | 1.18 |
| **Spacing Criterion (Diagonal)** | 1.24 |

NVLAP Lab Code 500089-0

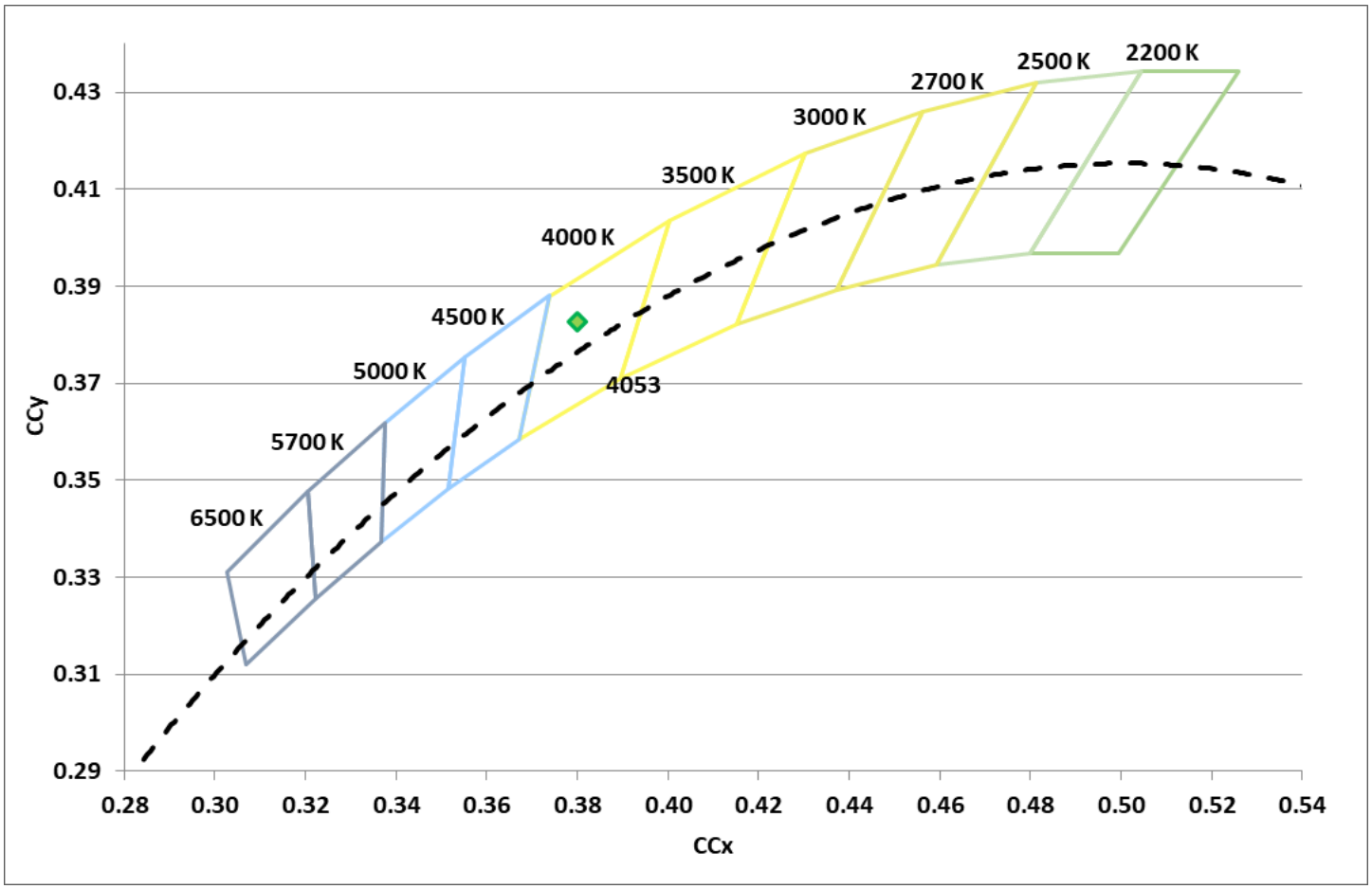
## Chromaticity Coordinates

| x | y | u | v | u' | v' | Duv |
|---|---|---|---|---|---|---|
| 0.3800 | 0.3826 | 0.2225 | 0.3360 | 0.2225 | 0.5041 | 0.0028 |

## Color Rendering Index Details

| Ra | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | R13 | R14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 93 | 94 | 96 | 97 | 93 | 92 | 93 | 95 | 88 | 69 | 89 | 93 | 69 | 94 | 98 |

## Chromaticity Diagram



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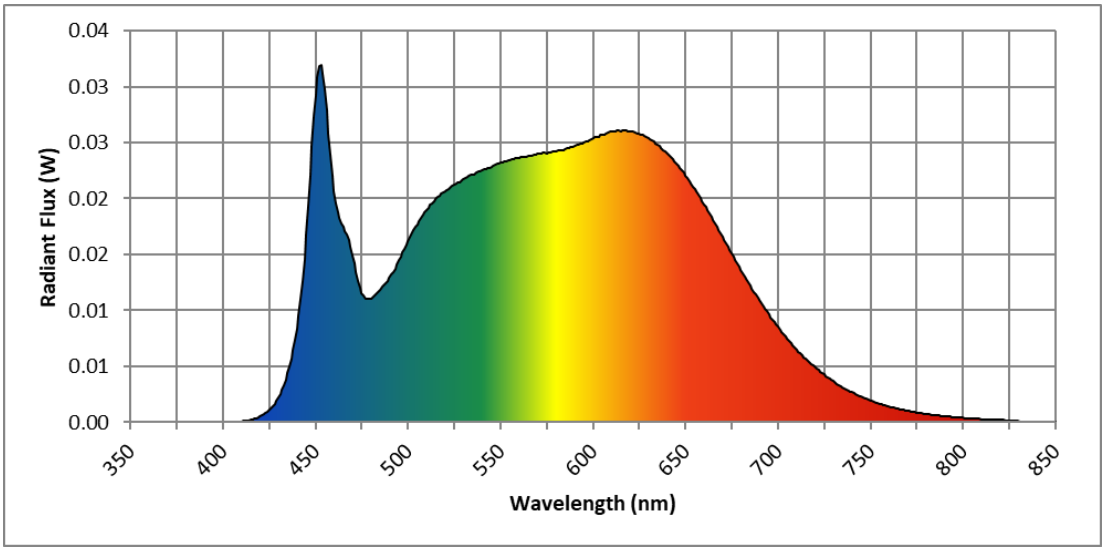
## Spectral Distribution

| λ(nm) | W/nm | λ(nm) | W/nm | λ(nm) | W/nm |
|---|---|---|---|---|---|
| 360 | 0.000014 | 530 | 0.021713 | 700 | 0.008510 |
| 370 | 0.000009 | 540 | 0.022477 | 710 | 0.006491 |
| 380 | 0.000058 | 550 | 0.023198 | 720 | 0.004949 |
| 390 | 0.000006 | 560 | 0.023637 | 730 | 0.003661 |
| 400 | 0.000030 | 570 | 0.023966 | 740 | 0.002663 |
| 410 | 0.000080 | 580 | 0.024230 | 750 | 0.001943 |
| 420 | 0.000503 | 590 | 0.024736 | 760 | 0.001405 |
| 430 | 0.002226 | 600 | 0.025395 | 770 | 0.001016 |
| 440 | 0.008360 | 610 | 0.025951 | 780 | 0.000742 |
| 450 | 0.029308 | 620 | 0.026014 | 790 | 0.000528 |
| 460 | 0.020628 | 630 | 0.025351 | 800 | 0.000382 |
| 470 | 0.014896 | 640 | 0.024040 | 810 | 0.000274 |
| 480 | 0.011074 | 650 | 0.022031 | 820 | 0.000195 |
| 490 | 0.012903 | 660 | 0.019497 | 830 | 0.000142 |
| 500 | 0.016198 | 670 | 0.016617 | | |
| 510 | 0.018937 | 680 | 0.013617 | | |
| 520 | 0.020668 | 690 | 0.010892 | | |

| | | |
|---|---|---|
| **Dominant Wavelength** | 577 | nm |
| **Peak Wavelength** | 453 | nm |

**Spectral Power Distribution (W/nm)**



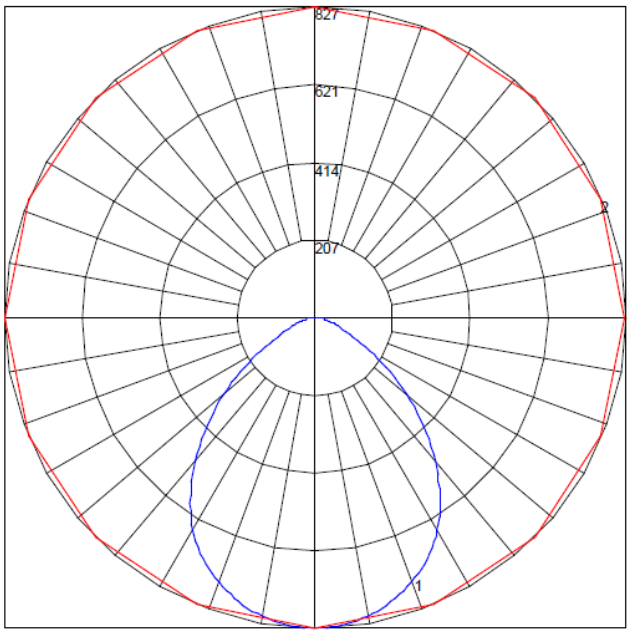
**Zonal Lumen Summary**

| Zone | Lumens | % of Total | Zone | Lumens |
|---|---|---|---|---|
| 0-20 | 298.63 | 18.0 | 0-10 | 78.0 |
| 0-30 | 623.61 | 37.5 | 10-20 | 220.6 |
| 0-40 | 984.36 | 59.2 | 20-30 | 325.0 |
| 0-60 | 1505.08 | 90.5 | 30-40 | 360.8 |
| 0-80 | 1648.12 | 99.1 | 40-50 | 313.7 |
| 0-90 | 1662.95 | 100.0 | 50-60 | 207.0 |
| 10-90 | 1584.95 | 95.3 | 60-70 | 95.9 |
| 20-40 | 685.73 | 41.2 | 70-80 | 47.2 |
| 20-50 | 999.45 | 60.1 | 80-90 | 14.8 |
| 40-70 | 616.59 | 37.1 | 90-100 | 0.0 |
| 60-80 | 143.03 | 8.6 | 100-110 | 0.0 |
| 70-80 | 47.17 | 2.8 | 110-120 | 0.0 |
| 80-90 | 14.84 | 0.9 | 120-130 | 0.0 |
| 90-110 | 0.0 | 0.0 | 130-140 | 0.0 |
| 90-120 | 0.0 | 0.0 | 140-150 | 0.0 |
| 90-130 | 0.0 | 0.0 | 150-160 | 0.0 |
| 90-150 | 0.0 | 0.0 | 160-170 | 0.0 |
| 90-180 | 0.0 | 0.0 | 170-180 | 0.0 |
| 110-180 | 0.0 | 0.0 | | |
| Total | **1662.95** | **100** | | |

**Luminance Data (Cd./Sq.M)**

| Average in Degrees | Average 0-Deg | Average 45-Deg | Average 90-Deg |
|---|---|---|---|
| 45 | 15925 | 15928 | 15905 |
| 55 | 11092 | 11079 | 11107 |
| 65 | 5981 | 5977 | 5983 |
| 75 | 4761 | 4766 | 4743 |
| 85 | 4217 | 4224 | 4214 |

## Candela Plots




Maximum Candela = 827.484 Located At Horizontal Angle = 67.5, Vertical Angle = 1
# 1 - Vertical Plane Through Horizontal Angles (67.5 - 247.5) (Through Max. Cd.)
# 2 - Horizontal Cone Through Vertical Angle (1) (Through Max. Cd.)

## Coefficients of Utilization

| RC | 80 | | | | 70 | | | | 50 | | | 30 | | | 10 | | | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RW | 70 | 50 | 30 | 10 | 70 | 50 | 30 | 10 | 50 | 30 | 10 | 50 | 30 | 10 | 50 | 30 | 10 | 0 |
| 0 | 119 | 119 | 119 | 119 | 116 | 116 | 116 | 116 | 111 | 111 | 111 | 106 | 106 | 106 | 102 | 102 | 102 | 100 |
| 1 | 111 | 107 | 103 | 100 | 108 | 105 | 101 | 98 | 100 | 98 | 95 | 97 | 94 | 93 | 93 | 91 | 90 | 88 |
| 2 | 102 | 95 | 90 | 85 | 100 | 94 | 88 | 84 | 90 | 86 | 82 | 87 | 83 | 80 | 84 | 81 | 78 | 76 |
| 3 | 95 | 86 | 79 | 73 | 92 | 84 | 78 | 72 | 81 | 76 | 71 | 79 | 74 | 70 | 76 | 72 | 69 | 67 |
| 4 | 88 | 77 | 70 | 64 | 86 | 76 | 69 | 63 | 74 | 67 | 62 | 71 | 66 | 62 | 69 | 65 | 61 | 59 |
| 5 | 81 | 70 | 62 | 56 | 79 | 69 | 61 | 56 | 67 | 60 | 55 | 65 | 59 | 55 | 63 | 58 | 54 | 52 |
| 6 | 76 | 64 | 56 | 50 | 74 | 63 | 55 | 50 | 61 | 54 | 49 | 59 | 53 | 49 | 58 | 53 | 48 | 47 |
| 7 | 70 | 58 | 50 | 45 | 69 | 57 | 50 | 45 | 56 | 49 | 44 | 55 | 48 | 44 | 53 | 48 | 44 | 42 |
| 8 | 66 | 54 | 46 | 40 | 64 | 53 | 45 | 40 | 52 | 45 | 40 | 50 | 44 | 40 | 49 | 44 | 40 | 38 |
| 9 | 62 | 49 | 42 | 37 | 60 | 49 | 42 | 37 | 48 | 41 | 36 | 47 | 41 | 36 | 46 | 40 | 36 | 34 |
| 10 | 58 | 46 | 38 | 34 | 57 | 45 | 38 | 33 | 44 | 38 | 33 | 43 | 37 | 33 | 43 | 37 | 33 | 31 |

## Candela Tabulations

| | 0 | 22.5 | 45 | 67.5 | 90 |
|---|---|---|---|---|---|
| 0 | 827.1 | 827.1 | 827.1 | 827.1 | 827.1 |
| 1 | 826.4 | 825.5 | 827.2 | 827.5 | 827.2 |
| 2 | 825.7 | 825.6 | 826.0 | 826.1 | 826.3 |
| 3 | 824.5 | 824.3 | 824.8 | 825.8 | 825.7 |
| 4 | 822.8 | 823.0 | 824.0 | 824.0 | 823.9 |
| 5 | 822.4 | 821.2 | 821.5 | 822.5 | 822.5 |
| 6 | 818.7 | 818.9 | 820.4 | 820.0 | 821.1 |
| 7 | 816.9 | 816.8 | 816.4 | 817.6 | 817.4 |
| 8 | 814.4 | 814.1 | 814.6 | 815.2 | 815.4 |
| 9 | 810.5 | 810.8 | 811.6 | 811.5 | 812.6 |
| 10 | 807.3 | 806.9 | 807.8 | 808.3 | 807.3 |
| 11 | 803.6 | 803.1 | 803.5 | 803.8 | 804.7 |
| 12 | 799.3 | 799.4 | 799.8 | 800.3 | 800.2 |
| 13 | 794.0 | 794.2 | 795.0 | 795.4 | 795.6 |
| 14 | 789.9 | 789.1 | 789.5 | 789.4 | 789.4 |
| 15 | 782.8 | 782.0 | 783.4 | 783.7 | 784.1 |
| 16 | 775.9 | 775.6 | 776.8 | 777.2 | 777.5 |
| 17 | 769.5 | 769.2 | 770.4 | 770.0 | 770.1 |
| 18 | 762.8 | 762.2 | 763.4 | 763.8 | 764.6 |
| 19 | 756.4 | 755.8 | 756.5 | 756.7 | 756.8 |
| 20 | 748.8 | 748.1 | 749.6 | 749.2 | 749.7 |
| 21 | 739.9 | 739.9 | 740.7 | 741.1 | 741.5 |
| 22 | 732.2 | 732.8 | 732.7 | 734.3 | 733.0 |
| 23 | 724.9 | 724.2 | 725.3 | 725.3 | 725.0 |
| 24 | 715.0 | 716.7 | 716.2 | 717.4 | 716.8 |
| 25 | 707.0 | 707.0 | 706.8 | 707.5 | 706.7 |
| 26 | 696.9 | 698.3 | 698.5 | 698.6 | 698.9 |
| 27 | 687.6 | 687.6 | 687.7 | 688.5 | 688.0 |
| 28 | 675.6 | 675.9 | 677.1 | 677.0 | 677.5 |
| 29 | 664.4 | 664.2 | 664.4 | 665.1 | 664.9 |
| 30 | 652.3 | 651.6 | 653.3 | 652.4 | 652.4 |
| 31 | 638.6 | 638.5 | 639.5 | 639.2 | 639.9 |
| 32 | 624.2 | 623.6 | 625.0 | 625.3 | 624.3 |
| 33 | 610.5 | 609.1 | 610.4 | 610.3 | 610.6 |
| 34 | 594.3 | 594.8 | 595.9 | 595.9 | 595.3 |
| 35 | 578.8 | 578.2 | 578.8 | 579.9 | 579.4 |
| 36 | 561.6 | 562.3 | 562.7 | 563.6 | 563.1 |

## Candela Tabulations (Continued)

| | 0 | 22.5 | 45 | 67.5 | 90 |
|---|---|---|---|---|---|
| 37 | 546.2 | 546.4 | 546.4 | 548.0 | 547.2 |
| 38 | 529.5 | 530.1 | 530.2 | 531.1 | 530.5 |
| 39 | 512.0 | 512.9 | 511.8 | 513.7 | 513.6 |
| 40 | 495.1 | 495.6 | 495.6 | 496.2 | 495.9 |
| 41 | 478.3 | 479.1 | 478.9 | 479.8 | 480.2 |
| 42 | 460.9 | 461.4 | 461.2 | 461.4 | 462.0 |
| 43 | 443.4 | 443.3 | 443.2 | 443.8 | 443.8 |
| 44 | 426.0 | 425.8 | 426.8 | 426.2 | 426.7 |
| 45 | 409.0 | 408.4 | 409.1 | 408.5 | 408.5 |
| 46 | 389.8 | 389.5 | 390.4 | 390.0 | 390.4 |
| 47 | 372.0 | 371.0 | 372.7 | 372.0 | 372.2 |
| 48 | 353.7 | 353.2 | 354.5 | 354.2 | 354.1 |
| 49 | 335.7 | 334.8 | 335.9 | 336.2 | 335.4 |
| 50 | 316.4 | 316.0 | 316.6 | 317.3 | 316.5 |
| 51 | 299.1 | 299.1 | 299.5 | 299.9 | 299.2 |
| 52 | 281.6 | 281.4 | 281.3 | 282.3 | 281.9 |
| 53 | 263.8 | 263.7 | 263.3 | 264.5 | 264.1 |
| 54 | 247.1 | 247.0 | 246.7 | 247.6 | 247.1 |
| 55 | 231.1 | 231.2 | 230.8 | 231.3 | 231.4 |
| 56 | 214.4 | 214.7 | 214.6 | 214.6 | 215.2 |
| 57 | 198.6 | 198.5 | 198.6 | 198.7 | 199.0 |
| 58 | 183.3 | 183.4 | 184.0 | 183.5 | 183.8 |
| 59 | 168.7 | 168.5 | 169.0 | 168.4 | 168.4 |
| 60 | 153.6 | 153.1 | 153.9 | 153.4 | 153.7 |
| 61 | 139.8 | 139.4 | 140.2 | 139.9 | 139.8 |
| 62 | 126.5 | 126.1 | 126.9 | 126.8 | 126.7 |
| 63 | 113.8 | 113.1 | 113.6 | 114.0 | 113.7 |
| 64 | 102.0 | 101.6 | 101.9 | 102.5 | 102.0 |
| 65 | 91.8 | 91.5 | 91.8 | 92.2 | 91.8 |
| 66 | 82.3 | 82.1 | 82.4 | 83.0 | 83.0 |
| 67 | 74.9 | 74.6 | 74.9 | 75.4 | 75.5 |
| 68 | 68.9 | 68.9 | 69.1 | 69.6 | 69.5 |
| 69 | 64.4 | 64.4 | 64.5 | 64.6 | 64.5 |
| 70 | 60.7 | 60.7 | 60.7 | 60.5 | 60.6 |
| 71 | 57.4 | 57.5 | 57.5 | 57.3 | 57.4 |
| 72 | 54.3 | 54.3 | 54.3 | 54.0 | 54.1 |
| 73 | 50.9 | 51.0 | 51.0 | 50.9 | 50.8 |

## Candela Tabulations (Continued)

| | 0 | 22.5 | 45 | 67.5 | 90 |
|---|---|---|---|---|---|
| 74 | 48.0 | 48.0 | 48.0 | 47.7 | 47.7 |
| 75 | 44.8 | 44.7 | 44.8 | 44.7 | 44.6 |
| 76 | 41.6 | 41.5 | 41.6 | 41.5 | 41.4 |
| 77 | 38.4 | 38.3 | 38.4 | 38.4 | 38.3 |
| 78 | 35.3 | 35.2 | 35.2 | 35.3 | 35.2 |
| 79 | 32.1 | 32.0 | 32.1 | 32.1 | 32.0 |
| 80 | 28.9 | 28.8 | 28.9 | 29.0 | 28.9 |
| 81 | 25.8 | 25.8 | 25.8 | 25.8 | 25.8 |
| 82 | 22.6 | 22.6 | 22.7 | 22.7 | 22.7 |
| 83 | 19.6 | 19.5 | 19.5 | 19.5 | 19.6 |
| 84 | 16.4 | 16.5 | 16.5 | 16.5 | 16.5 |
| 85 | 13.4 | 13.4 | 13.4 | 13.3 | 13.3 |
| 86 | 10.3 | 10.3 | 10.3 | 10.2 | 10.3 |
| 87 | 7.2 | 7.3 | 7.3 | 7.1 | 7.1 |
| 88 | 4.2 | 4.3 | 4.4 | 4.4 | 4.3 |
| 89 | 2.2 | 2.0 | 2.3 | 2.5 | 2.6 |
| 90 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Integrating Sphere Equipment List**

| Description | Manufacturer | Model | Serial Number |
|---|---|---|---|
| 2M Sphere | Labsphere | ILLUMIA PLUS 3020-300 4PI | 1109184535 |
| CCD Array Spectrometer | Labsphere | MC-9801:3683L | 98011077 |
| Programmable AC Source | Chroma | 61602 | 616020003699 |
| Power Analyzer | Xitron | XT2640 | 264AD2006001 |

**Goniophotometer Equipment List**

| Description | Manufacturer | Model | Serial Number |
|---|---|---|---|
| AC Power Source | Chroma | 61602 | 616020002300 |
| Type C Goniophotometer | LSI / UL | 6440T | 6440PN2028 |
| Spectroradiometer | Gooch & Housego | 770VIS/NIR | 12415189 |
| Spectrometer | Inphora, Inc | PDET 31 | 130627 |
| Power Meter | Xitron | XT2640 | M20140823 |

**Test Methods Used:**

| Title | Description |
|---|---|
| ANSI C82.77:2002 | Harmonic Emission Limits- Related Power Quality Reqt's for Lighting Equipment |
| CIE Pub. 13.3:1995 | Method of Measuring and Specifying Color Rendering of Light Sources |
| CIE Pub. 15:2004 | Colorimetry |
| IES LM-58:1994 | Spectroradiometric Measurements |
| IES LM-79:2008 | Electrical and Photometric Measurements of Solid-State Lighting Products |

**Reference Standard Used:**

| Equipment | Description |
|---|---|
| 3m Sphere | Tungsten Halogen Omni-Directional 35W Calibration Lamp, Serial Number E4 |
| Type C Goniophotometer and Spectrometer | Tungsten Halogen Omni-Directional 500W Calibration Lamp, Serial Numbers 16C293. 16C294, 16C295. For color calibration of spectrometer, 13C074. |

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This report must not be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the federal government.

The results contained in this report pertain only to the tested sample.

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*Items marked with a single asterisk are not covered by the NVLAP accreditation.

In the event that the recorded temperature is outside of 25 ± 1˚C, this is considered a non-standard condition.

This report may contain data not covered by the NVLAP accreditation, and are identified with **.

In the event that testing is subcontracted, or subcontracted equipment was used, test results in this report marked with the symbol *, or noted as “Sphere” or “Integrating Sphere” or “Goniophotometer,” were performed by the subcontracted laboratory identified in the equipment list of this report.

**Additional Comments:**

The photos below are intended to show the orientation and fixturing/set-up of the units under test. These are critical to understanding the results of the test given the sensitivity of many products and measurement systems to orientation and set-up considerations, and also for reproducing the conditions of the test.

| Goniophotometer | Integrating Sphere |
|---|---|
| | |

**Document Revision History:**

Each subsequent revision of this report replaces the preceding report.

| Date | Rev | DCN # | Change at the time of this test | By | Approval |
|---|---|---|---|---|---|
| 03/25/2022 | A | DMS | Origination | M. Hubbard | J. Vollers |