

Cooper Lighting Solutions Photometric Lab  
1121 Highway 74 South  
Peachtree City, GA 30269



Scaled data based on original data using  
LM-79-2019 Approved Method: Electrical and Photometric Measurements of Solid-  
State Lighting Products

Test Report Prepared for  
Cooper Lighting Solutions

Brand: FAIL-SAFE

Report Number: P1356687

Luminaire Tested: 1ASL4-10HE-2-65-UNV

Issue Date: 2/17/2026

**Test Information**

Test Method: LM-79-2019  
Report Number: P1356687  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G2-2511-597-7)  
Test Lab: INNOVATION CENTER  
Issue Date: 2/17/2026  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: FAIL-SAFE  
Catalog Number: 1ASL4-10HE-2-65-UNV  
Description: 1FT 1000 LUMEN PER FOOT 4ASL LED LUMINAIRE WITH OPL LENS AND 6500K LEDS 2 ROW  
Light Source: -  
Ballast/Driver: -

**Summary**

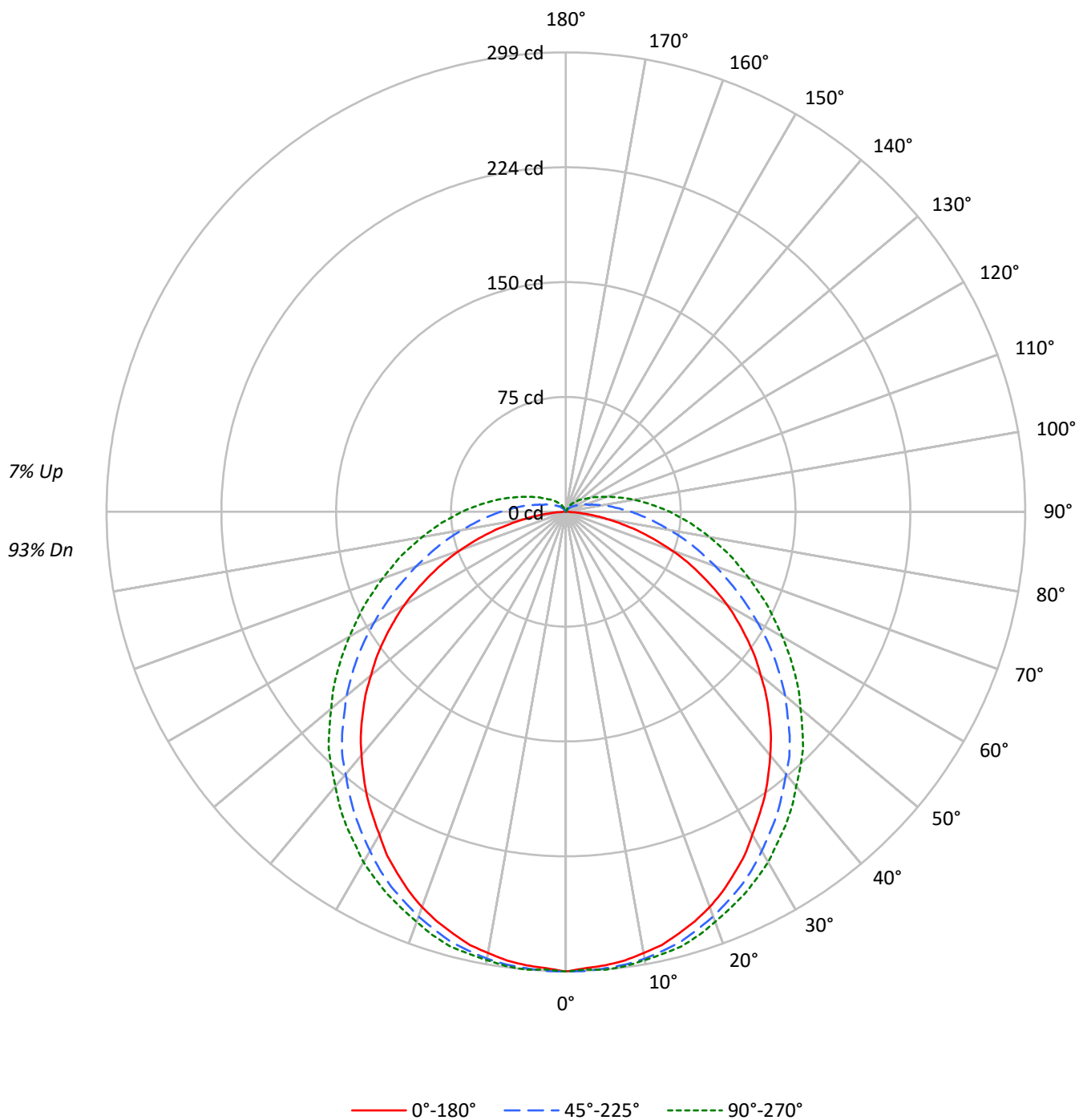
Lumens per Lamp: N/A  
Luminaire Lumens: 1027.0 lumens  
Efficiency: N/A  
Efficacy: 123.7 lumens/watt  
Spacing Criteria (0/90/45): 1.21 / 1.3 / 1.4  
Luminous Opening: Rectangular w/ Sides (W: 0.33' x L: 0.98' x H: 0.1')  
CIE Type: Direct

Input Watts (W): 8.3  
Input Voltage (V): NR  
Input Current (Ain): NR  
Voltage Rise (V): NR  
Power Factor: NR  
Total Harmonic Distortion (THDi): NR  
Frequency (hertz): 60  
Stabilization Time: NR  
Operation Time: NR  
Ambient Temperature (°C): NR  
Test Distance: 24 FT

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CATALOG NUMBER: 1ASL4-10HE-2-65-UNV

### Luminous Intensity Polar Plot





TEST NUMBER: P1356687

CATALOG NUMBER: 1ASL4-10HE-2-65-UNV

### COEFFICIENT OF UTILIZATION - ZONAL CAVITY METHOD:

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |  |  |   |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|--|--|---|
| RF  | 20  |     |     |     | 20  |     |     |     | 20  |     |     |     | 20  |     |    |    | 20 |    |  |  |   |
| 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  |  |  |   |
| RCR |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |  |  |   |
| 0   | 117 | 117 | 117 | 117 | 114 | 114 | 114 | 114 | 107 | 107 | 107 | 101 | 101 | 101 | 95 | 95 | 95 | 93 |  |  |   |
| 1   | 105 | 100 | 95  | 90  | 102 | 97  | 92  | 88  | 91  | 87  | 84  | 86  | 83  | 80  | 81 | 79 | 77 | 74 |  |  |   |
| 2   | 95  | 86  | 79  | 72  | 92  | 84  | 77  | 71  | 79  | 73  | 68  | 74  | 70  | 65  | 70 | 66 | 63 | 60 |  |  |   |
| 3   | 86  | 75  | 66  | 59  | 83  | 73  | 65  | 58  | 69  | 62  | 56  | 65  | 59  | 55  | 62 | 57 | 53 | 50 |  |  |   |
| 4   | 79  | 66  | 57  | 50  | 76  | 64  | 56  | 49  | 61  | 54  | 48  | 58  | 51  | 46  | 55 | 49 | 45 | 42 |  |  |   |
| 5   | 72  | 59  | 50  | 43  | 70  | 57  | 49  | 42  | 54  | 47  | 41  | 52  | 45  | 40  | 49 | 43 | 39 | 36 |  |  |   |
| 6   | 67  | 53  | 44  | 37  | 64  | 52  | 43  | 37  | 49  | 41  | 36  | 47  | 40  | 35  | 44 | 39 | 34 | 32 |  |  |   |
| 7   | 62  | 48  | 39  | 33  | 60  | 47  | 38  | 32  | 45  | 37  | 32  | 43  | 36  | 31  | 41 | 35 | 30 | 28 |  |  |   |
| 8   | 58  | 44  | 35  | 29  | 56  | 43  | 34  | 29  | 41  | 33  | 28  | 39  | 32  | 28  | 37 | 31 | 27 | 25 |  |  |   |
| 9   | 54  | 40  | 32  | 26  | 52  | 39  | 31  | 26  | 37  | 30  | 25  | 36  | 29  | 25  | 34 | 29 | 24 | 22 |  |  |   |
| 10  | 50  | 37  | 29  | 24  | 49  | 36  | 28  | 23  | 35  | 28  | 23  | 33  | 27  | 22  | 32 | 26 | 22 | 20 |  |  |   |

**AVERAGE LUMINANCE (cd/sqm):**

|     | 0°   | 45°  | 90°  |
|-----|------|------|------|
| 0°  | 9867 | 9867 | 9867 |
| 5°  | 9719 | 9623 | 9641 |
| 10° | 9585 | 9401 | 9404 |
| 15° | 9431 | 9164 | 9218 |
| 20° | 9251 | 8880 | 8952 |
| 25° | 9000 | 8604 | 8725 |
| 30° | 8707 | 8289 | 8497 |
| 35° | 8460 | 7999 | 8235 |
| 40° | 8181 | 7689 | 7957 |
| 45° | 7891 | 7412 | 7757 |
| 50° | 7540 | 7065 | 7454 |
| 55° | 7183 | 6691 | 7219 |
| 60° | 6761 | 6273 | 6963 |
| 65° | 6157 | 5879 | 6770 |
| 70° | 5477 | 5502 | 6589 |
| 75° | 4551 | 5181 | 6529 |
| 80° | 3234 | 4869 | 6508 |
| 85° | 1605 | 4711 | 6696 |

**MAXIMUM LUMINANCE 45°-90°:**

Horizontal Angle: 0°

Vertical Angle:  $45^\circ$

Luminance: 7891 cd/sqm

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**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 28.4   | 2.8       |
| 10°-20°   | 81.5   | 7.9       |
| 20°-30°   | 123.6  | 12.0      |
| 30°-40°   | 149.5  | 14.6      |
| 40°-50°   | 157.6  | 15.3      |
| 50°-60°   | 147.1  | 14.3      |
| 60°-70°   | 121.4  | 11.8      |
| 70°-80°   | 88.1   | 8.6       |
| 80°-90°   | 55.6   | 5.4       |
| 90°-100°  | 33.2   | 3.2       |
| 100°-110° | 19.0   | 1.9       |
| 110°-120° | 10.8   | 1.1       |
| 120°-130° | 6.2    | 0.6       |
| 130°-140° | 3.3    | 0.3       |
| 140°-150° | 1.5    | 0.1       |
| 150°-160° | 0.3    | 0.0       |
| 160°-170° | 0.0    | 0.0       |
| 170°-180° | 0.0    | 0.0       |
| 0°-30°    | 233.5  | 22.7      |
| 0°-40°    | 382.9  | 37.3      |
| 0°-60°    | 687.6  | 67.0      |
| 0°-90°    | 952.7  | 92.8      |
| 90°-120°  | 63.1   | 6.1       |
| 90°-150°  | 74.0   | 7.2       |
| 90°-180°  | 74.0   | 7.2       |
| 0°-180°   | 1027.0 | 100.0     |

**CANDELA DISTRIBUTION:**

|      | 0°  | 22.5° | 45° | 67.5° | 90° | Flux |
|------|-----|-------|-----|-------|-----|------|
| 0°   | 299 | 299   | 299 | 299   | 299 |      |
| 5°   | 296 | 299   | 298 | 298   | 299 | 28   |
| 15°  | 284 | 288   | 290 | 291   | 293 | 80   |
| 25°  | 260 | 263   | 269 | 273   | 275 | 120  |
| 35°  | 226 | 231   | 240 | 246   | 249 | 141  |
| 45°  | 187 | 195   | 206 | 214   | 218 | 144  |
| 55°  | 144 | 152   | 166 | 177   | 182 | 129  |
| 65°  | 97  | 107   | 123 | 138   | 145 | 96   |
| 75°  | 50  | 63    | 86  | 104   | 111 | 52   |
| 85°  | 9   | 29    | 55  | 73    | 81  | 12   |
| 90°  | 0   | 18    | 42  | 60    | 68  | 0    |
| 95°  | 0   | 11    | 32  | 49    | 56  | 0    |
| 105° | 0   | 4     | 18  | 31    | 36  | 0    |
| 115° | 0   | 2     | 10  | 19    | 23  | 0    |
| 125° | 0   | 1     | 7   | 12    | 14  | 0    |
| 135° | 0   | 0     | 4   | 8     | 9   | 0    |
| 145° | 0   | 0     | 2   | 5     | 6   | 0    |
| 155° | 0   | 0     | 0   | 1     | 2   | 0    |
| 165° | 0   | 0     | 0   | 0     | 0   | 0    |
| 175° | 0   | 0     | 0   | 0     | 0   | 0    |
| 180° | 0   | 0     | 0   | 0     | 0   | 0    |

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**CANDELA DISTRIBUTION (FULL):**

|        | 0°    | 22.5° | 45°   | 67.5° | 90°   |
|--------|-------|-------|-------|-------|-------|
| 0°     | 299.2 | 299.2 | 299.2 | 299.2 | 299.2 |
| 2.5°   | 297.3 | 300.1 | 299.2 | 298.2 | 298.2 |
| 5°     | 296.3 | 299.2 | 298.2 | 298.2 | 299.2 |
| 7.5°   | 294.5 | 297.3 | 297.3 | 297.3 | 298.2 |
| 10°    | 291.6 | 295.4 | 295.4 | 295.4 | 296.3 |
| 12.5°  | 288.8 | 291.6 | 292.6 | 293.5 | 294.5 |
| 15°    | 284.1 | 287.9 | 289.7 | 290.7 | 292.6 |
| 17.5°  | 279.4 | 282.2 | 285.0 | 287.9 | 288.8 |
| 20°    | 273.8 | 277.5 | 280.3 | 283.2 | 284.1 |
| 22.5°  | 267.2 | 270.9 | 274.7 | 277.5 | 279.4 |
| 25°    | 259.6 | 263.4 | 269.1 | 272.8 | 274.7 |
| 27.5°  | 252.1 | 255.9 | 262.5 | 267.2 | 269.1 |
| 30°    | 242.7 | 248.4 | 254.9 | 260.6 | 263.4 |
| 32.5°  | 234.2 | 239.9 | 247.4 | 254.0 | 255.9 |
| 35°    | 225.8 | 231.4 | 239.9 | 246.5 | 249.3 |
| 37.5°  | 216.4 | 223.0 | 231.4 | 238.9 | 241.8 |
| 40°    | 207.0 | 213.5 | 223.0 | 231.4 | 233.3 |
| 42.5°  | 197.6 | 204.1 | 215.4 | 223.0 | 225.8 |
| 45°    | 187.2 | 194.7 | 206.0 | 214.5 | 218.3 |
| 47.5°  | 176.9 | 184.4 | 195.7 | 205.1 | 208.8 |
| 50°    | 165.6 | 174.0 | 186.3 | 195.7 | 199.4 |
| 52.5°  | 155.2 | 163.7 | 175.9 | 186.3 | 191.0 |
| 55°    | 143.9 | 152.4 | 165.6 | 176.9 | 181.6 |
| 57.5°  | 132.6 | 141.1 | 155.2 | 167.5 | 172.2 |
| 60°    | 121.4 | 129.8 | 143.9 | 158.0 | 162.7 |
| 62.5°  | 109.1 | 118.5 | 133.6 | 147.7 | 153.3 |
| 65°    | 96.9  | 107.2 | 123.2 | 138.3 | 144.9 |
| 67.5°  | 85.6  | 96.0  | 112.9 | 129.8 | 135.5 |
| 70°    | 73.4  | 84.7  | 103.5 | 120.4 | 127.0 |
| 72.5°  | 61.1  | 73.4  | 94.1  | 111.9 | 118.5 |
| 75°    | 49.9  | 63.0  | 85.6  | 103.5 | 111.0 |
| 77.5°  | 37.6  | 53.6  | 77.1  | 96.0  | 102.5 |
| 80°    | 27.3  | 44.2  | 68.7  | 88.4  | 95.0  |
| 82.5°  | 17.9  | 35.7  | 61.1  | 80.9  | 87.5  |
| 85°    | 9.4   | 29.2  | 54.6  | 73.4  | 80.9  |
| 87.5°  | 2.8   | 22.6  | 48.0  | 66.8  | 73.4  |
| 90°    | 0.0   | 17.9  | 42.3  | 60.2  | 67.7  |
| 92.5°  | 0.0   | 14.1  | 36.7  | 54.6  | 61.1  |
| 95°    | 0.0   | 11.3  | 32.0  | 48.9  | 55.5  |
| 97.5°  | 0.0   | 9.4   | 28.2  | 44.2  | 49.9  |
| 100°   | 0.0   | 7.5   | 24.5  | 39.5  | 45.2  |
| 102.5° | 0.0   | 5.6   | 20.7  | 34.8  | 40.5  |
| 105°   | 0.0   | 3.8   | 17.9  | 31.0  | 35.7  |
| 107.5° | 0.0   | 2.8   | 15.1  | 27.3  | 32.0  |
| 110°   | 0.0   | 2.8   | 14.1  | 23.5  | 28.2  |



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**CANDELA DISTRIBUTION (continued):**

|        | 0°  | 22.5° | 45°  | 67.5° | 90°  |
|--------|-----|-------|------|-------|------|
| 112.5° | 0.0 | 1.9   | 12.2 | 21.6  | 25.4 |
| 115°   | 0.0 | 1.9   | 10.3 | 18.8  | 22.6 |
| 117.5° | 0.0 | 1.9   | 9.4  | 16.9  | 20.7 |
| 120°   | 0.0 | 1.9   | 8.5  | 15.1  | 17.9 |
| 122.5° | 0.0 | 0.9   | 7.5  | 13.2  | 16.0 |
| 125°   | 0.0 | 0.9   | 6.6  | 12.2  | 14.1 |
| 127.5° | 0.0 | 0.9   | 5.6  | 11.3  | 13.2 |
| 130°   | 0.0 | 0.9   | 5.6  | 10.3  | 12.2 |
| 132.5° | 0.0 | 0.0   | 4.7  | 9.4   | 11.3 |
| 135°   | 0.0 | 0.0   | 3.8  | 7.5   | 9.4  |
| 137.5° | 0.0 | 0.0   | 3.8  | 6.6   | 8.5  |
| 140°   | 0.0 | 0.0   | 2.8  | 6.6   | 7.5  |
| 142.5° | 0.0 | 0.0   | 1.9  | 5.6   | 6.6  |
| 145°   | 0.0 | 0.0   | 1.9  | 4.7   | 5.6  |
| 147.5° | 0.0 | 0.0   | 0.9  | 3.8   | 4.7  |
| 150°   | 0.0 | 0.0   | 0.9  | 2.8   | 3.8  |
| 152.5° | 0.0 | 0.0   | 0.0  | 1.9   | 2.8  |
| 155°   | 0.0 | 0.0   | 0.0  | 0.9   | 1.9  |
| 157.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.9  |
| 160°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 162.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 165°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 167.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 170°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 172.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 175°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 177.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 180°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |

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**CIE UGR TABLE:**

| Reflectances:   |      |                  |       |       |       |       |                |       |       |       |       |
|-----------------|------|------------------|-------|-------|-------|-------|----------------|-------|-------|-------|-------|
| Ceiling         |      | 0.7              | 0.7   | 0.5   | 0.5   | 0.3   | 0.7            | 0.7   | 0.5   | 0.5   | 0.3   |
| Wall            |      | 0.5              | 0.3   | 0.5   | 0.3   | 0.3   | 0.5            | 0.3   | 0.5   | 0.3   | 0.3   |
| Reference plane |      | 0.2              | 0.2   | 0.2   | 0.2   | 0.2   | 0.2            | 0.2   | 0.2   | 0.2   | 0.2   |
| Room dimensions |      | Viewed crosswise |       |       |       |       | Viewed endwise |       |       |       |       |
| X=2H            | Y=2H | 17.17            | 18.71 | 17.64 | 19.17 | 19.66 | 18.99          | 20.53 | 19.47 | 20.99 | 21.48 |
|                 | 3H   | 18.68            | 20.08 | 19.17 | 20.55 | 21.08 | 21.34          | 22.74 | 21.83 | 23.21 | 23.74 |
|                 | 4H   | 19.16            | 20.49 | 19.67 | 20.98 | 21.52 | 22.47          | 23.80 | 22.98 | 24.29 | 24.83 |
|                 | 6H   | 19.44            | 20.68 | 19.96 | 21.18 | 21.74 | 23.61          | 24.85 | 24.13 | 25.35 | 25.91 |
|                 | 8H   | 19.50            | 20.68 | 20.03 | 21.21 | 21.77 | 24.18          | 25.36 | 24.71 | 25.89 | 26.45 |
|                 | 12H  | 19.51            | 20.65 | 20.05 | 21.17 | 21.76 | 24.76          | 25.90 | 25.30 | 26.42 | 27.01 |
| 4H              | 2H   | 18.00            | 19.33 | 18.51 | 19.82 | 20.36 | 19.43          | 20.76 | 19.94 | 21.25 | 21.79 |
|                 | 3H   | 19.75            | 20.88 | 20.27 | 21.41 | 21.98 | 22.02          | 23.15 | 22.54 | 23.68 | 24.25 |
|                 | 4H   | 20.36            | 21.40 | 20.90 | 21.94 | 22.54 | 23.32          | 24.36 | 23.86 | 24.90 | 25.50 |
|                 | 6H   | 20.77            | 21.68 | 21.33 | 22.25 | 22.86 | 24.66          | 25.58 | 25.22 | 26.14 | 26.76 |
|                 | 8H   | 20.87            | 21.73 | 21.43 | 22.29 | 22.92 | 25.33          | 26.19 | 25.89 | 26.76 | 27.38 |
|                 | 12H  | 20.91            | 21.70 | 21.50 | 22.29 | 22.92 | 26.04          | 26.82 | 26.62 | 27.42 | 28.05 |
| 8H              | 4H   | 21.00            | 21.87 | 21.57 | 22.43 | 23.06 | 23.55          | 24.41 | 24.11 | 24.98 | 25.60 |
|                 | 6H   | 21.59            | 22.32 | 22.19 | 22.93 | 23.56 | 25.07          | 25.80 | 25.66 | 26.41 | 27.04 |
|                 | 8H   | 21.78            | 22.44 | 22.39 | 23.06 | 23.70 | 25.88          | 26.54 | 26.49 | 27.16 | 27.80 |
|                 | 12H  | 21.90            | 22.49 | 22.51 | 23.10 | 23.81 | 26.77          | 27.36 | 27.38 | 27.97 | 28.68 |
| 12H             | 4H   | 21.18            | 21.96 | 21.76 | 22.56 | 23.19 | 23.56          | 24.34 | 24.15 | 24.94 | 25.57 |
|                 | 6H   | 21.86            | 22.52 | 22.47 | 23.14 | 23.78 | 25.11          | 25.77 | 25.72 | 26.39 | 27.03 |
|                 | 8H   | 22.14            | 22.73 | 22.75 | 23.34 | 24.05 | 26.00          | 26.59 | 26.61 | 27.19 | 27.90 |

LM-79-2019: Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

Report Prepared for

Cooper Lighting Solutions

Fail-Safe

Report Number: SP1-2511-597-6

Test Date: 11/18/2025

Luminaire Tested: 4ASL-2-65-UNV-OPL-1\_600mA

Data in this report applies to families of products including 4ASL

### Test Information

Test Method: LM-79-2019  
 Report Number: SP1-2511-597-6  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry:  $4\pi$   
 Issue Date: 11/18/2025  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: Fail-Safe  
 Catalog Number: **4ASL-2-65-UNV-OPL-1\_600mA**  
 Description: 2foot 4ASL LED LUMINAIRE WITH OPL LENS AND 6500K LEDS with 1 rows at 600mA

### Spectral Parameters

CCT (K): 6972  
 CIE  $u'$ : 0.1979  
 CIE  $v'$ : 0.4612  
 Duv: 0.0005  
 CIE x: 0.3066  
 CIE y: 0.3177  
 CIE z: 0.3758  
 Peak Wavelength (nm): 455  
 Dominant Wavelength (nm): 483  
 Purity: 10.33335  
 R<sub>f</sub>: 88.2  
 R<sub>g</sub>: 97.1

CRI (Ra): 94.3  
 R1: 96.1  
 R2: 98.8  
 R3: 96.4  
 R4: 92.8  
 R5: 92.9  
 R6: 92.2  
 R7: 93.5  
 R8: 91.4  
 R9: 82.6  
 R10: 95.4  
 R11: 95.2  
 R12: 63.5  
 R13: 99.3  
 R14: 98.1  
 R15: 93.7



### Test Conditions

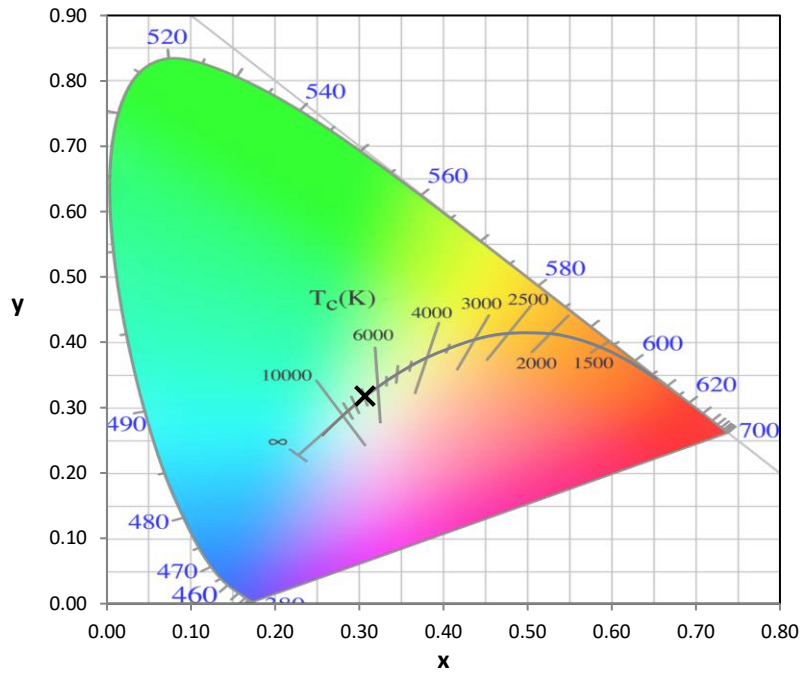
Stabilization Time: 20M  
 Operation Time: 1H 20M  
 Sphere Temperature (°C): 24.1

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| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | 76INCH SPHERE IN0058  | 6/16/2025        | 12/16/2025           |
| Power Meter                    | XITRON INXT2011004    | 10/21/2025       | 10/21/2026           |
| AC Power Source                | CHROMA 61603 IN0063   | 10/21/2025       | 10/21/2026           |
| DC Power Source                | AGILENT E3634A IN0208 | 10/21/2025       | 10/21/2026           |
| Sphere Thermometer             | ONSET IN0085          | 10/21/2025       | 10/21/2026           |
| Room Thermometer               | ONSET IN0046          | 10/21/2025       | 10/21/2026           |

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**CIE 1931 Chromaticity Diagram**



**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



Point lies inside the ANSI 6500K 7-step quadrangle

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### Photopic Flux vs. Wavelength

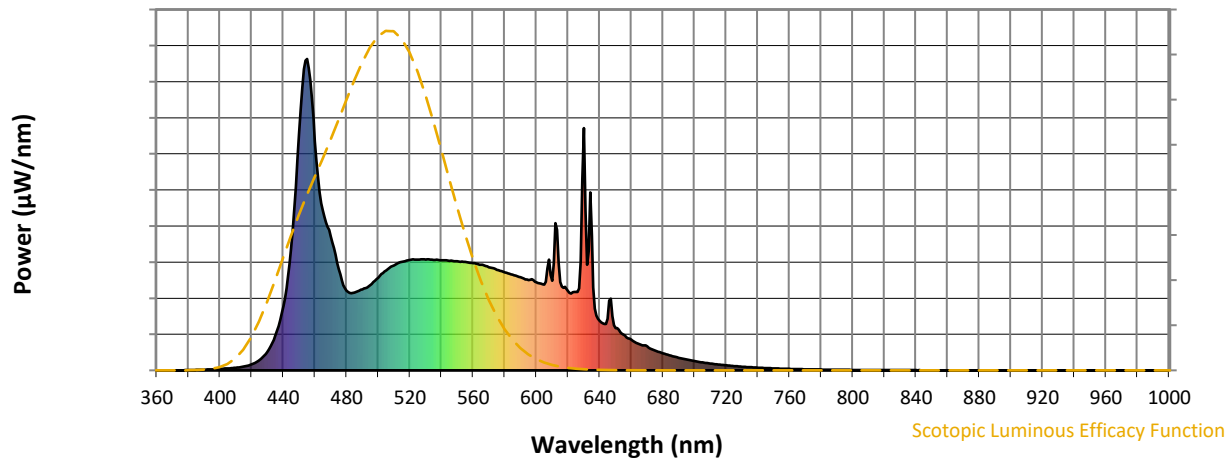


### Photopic Lumens: NR

| λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) |
|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|
| 360    | 0                        | NR            | 490    | 260                      | NR            | 620    | 255                      | NR            | 750    | 6                        | NR            | 880    | 0                        | NR            |
| 365    | 0                        | NR            | 495    | 274                      | NR            | 625    | 252                      | NR            | 755    | 6                        | NR            | 885    | 0                        | NR            |
| 370    | 0                        | NR            | 500    | 297                      | NR            | 630    | 778                      | NR            | 760    | 5                        | NR            | 890    | 0                        | NR            |
| 375    | 0                        | NR            | 505    | 320                      | NR            | 635    | 431                      | NR            | 765    | 4                        | NR            | 895    | 0                        | NR            |
| 380    | 1                        | NR            | 510    | 337                      | NR            | 640    | 160                      | NR            | 770    | 4                        | NR            | 900    | 0                        | NR            |
| 385    | 2                        | NR            | 515    | 349                      | NR            | 645    | 165                      | NR            | 775    | 3                        | NR            | 905    | 0                        | NR            |
| 390    | 2                        | NR            | 520    | 354                      | NR            | 650    | 135                      | NR            | 780    | 3                        | NR            | 910    | 0                        | NR            |
| 395    | 3                        | NR            | 525    | 356                      | NR            | 655    | 115                      | NR            | 785    | 2                        | NR            | 915    | 0                        | NR            |
| 400    | 5                        | NR            | 530    | 356                      | NR            | 660    | 99                       | NR            | 790    | 2                        | NR            | 920    | 0                        | NR            |
| 405    | 6                        | NR            | 535    | 355                      | NR            | 665    | 84                       | NR            | 795    | 2                        | NR            | 925    | 0                        | NR            |
| 410    | 8                        | NR            | 540    | 354                      | NR            | 670    | 77                       | NR            | 800    | 2                        | NR            | 930    | 0                        | NR            |
| 415    | 12                       | NR            | 545    | 351                      | NR            | 675    | 64                       | NR            | 805    | 1                        | NR            | 935    | 0                        | NR            |
| 420    | 19                       | NR            | 550    | 350                      | NR            | 680    | 55                       | NR            | 810    | 1                        | NR            | 940    | 0                        | NR            |
| 425    | 33                       | NR            | 555    | 348                      | NR            | 685    | 47                       | NR            | 815    | 1                        | NR            | 945    | 0                        | NR            |
| 430    | 60                       | NR            | 560    | 344                      | NR            | 690    | 41                       | NR            | 820    | 1                        | NR            | 950    | 0                        | NR            |
| 435    | 113                      | NR            | 565    | 339                      | NR            | 695    | 35                       | NR            | 825    | 1                        | NR            | 955    | 0                        | NR            |
| 440    | 206                      | NR            | 570    | 331                      | NR            | 700    | 30                       | NR            | 830    | 1                        | NR            | 960    | 0                        | NR            |
| 445    | 392                      | NR            | 575    | 323                      | NR            | 705    | 26                       | NR            | 835    | 1                        | NR            | 965    | 0                        | NR            |
| 450    | 764                      | NR            | 580    | 315                      | NR            | 710    | 22                       | NR            | 840    | 1                        | NR            | 970    | 0                        | NR            |
| 455    | 1000                     | NR            | 585    | 307                      | NR            | 715    | 19                       | NR            | 845    | 0                        | NR            | 975    | 0                        | NR            |
| 460    | 736                      | NR            | 590    | 299                      | NR            | 720    | 16                       | NR            | 850    | 0                        | NR            | 980    | 0                        | NR            |
| 465    | 513                      | NR            | 595    | 290                      | NR            | 725    | 14                       | NR            | 855    | 0                        | NR            | 985    | 0                        | NR            |
| 470    | 430                      | NR            | 600    | 282                      | NR            | 730    | 12                       | NR            | 860    | 0                        | NR            | 990    | 0                        | NR            |
| 475    | 325                      | NR            | 605    | 276                      | NR            | 735    | 10                       | NR            | 865    | 0                        | NR            | 995    | 0                        | NR            |
| 480    | 256                      | NR            | 610    | 287                      | NR            | 740    | 9                        | NR            | 870    | 0                        | NR            | 1000   | 0                        | NR            |
| 485    | 250                      | NR            | 615    | 284                      | NR            | 745    | 7                        | NR            | 875    | 0                        | NR            |        |                          |               |

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### Scotopic Flux vs. Wavelength



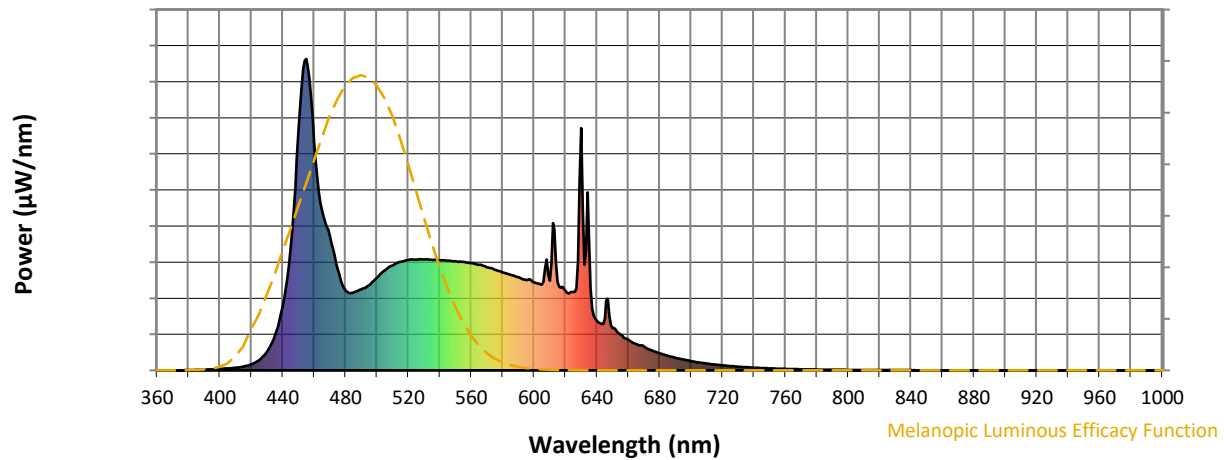
Scotopic Lumens: NR

S/P: 2.48

| λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) |
|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|
| 360       | 0                           | NR               | 490       | 260                         | NR               | 620       | 255                         | NR               | 750       | 6                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 274                         | NR               | 625       | 252                         | NR               | 755       | 6                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 297                         | NR               | 630       | 778                         | NR               | 760       | 5                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 320                         | NR               | 635       | 431                         | NR               | 765       | 4                           | NR               | 895       | 0                           | NR               |
| 380       | 1                           | NR               | 510       | 337                         | NR               | 640       | 160                         | NR               | 770       | 4                           | NR               | 900       | 0                           | NR               |
| 385       | 2                           | NR               | 515       | 349                         | NR               | 645       | 165                         | NR               | 775       | 3                           | NR               | 905       | 0                           | NR               |
| 390       | 2                           | NR               | 520       | 354                         | NR               | 650       | 135                         | NR               | 780       | 3                           | NR               | 910       | 0                           | NR               |
| 395       | 3                           | NR               | 525       | 356                         | NR               | 655       | 115                         | NR               | 785       | 2                           | NR               | 915       | 0                           | NR               |
| 400       | 5                           | NR               | 530       | 356                         | NR               | 660       | 99                          | NR               | 790       | 2                           | NR               | 920       | 0                           | NR               |
| 405       | 6                           | NR               | 535       | 355                         | NR               | 665       | 84                          | NR               | 795       | 2                           | NR               | 925       | 0                           | NR               |
| 410       | 8                           | NR               | 540       | 354                         | NR               | 670       | 77                          | NR               | 800       | 2                           | NR               | 930       | 0                           | NR               |
| 415       | 12                          | NR               | 545       | 351                         | NR               | 675       | 64                          | NR               | 805       | 1                           | NR               | 935       | 0                           | NR               |
| 420       | 19                          | NR               | 550       | 350                         | NR               | 680       | 55                          | NR               | 810       | 1                           | NR               | 940       | 0                           | NR               |
| 425       | 33                          | NR               | 555       | 348                         | NR               | 685       | 47                          | NR               | 815       | 1                           | NR               | 945       | 0                           | NR               |
| 430       | 60                          | NR               | 560       | 344                         | NR               | 690       | 41                          | NR               | 820       | 1                           | NR               | 950       | 0                           | NR               |
| 435       | 113                         | NR               | 565       | 339                         | NR               | 695       | 35                          | NR               | 825       | 1                           | NR               | 955       | 0                           | NR               |
| 440       | 206                         | NR               | 570       | 331                         | NR               | 700       | 30                          | NR               | 830       | 1                           | NR               | 960       | 0                           | NR               |
| 445       | 392                         | NR               | 575       | 323                         | NR               | 705       | 26                          | NR               | 835       | 1                           | NR               | 965       | 0                           | NR               |
| 450       | 764                         | NR               | 580       | 315                         | NR               | 710       | 22                          | NR               | 840       | 1                           | NR               | 970       | 0                           | NR               |
| 455       | 1000                        | NR               | 585       | 307                         | NR               | 715       | 19                          | NR               | 845       | 0                           | NR               | 975       | 0                           | NR               |
| 460       | 736                         | NR               | 590       | 299                         | NR               | 720       | 16                          | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 513                         | NR               | 595       | 290                         | NR               | 725       | 14                          | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 430                         | NR               | 600       | 282                         | NR               | 730       | 12                          | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 325                         | NR               | 605       | 276                         | NR               | 735       | 10                          | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 256                         | NR               | 610       | 287                         | NR               | 740       | 9                           | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 250                         | NR               | 615       | 284                         | NR               | 745       | 7                           | NR               | 875       | 0                           | NR               |           |                             |                  |

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### Melanopic Flux vs. Wavelength



Melanopic Lumens: NR

M/P: 5.67

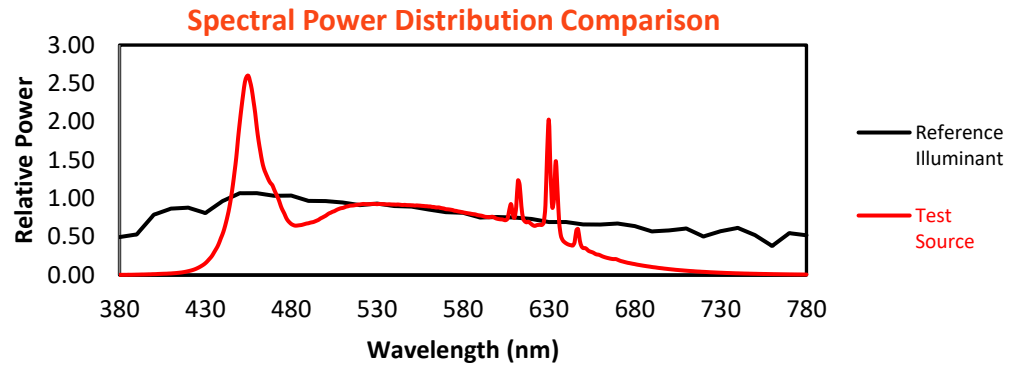
| λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) |
|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|
| 360       | 0                           | NR               | 490       | 260                         | NR               | 620       | 255                         | NR               | 750       | 6                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 274                         | NR               | 625       | 252                         | NR               | 755       | 6                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 297                         | NR               | 630       | 778                         | NR               | 760       | 5                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 320                         | NR               | 635       | 431                         | NR               | 765       | 4                           | NR               | 895       | 0                           | NR               |
| 380       | 1                           | NR               | 510       | 337                         | NR               | 640       | 160                         | NR               | 770       | 4                           | NR               | 900       | 0                           | NR               |
| 385       | 2                           | NR               | 515       | 349                         | NR               | 645       | 165                         | NR               | 775       | 3                           | NR               | 905       | 0                           | NR               |
| 390       | 2                           | NR               | 520       | 354                         | NR               | 650       | 135                         | NR               | 780       | 3                           | NR               | 910       | 0                           | NR               |
| 395       | 3                           | NR               | 525       | 356                         | NR               | 655       | 115                         | NR               | 785       | 2                           | NR               | 915       | 0                           | NR               |
| 400       | 5                           | NR               | 530       | 356                         | NR               | 660       | 99                          | NR               | 790       | 2                           | NR               | 920       | 0                           | NR               |
| 405       | 6                           | NR               | 535       | 355                         | NR               | 665       | 84                          | NR               | 795       | 2                           | NR               | 925       | 0                           | NR               |
| 410       | 8                           | NR               | 540       | 354                         | NR               | 670       | 77                          | NR               | 800       | 2                           | NR               | 930       | 0                           | NR               |
| 415       | 12                          | NR               | 545       | 351                         | NR               | 675       | 64                          | NR               | 805       | 1                           | NR               | 935       | 0                           | NR               |
| 420       | 19                          | NR               | 550       | 350                         | NR               | 680       | 55                          | NR               | 810       | 1                           | NR               | 940       | 0                           | NR               |
| 425       | 33                          | NR               | 555       | 348                         | NR               | 685       | 47                          | NR               | 815       | 1                           | NR               | 945       | 0                           | NR               |
| 430       | 60                          | NR               | 560       | 344                         | NR               | 690       | 41                          | NR               | 820       | 1                           | NR               | 950       | 0                           | NR               |
| 435       | 113                         | NR               | 565       | 339                         | NR               | 695       | 35                          | NR               | 825       | 1                           | NR               | 955       | 0                           | NR               |
| 440       | 206                         | NR               | 570       | 331                         | NR               | 700       | 30                          | NR               | 830       | 1                           | NR               | 960       | 0                           | NR               |
| 445       | 392                         | NR               | 575       | 323                         | NR               | 705       | 26                          | NR               | 835       | 1                           | NR               | 965       | 0                           | NR               |
| 450       | 764                         | NR               | 580       | 315                         | NR               | 710       | 22                          | NR               | 840       | 1                           | NR               | 970       | 0                           | NR               |
| 455       | 1000                        | NR               | 585       | 307                         | NR               | 715       | 19                          | NR               | 845       | 0                           | NR               | 975       | 0                           | NR               |
| 460       | 736                         | NR               | 590       | 299                         | NR               | 720       | 16                          | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 513                         | NR               | 595       | 290                         | NR               | 725       | 14                          | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 430                         | NR               | 600       | 282                         | NR               | 730       | 12                          | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 325                         | NR               | 605       | 276                         | NR               | 735       | 10                          | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 256                         | NR               | 610       | 287                         | NR               | 740       | 9                           | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 250                         | NR               | 615       | 284                         | NR               | 745       | 7                           | NR               | 875       | 0                           | NR               |           |                             |                  |

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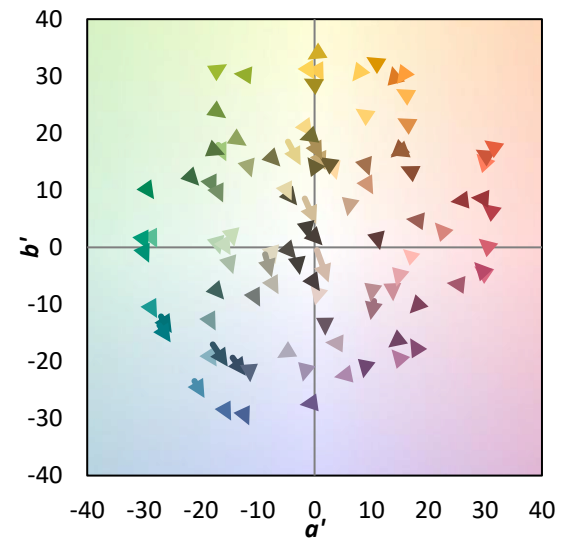
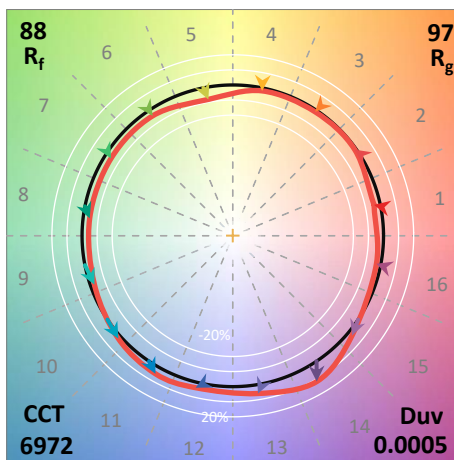
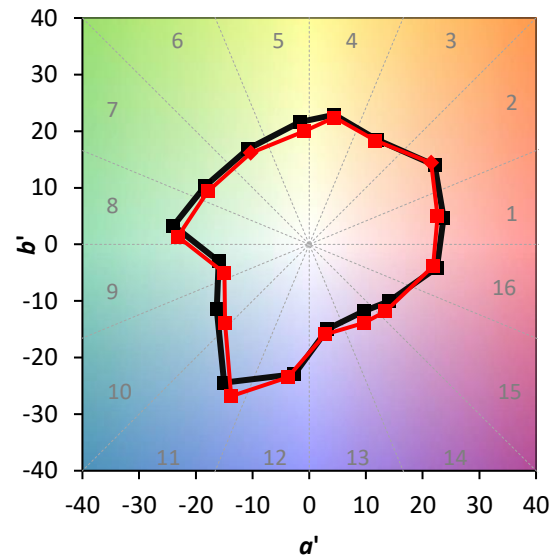
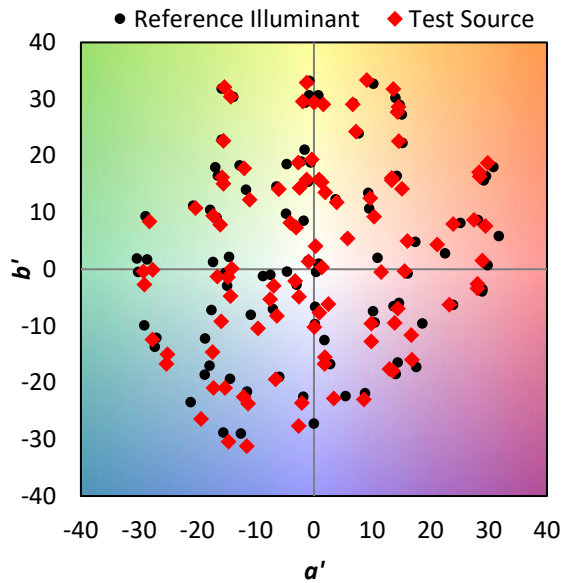
TM-30-18

### Summary

$R_f = 88.2$   
 $R_g = 97.1$   
 $CIE R_a = 94.3$   
 $R_9 = 82.6$

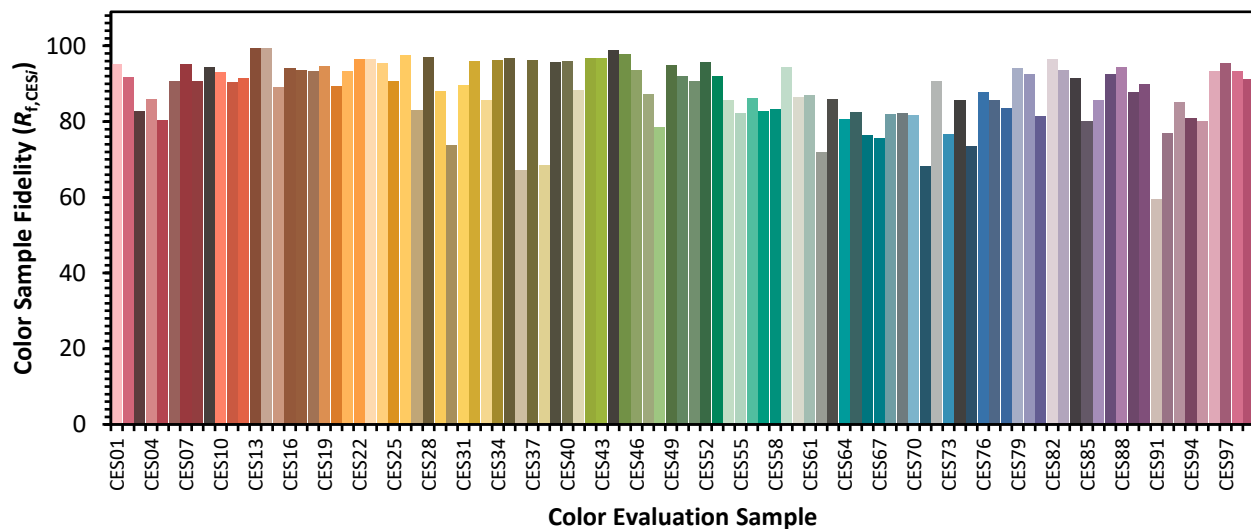


### Color Vector Graphics

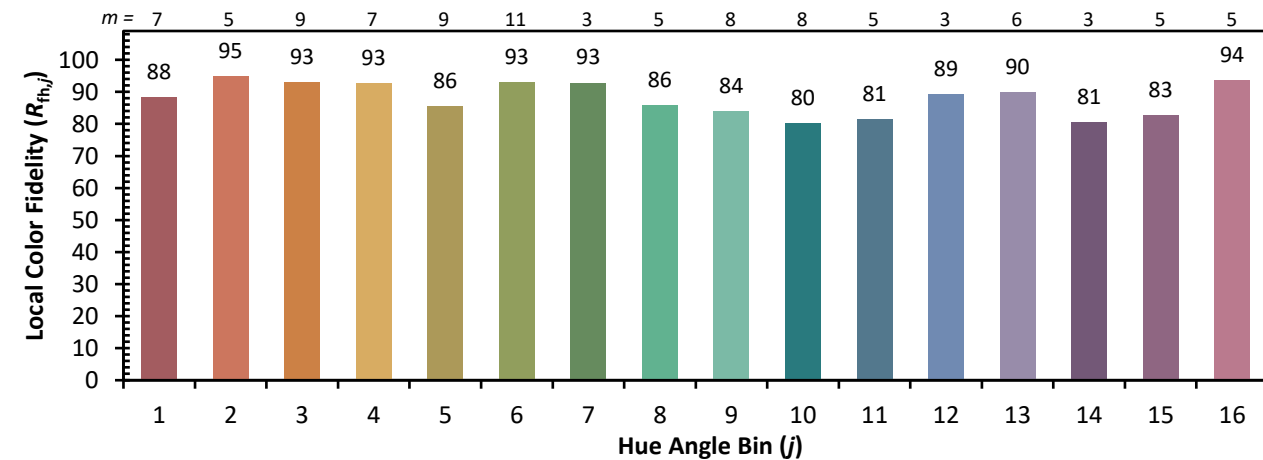


**Individual Sample Fidelity Index ( $R_{f,i}$ )**

|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 85 | CES26 = 97 | CES51 = 91 | CES76 = 88 |
| CES02 = 60 | CES27 = 83 | CES52 = 96 | CES77 = 86 |
| CES03 = 31 | CES28 = 97 | CES53 = 92 | CES78 = 83 |
| CES04 = 68 | CES29 = 88 | CES54 = 86 | CES79 = 94 |
| CES05 = 47 | CES30 = 74 | CES55 = 82 | CES80 = 93 |
| CES06 = 49 | CES31 = 90 | CES56 = 86 | CES81 = 81 |
| CES07 = 40 | CES32 = 96 | CES57 = 83 | CES82 = 96 |
| CES08 = 39 | CES33 = 86 | CES58 = 83 | CES83 = 94 |
| CES09 = 29 | CES34 = 96 | CES59 = 94 | CES84 = 91 |
| CES10 = 72 | CES35 = 97 | CES60 = 87 | CES85 = 80 |
| CES11 = 55 | CES36 = 67 | CES61 = 87 | CES86 = 86 |
| CES12 = 61 | CES37 = 96 | CES62 = 72 | CES87 = 93 |
| CES13 = 42 | CES38 = 68 | CES63 = 86 | CES88 = 94 |
| CES14 = 74 | CES39 = 96 | CES64 = 81 | CES89 = 88 |
| CES15 = 71 | CES40 = 96 | CES65 = 83 | CES90 = 90 |
| CES16 = 46 | CES41 = 88 | CES66 = 76 | CES91 = 60 |
| CES17 = 48 | CES42 = 97 | CES67 = 76 | CES92 = 77 |
| CES18 = 55 | CES43 = 97 | CES68 = 82 | CES93 = 85 |
| CES19 = 69 | CES44 = 99 | CES69 = 82 | CES94 = 81 |
| CES20 = 64 | CES45 = 98 | CES70 = 82 | CES95 = 80 |
| CES21 = 84 | CES46 = 93 | CES71 = 68 | CES96 = 93 |
| CES22 = 76 | CES47 = 87 | CES72 = 91 | CES97 = 95 |
| CES23 = 91 | CES48 = 79 | CES73 = 77 | CES98 = 93 |
| CES24 = 89 | CES49 = 95 | CES74 = 86 | CES99 = 91 |
| CES25 = 69 | CES50 = 92 | CES75 = 74 |            |



Color Rendition by Hue-Angle Bin



**Measure Comparisons**



(END OF REPORT)