

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: METALUX

Report Number: P982846

Luminaire Tested: 22CZ-LD5-44-UNV-L950-SQP-CD1-U

Issue Date: 04/23/2025

**Test Information**

Test Method: LM-79-2019  
Report Number: P982846  
Test Lab: INNOVATION CENTER(P3)  
Issue Date: 04/23/2025  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: METALUX  
Catalog Number: 22CZ-LD5-44-UNV-L950-SQP-CD1-U  
Description: METALUX CRUZE 2x2 4400LM PACKAGE 90CRI 5000K TROFFER LENS WITH SQUARE PATTERN  
Light Source: 5000K CCT, 90 CRI LEDS  
Ballast/Driver: -

**Summary**

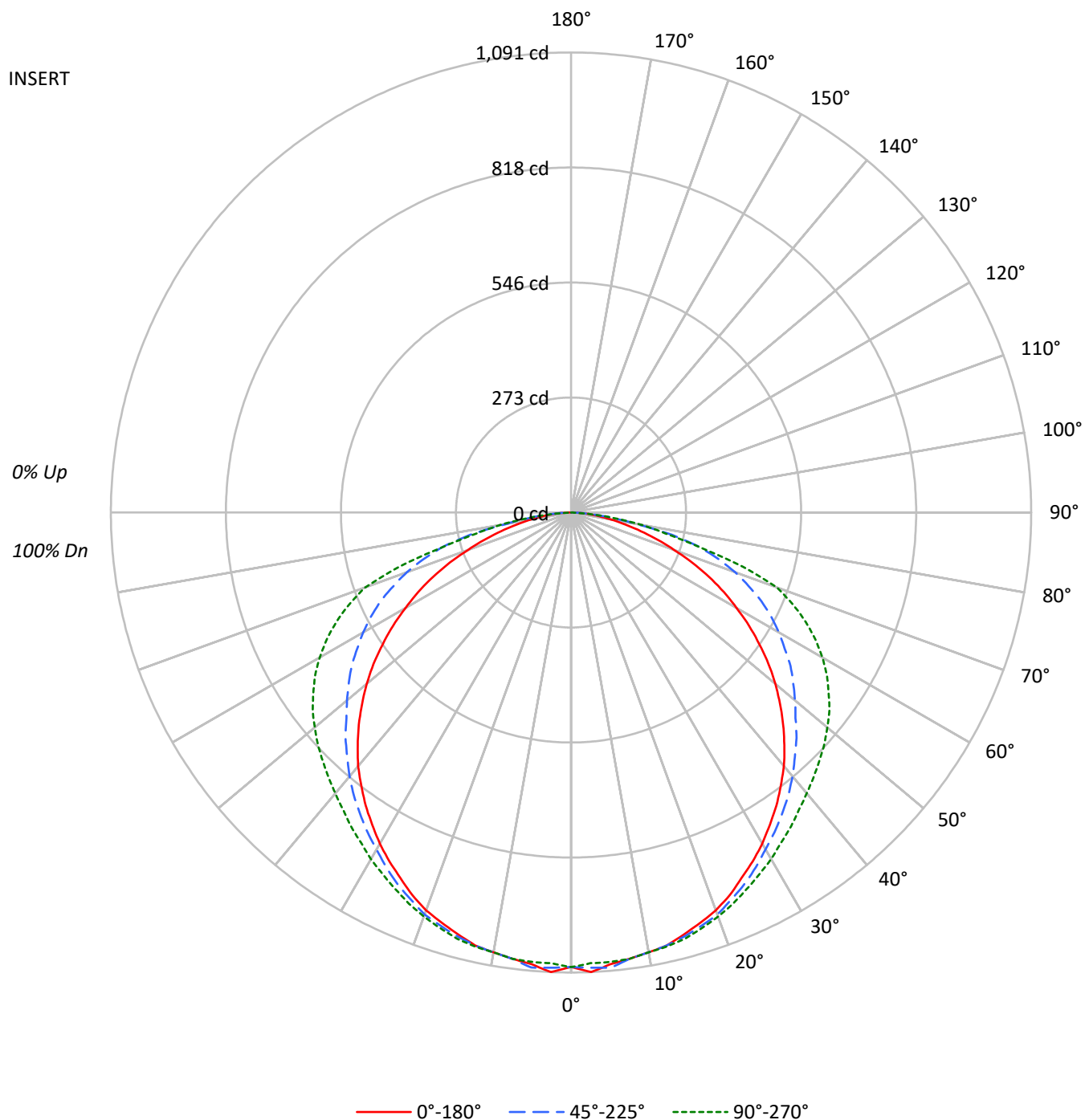
Lumens per Lamp: N/A  
Luminaire Lumens: 3393.2 lumens  
Efficiency: N/A  
Efficacy: 103.5 lumens/watt  
Spacing Criteria (0/90/45): 1.25 / 1.31 / 1.41  
Luminous Opening: Rectangular (W 2' x L: 2' x H: 0')  
CIE Type: Direct

Input Watts (W): 32.8  
Input Voltage (V): 120  
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: 28.75 FT

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CATALOG NUMBER: 22CZ-LD5-44-UNV-L950-SQP-CD1-U

### Luminous Intensity Polar Plot



TEST NUMBER: P982846

CATALOG NUMBER: 22CZ-LD5-44-UNV-L950-SQP-CD1-U

**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   | 119 | 119 | 119 | 119 | 116 | 116 | 116 | 116 | 111 | 111 | 111 |  | 106 | 106 | 106 |  | 102 | 102 | 102 | 100 |
| 1   | 108 | 103 | 99  | 95  | 105 | 101 | 97  | 93  | 97  | 93  | 90  |  | 93  | 90  | 87  |  | 89  | 87  | 85  | 83  |
| 2   | 98  | 89  | 82  | 76  | 95  | 87  | 81  | 75  | 84  | 78  | 73  |  | 80  | 76  | 71  |  | 77  | 73  | 70  | 68  |
| 3   | 89  | 78  | 69  | 62  | 86  | 76  | 68  | 62  | 73  | 66  | 61  |  | 70  | 64  | 59  |  | 68  | 63  | 58  | 56  |
| 4   | 81  | 68  | 59  | 52  | 79  | 67  | 58  | 52  | 64  | 57  | 51  |  | 62  | 56  | 50  |  | 60  | 54  | 50  | 47  |
| 5   | 74  | 61  | 52  | 45  | 72  | 60  | 51  | 44  | 58  | 50  | 44  |  | 56  | 49  | 43  |  | 54  | 48  | 43  | 41  |
| 6   | 68  | 55  | 45  | 39  | 66  | 54  | 45  | 39  | 52  | 44  | 38  |  | 50  | 43  | 38  |  | 48  | 42  | 37  | 35  |
| 7   | 63  | 49  | 40  | 34  | 62  | 49  | 40  | 34  | 47  | 39  | 34  |  | 45  | 39  | 33  |  | 44  | 38  | 33  | 31  |
| 8   | 59  | 45  | 36  | 30  | 57  | 44  | 36  | 30  | 43  | 35  | 30  |  | 42  | 35  | 30  |  | 40  | 34  | 29  | 28  |
| 9   | 55  | 41  | 33  | 27  | 54  | 41  | 33  | 27  | 39  | 32  | 27  |  | 38  | 32  | 27  |  | 37  | 31  | 27  | 25  |
| 10  | 51  | 38  | 30  | 24  | 50  | 37  | 30  | 24  | 36  | 29  | 24  |  | 35  | 29  | 24  |  | 35  | 28  | 24  | 22  |

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

|     | 0°   | 45°  | 90°  |
|-----|------|------|------|
| 0°  | 2901 | 2901 | 2901 |
| 5°  | 2904 | 2926 | 2890 |
| 10° | 2895 | 2895 | 2895 |
| 15° | 2885 | 2900 | 2914 |
| 20° | 2875 | 2905 | 2921 |
| 25° | 2840 | 2888 | 2926 |
| 30° | 2817 | 2866 | 2948 |
| 35° | 2788 | 2865 | 2987 |
| 40° | 2759 | 2869 | 3054 |
| 45° | 2707 | 2878 | 3169 |
| 50° | 2648 | 2902 | 3321 |
| 55° | 2559 | 2980 | 3499 |
| 60° | 2440 | 3063 | 3702 |
| 65° | 2299 | 3171 | 3910 |
| 70° | 2052 | 3256 | 4085 |
| 75° | 1781 | 3260 | 3232 |
| 80° | 1509 | 2408 | 2614 |
| 85° | 1300 | 1627 | 1463 |

**MAXIMUM LUMINANCE 45°-90°:**

Horizontal Angle: 90°

Vertical Angle: 70°

Luminance: 4085 cd/sqm

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CATALOG NUMBER: 22CZ-LD5-44-UNV-L950-SQP-CD1-U

**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 102.3  | 3.0       |
| 10°-20°   | 293.9  | 8.7       |
| 20°-30°   | 447.9  | 13.2      |
| 30°-40°   | 548.0  | 16.1      |
| 40°-50°   | 589.6  | 17.4      |
| 50°-60°   | 571.1  | 16.8      |
| 60°-70°   | 483.8  | 14.3      |
| 70°-80°   | 292.4  | 8.6       |
| 80°-90°   | 64.2   | 1.9       |
| 90°-100°  | 0.0    | 0.0       |
| 100°-110° | 0.0    | 0.0       |
| 110°-120° | 0.0    | 0.0       |
| 120°-130° | 0.0    | 0.0       |
| 130°-140° | 0.0    | 0.0       |
| 140°-150° | 0.0    | 0.0       |
| 150°-160° | 0.0    | 0.0       |
| 160°-170° | 0.0    | 0.0       |
| 170°-180° | 0.0    | 0.0       |
| 0°-30°    | 844.1  | 24.9      |
| 0°-40°    | 1392.0 | 41.0      |
| 0°-60°    | 2552.8 | 75.2      |
| 0°-90°    | 3393.2 | 100.0     |
| 90°-120°  | 0.0    | 0.0       |
| 90°-150°  | 0.0    | 0.0       |
| 90°-180°  | 0.0    | 0.0       |
| 0°-180°   | 3393.2 | 100.0     |

**CANDELA DISTRIBUTION:**

|     | 0°   | 22.5° | 45°  | 67.5° | 90°  | Flux |
|-----|------|-------|------|-------|------|------|
| 0°  | 1078 | 1078  | 1078 | 1078  | 1078 |      |
| 5°  | 1075 | 1075  | 1083 | 1078  | 1070 | 102  |
| 15° | 1036 | 1038  | 1041 | 1044  | 1046 | 292  |
| 25° | 957  | 962   | 972  | 980   | 986  | 442  |
| 35° | 849  | 854   | 872  | 896   | 909  | 531  |
| 45° | 711  | 725   | 756  | 804   | 833  | 548  |
| 55° | 545  | 569   | 635  | 709   | 746  | 487  |
| 65° | 361  | 401   | 498  | 577   | 614  | 356  |
| 75° | 171  | 232   | 314  | 319   | 311  | 184  |
| 85° | 42   | 50    | 53   | 50    | 47   | 48   |
| 90° | 0    | 0     | 0    | 0     | 0    |      |

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**CANDELA DISTRIBUTION (FULL):**

|       | 0°     | 22.5°  | 45°    | 67.5°  | 90°    |
|-------|--------|--------|--------|--------|--------|
| 0°    | 1077.9 | 1077.9 | 1077.9 | 1077.9 | 1077.9 |
| 2.5°  | 1090.9 | 1088.4 | 1080.5 | 1075.2 | 1069.9 |
| 5°    | 1075.2 | 1075.2 | 1083.2 | 1077.9 | 1069.9 |
| 7.5°  | 1067.3 | 1067.3 | 1067.3 | 1080.5 | 1067.3 |
| 10°   | 1059.3 | 1062.0 | 1059.3 | 1069.9 | 1059.3 |
| 12.5° | 1051.4 | 1051.4 | 1051.4 | 1054.1 | 1054.1 |
| 15°   | 1035.5 | 1038.2 | 1040.8 | 1043.5 | 1046.1 |
| 17.5° | 1019.9 | 1022.5 | 1027.8 | 1030.5 | 1033.1 |
| 20°   | 1004.0 | 1006.7 | 1014.6 | 1014.6 | 1019.9 |
| 22.5° | 982.8  | 982.8  | 993.4  | 996.1  | 1004.0 |
| 25°   | 956.6  | 961.9  | 972.5  | 980.2  | 985.5  |
| 27.5° | 932.8  | 938.1  | 948.7  | 959.3  | 967.2  |
| 30°   | 906.6  | 911.9  | 922.2  | 938.1  | 948.7  |
| 32.5° | 877.5  | 882.8  | 898.6  | 917.1  | 927.5  |
| 35°   | 848.6  | 853.9  | 872.2  | 896.0  | 909.2  |
| 37.5° | 816.8  | 824.8  | 845.9  | 872.2  | 888.0  |
| 40°   | 785.3  | 793.2  | 816.8  | 845.9  | 869.5  |
| 42.5° | 748.5  | 758.9  | 785.3  | 824.8  | 851.2  |
| 45°   | 711.4  | 724.7  | 756.2  | 803.8  | 832.7  |
| 47.5° | 672.0  | 685.2  | 722.0  | 782.7  | 814.2  |
| 50°   | 632.5  | 648.2  | 693.2  | 758.9  | 793.2  |
| 52.5° | 590.2  | 606.1  | 664.0  | 735.3  | 772.1  |
| 55°   | 545.4  | 569.2  | 635.2  | 708.8  | 745.8  |
| 57.5° | 500.7  | 527.1  | 600.8  | 679.9  | 719.4  |
| 60°   | 453.3  | 484.8  | 569.2  | 648.2  | 687.9  |
| 62.5° | 408.5  | 442.7  | 534.9  | 614.0  | 653.5  |
| 65°   | 361.1  | 400.6  | 498.0  | 577.2  | 614.0  |
| 67.5° | 310.9  | 361.1  | 455.9  | 532.2  | 569.2  |
| 70°   | 260.8  | 318.8  | 413.8  | 484.8  | 519.2  |
| 72.5° | 216.1  | 276.7  | 366.2  | 426.8  | 426.8  |
| 75°   | 171.3  | 231.9  | 313.5  | 318.8  | 310.9  |
| 77.5° | 131.8  | 189.8  | 245.2  | 224.0  | 229.3  |
| 80°   | 97.4   | 144.8  | 155.4  | 163.4  | 168.7  |
| 82.5° | 65.9   | 97.4   | 100.1  | 105.4  | 105.4  |
| 85°   | 42.1   | 50.0   | 52.7   | 50.0   | 47.4   |
| 87.5° | 18.5   | 21.2   | 15.9   | 10.6   | 7.9    |
| 90°   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |

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

Report Prepared for

Cooper Lighting Solutions

Metalux

Report Number: SP3-2508-516-8

Test Date: 09/03/2025

Luminaire Tested: 24CZ-LD5-65-S-UNV-L950-CD1-U

Data in this report applies to families of products including 24CZ-LD5-65-S-UNV-L950-CD1-U

### Test Information

Test Method: LM-79-2019  
 Report Number: SP3-2508-516-8  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP3 - 3M SPHERE  
 Measurement Geometry:  $4\pi$   
 Issue Date: 09/05/2025  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: Metalux  
 Catalog Number: **24CZ-LD5-65-S-UNV-L950-CD1-U**  
 Description: 2X4 CRUZE SB 6500LM 950 SMOOTH LENS

### Spectral Parameters

CCT (K): 5019  
 CIE  $u'$ : 0.2113  
 CIE  $v'$ : 0.4842  
 Duv: -0.0002  
 CIE x: 0.3445  
 CIE y: 0.3508  
 CIE z: 0.3046  
 Peak Wavelength (nm): 630  
 Dominant Wavelength (nm): 572  
 Purity: 8.636369  
 R<sub>f</sub>: 89.8  
 R<sub>g</sub>: 98.5

CRI (Ra): 94.6  
 R1: 96.4  
 R2: 98.4  
 R3: 96.9  
 R4: 94.5  
 R5: 94.5  
 R6: 93.5  
 R7: 93.6  
 R8: 89.4  
 R9: 74.6  
 R10: 94.2  
 R11: 95.5  
 R12: 70.8  
 R13: 98.0  
 R14: 98.0  
 R15: 95.0



### Test Conditions

Stabilization Time: M  
 Operation Time: 1H 0M  
 Sphere Temperature (°C): 25.0

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| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | 3M SPHERE IN02505     | 7/1/2025         | 1/1/2026             |
| Power Meter                    | XITRON INXT2011006    | 1/20/2025        | 1/20/2026            |
| AC Power Source                | CHROMA 61604 IN6064A  | 10/22/2024       | 10/22/2025           |
| DC Power Source                | EYSIGHT N5770A IN0534 | 10/22/2024       | 10/22/2025           |
| Sphere Thermometer             | TANDD IN4036E         | 10/22/2024       | 10/22/2025           |
|                                |                       |                  |                      |

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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 5000K 4-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    | 249                      | NR            | 620    | 343                      | NR            | 750    | 8                        | NR            | 880    | 0                        | NR            |
| 365    | 0                        | NR            | 495    | 269                      | NR            | 625    | 339                      | NR            | 755    | 7                        | NR            | 885    | 0                        | NR            |
| 370    | 0                        | NR            | 500    | 296                      | NR            | 630    | 1000                     | NR            | 760    | 6                        | NR            | 890    | 0                        | NR            |
| 375    | 0                        | NR            | 505    | 325                      | NR            | 635    | 705                      | NR            | 765    | 5                        | NR            | 895    | 0                        | NR            |
| 380    | 0                        | NR            | 510    | 347                      | NR            | 640    | 221                      | NR            | 770    | 4                        | NR            | 900    | 0                        | NR            |
| 385    | 0                        | NR            | 515    | 363                      | NR            | 645    | 210                      | NR            | 775    | 4                        | NR            | 905    | 0                        | NR            |
| 390    | 1                        | NR            | 520    | 371                      | NR            | 650    | 186                      | NR            | 780    | 3                        | NR            | 910    | 0                        | NR            |
| 395    | 3                        | NR            | 525    | 378                      | NR            | 655    | 155                      | NR            | 785    | 3                        | NR            | 915    | 0                        | NR            |
| 400    | 4                        | NR            | 530    | 381                      | NR            | 660    | 132                      | NR            | 790    | 2                        | NR            | 920    | 0                        | NR            |
| 405    | 5                        | NR            | 535    | 383                      | NR            | 665    | 111                      | NR            | 795    | 2                        | NR            | 925    | 0                        | NR            |
| 410    | 7                        | NR            | 540    | 385                      | NR            | 670    | 102                      | NR            | 800    | 2                        | NR            | 930    | 0                        | NR            |
| 415    | 10                       | NR            | 545    | 389                      | NR            | 675    | 84                       | NR            | 805    | 1                        | NR            | 935    | 0                        | NR            |
| 420    | 17                       | NR            | 550    | 391                      | NR            | 680    | 72                       | NR            | 810    | 1                        | NR            | 940    | 0                        | NR            |
| 425    | 29                       | NR            | 555    | 392                      | NR            | 685    | 62                       | NR            | 815    | 1                        | NR            | 945    | 0                        | NR            |
| 430    | 53                       | NR            | 560    | 393                      | NR            | 690    | 53                       | NR            | 820    | 1                        | NR            | 950    | 0                        | NR            |
| 435    | 97                       | NR            | 565    | 394                      | NR            | 695    | 45                       | NR            | 825    | 1                        | NR            | 955    | 0                        | NR            |
| 440    | 173                      | NR            | 570    | 391                      | NR            | 700    | 39                       | NR            | 830    | 1                        | NR            | 960    | 0                        | NR            |
| 445    | 321                      | NR            | 575    | 389                      | NR            | 705    | 33                       | NR            | 835    | 1                        | NR            | 965    | 0                        | NR            |
| 450    | 597                      | NR            | 580    | 385                      | NR            | 710    | 28                       | NR            | 840    | 1                        | NR            | 970    | 0                        | NR            |
| 455    | 795                      | NR            | 585    | 382                      | NR            | 715    | 24                       | NR            | 845    | 1                        | NR            | 975    | 0                        | NR            |
| 460    | 615                      | NR            | 590    | 375                      | NR            | 720    | 21                       | NR            | 850    | 0                        | NR            | 980    | 0                        | NR            |
| 465    | 438                      | NR            | 595    | 367                      | NR            | 725    | 17                       | NR            | 855    | 0                        | NR            | 985    | 0                        | NR            |
| 470    | 372                      | NR            | 600    | 361                      | NR            | 730    | 15                       | NR            | 860    | 0                        | NR            | 990    | 0                        | NR            |
| 475    | 290                      | NR            | 605    | 355                      | NR            | 735    | 13                       | NR            | 865    | 0                        | NR            | 995    | 0                        | NR            |
| 480    | 236                      | NR            | 610    | 383                      | NR            | 740    | 11                       | NR            | 870    | 0                        | NR            | 1000   | 0                        | NR            |
| 485    | 232                      | NR            | 615    | 408                      | NR            | 745    | 9                        | NR            | 875    | 0                        | NR            |        |                          |               |

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### Scotopic Flux vs. Wavelength



Scotopic Lumens: NR

S/P: 2.11

| $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) |
|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|
| 360               | 0                                    | NR                             | 490               | 249                                  | NR                             | 620               | 343                                  | NR                             | 750               | 8                                    | NR                             | 880               | 0                                    | NR                             |
| 365               | 0                                    | NR                             | 495               | 269                                  | NR                             | 625               | 339                                  | NR                             | 755               | 7                                    | NR                             | 885               | 0                                    | NR                             |
| 370               | 0                                    | NR                             | 500               | 296                                  | NR                             | 630               | 1000                                 | NR                             | 760               | 6                                    | NR                             | 890               | 0                                    | NR                             |
| 375               | 0                                    | NR                             | 505               | 325                                  | NR                             | 635               | 705                                  | NR                             | 765               | 5                                    | NR                             | 895               | 0                                    | NR                             |
| 380               | 0                                    | NR                             | 510               | 347                                  | NR                             | 640               | 221                                  | NR                             | 770               | 4                                    | NR                             | 900               | 0                                    | NR                             |
| 385               | 0                                    | NR                             | 515               | 363                                  | NR                             | 645               | 210                                  | NR                             | 775               | 4                                    | NR                             | 905               | 0                                    | NR                             |
| 390               | 1                                    | NR                             | 520               | 371                                  | NR                             | 650               | 186                                  | NR                             | 780               | 3                                    | NR                             | 910               | 0                                    | NR                             |
| 395               | 3                                    | NR                             | 525               | 378                                  | NR                             | 655               | 155                                  | NR                             | 785               | 3                                    | NR                             | 915               | 0                                    | NR                             |
| 400               | 4                                    | NR                             | 530               | 381                                  | NR                             | 660               | 132                                  | NR                             | 790               | 2                                    | NR                             | 920               | 0                                    | NR                             |
| 405               | 5                                    | NR                             | 535               | 383                                  | NR                             | 665               | 111                                  | NR                             | 795               | 2                                    | NR                             | 925               | 0                                    | NR                             |
| 410               | 7                                    | NR                             | 540               | 385                                  | NR                             | 670               | 102                                  | NR                             | 800               | 2                                    | NR                             | 930               | 0                                    | NR                             |
| 415               | 10                                   | NR                             | 545               | 389                                  | NR                             | 675               | 84                                   | NR                             | 805               | 1                                    | NR                             | 935               | 0                                    | NR                             |
| 420               | 17                                   | NR                             | 550               | 391                                  | NR                             | 680               | 72                                   | NR                             | 810               | 1                                    | NR                             | 940               | 0                                    | NR                             |
| 425               | 29                                   | NR                             | 555               | 392                                  | NR                             | 685               | 62                                   | NR                             | 815               | 1                                    | NR                             | 945               | 0                                    | NR                             |
| 430               | 53                                   | NR                             | 560               | 393                                  | NR                             | 690               | 53                                   | NR                             | 820               | 1                                    | NR                             | 950               | 0                                    | NR                             |
| 435               | 97                                   | NR                             | 565               | 394                                  | NR                             | 695               | 45                                   | NR                             | 825               | 1                                    | NR                             | 955               | 0                                    | NR                             |
| 440               | 173                                  | NR                             | 570               | 391                                  | NR                             | 700               | 39                                   | NR                             | 830               | 1                                    | NR                             | 960               | 0                                    | NR                             |
| 445               | 321                                  | NR                             | 575               | 389                                  | NR                             | 705               | 33                                   | NR                             | 835               | 1                                    | NR                             | 965               | 0                                    | NR                             |
| 450               | 597                                  | NR                             | 580               | 385                                  | NR                             | 710               | 28                                   | NR                             | 840               | 1                                    | NR                             | 970               | 0                                    | NR                             |
| 455               | 795                                  | NR                             | 585               | 382                                  | NR                             | 715               | 24                                   | NR                             | 845               | 1                                    | NR                             | 975               | 0                                    | NR                             |
| 460               | 615                                  | NR                             | 590               | 375                                  | NR                             | 720               | 21                                   | NR                             | 850               | 0                                    | NR                             | 980               | 0                                    | NR                             |
| 465               | 438                                  | NR                             | 595               | 367                                  | NR                             | 725               | 17                                   | NR                             | 855               | 0                                    | NR                             | 985               | 0                                    | NR                             |
| 470               | 372                                  | NR                             | 600               | 361                                  | NR                             | 730               | 15                                   | NR                             | 860               | 0                                    | NR                             | 990               | 0                                    | NR                             |
| 475               | 290                                  | NR                             | 605               | 355                                  | NR                             | 735               | 13                                   | NR                             | 865               | 0                                    | NR                             | 995               | 0                                    | NR                             |
| 480               | 236                                  | NR                             | 610               | 383                                  | NR                             | 740               | 11                                   | NR                             | 870               | 0                                    | NR                             | 1000              | 0                                    | NR                             |
| 485               | 232                                  | NR                             | 615               | 408                                  | NR                             | 745               | 9                                    | NR                             | 875               | 0                                    | NR                             |                   |                                      |                                |

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### Melanopic Flux vs. Wavelength



Melanopic Lumens: NR

M/P: 4.62

| $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) |
|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|
| 360               | 0                                    | NR                             | 490               | 249                                  | NR                             | 620               | 343                                  | NR                             | 750               | 8                                    | NR                             | 880               | 0                                    | NR                             |
| 365               | 0                                    | NR                             | 495               | 269                                  | NR                             | 625               | 339                                  | NR                             | 755               | 7                                    | NR                             | 885               | 0                                    | NR                             |
| 370               | 0                                    | NR                             | 500               | 296                                  | NR                             | 630               | 1000                                 | NR                             | 760               | 6                                    | NR                             | 890               | 0                                    | NR                             |
| 375               | 0                                    | NR                             | 505               | 325                                  | NR                             | 635               | 705                                  | NR                             | 765               | 5                                    | NR                             | 895               | 0                                    | NR                             |
| 380               | 0                                    | NR                             | 510               | 347                                  | NR                             | 640               | 221                                  | NR                             | 770               | 4                                    | NR                             | 900               | 0                                    | NR                             |
| 385               | 0                                    | NR                             | 515               | 363                                  | NR                             | 645               | 210                                  | NR                             | 775               | 4                                    | NR                             | 905               | 0                                    | NR                             |
| 390               | 1                                    | NR                             | 520               | 371                                  | NR                             | 650               | 186                                  | NR                             | 780               | 3                                    | NR                             | 910               | 0                                    | NR                             |
| 395               | 3                                    | NR                             | 525               | 378                                  | NR                             | 655               | 155                                  | NR                             | 785               | 3                                    | NR                             | 915               | 0                                    | NR                             |
| 400               | 4                                    | NR                             | 530               | 381                                  | NR                             | 660               | 132                                  | NR                             | 790               | 2                                    | NR                             | 920               | 0                                    | NR                             |
| 405               | 5                                    | NR                             | 535               | 383                                  | NR                             | 665               | 111                                  | NR                             | 795               | 2                                    | NR                             | 925               | 0                                    | NR                             |
| 410               | 7                                    | NR                             | 540               | 385                                  | NR                             | 670               | 102                                  | NR                             | 800               | 2                                    | NR                             | 930               | 0                                    | NR                             |
| 415               | 10                                   | NR                             | 545               | 389                                  | NR                             | 675               | 84                                   | NR                             | 805               | 1                                    | NR                             | 935               | 0                                    | NR                             |
| 420               | 17                                   | NR                             | 550               | 391                                  | NR                             | 680               | 72                                   | NR                             | 810               | 1                                    | NR                             | 940               | 0                                    | NR                             |
| 425               | 29                                   | NR                             | 555               | 392                                  | NR                             | 685               | 62                                   | NR                             | 815               | 1                                    | NR                             | 945               | 0                                    | NR                             |
| 430               | 53                                   | NR                             | 560               | 393                                  | NR                             | 690               | 53                                   | NR                             | 820               | 1                                    | NR                             | 950               | 0                                    | NR                             |
| 435               | 97                                   | NR                             | 565               | 394                                  | NR                             | 695               | 45                                   | NR                             | 825               | 1                                    | NR                             | 955               | 0                                    | NR                             |
| 440               | 173                                  | NR                             | 570               | 391                                  | NR                             | 700               | 39                                   | NR                             | 830               | 1                                    | NR                             | 960               | 0                                    | NR                             |
| 445               | 321                                  | NR                             | 575               | 389                                  | NR                             | 705               | 33                                   | NR                             | 835               | 1                                    | NR                             | 965               | 0                                    | NR                             |
| 450               | 597                                  | NR                             | 580               | 385                                  | NR                             | 710               | 28                                   | NR                             | 840               | 1                                    | NR                             | 970               | 0                                    | NR                             |
| 455               | 795                                  | NR                             | 585               | 382                                  | NR                             | 715               | 24                                   | NR                             | 845               | 1                                    | NR                             | 975               | 0                                    | NR                             |
| 460               | 615                                  | NR                             | 590               | 375                                  | NR                             | 720               | 21                                   | NR                             | 850               | 0                                    | NR                             | 980               | 0                                    | NR                             |
| 465               | 438                                  | NR                             | 595               | 367                                  | NR                             | 725               | 17                                   | NR                             | 855               | 0                                    | NR                             | 985               | 0                                    | NR                             |
| 470               | 372                                  | NR                             | 600               | 361                                  | NR                             | 730               | 15                                   | NR                             | 860               | 0                                    | NR                             | 990               | 0                                    | NR                             |
| 475               | 290                                  | NR                             | 605               | 355                                  | NR                             | 735               | 13                                   | NR                             | 865               | 0                                    | NR                             | 995               | 0                                    | NR                             |
| 480               | 236                                  | NR                             | 610               | 383                                  | NR                             | 740               | 11                                   | NR                             | 870               | 0                                    | NR                             | 1000              | 0                                    | NR                             |
| 485               | 232                                  | NR                             | 615               | 408                                  | NR                             | 745               | 9                                    | NR                             | 875               | 0                                    | NR                             |                   |                                      |                                |

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TM-30-18

### Summary

$R_f = 89.8$   
 $R_g = 98.5$   
 $CIE R_a = 94.6$   
 $R_9 = 74.6$



### Color Vector Graphics



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

|            |             |            |            |
|------------|-------------|------------|------------|
| CES01 = 85 | CES26 = 96  | CES51 = 93 | CES76 = 88 |
| CES02 = 61 | CES27 = 88  | CES52 = 97 | CES77 = 87 |
| CES03 = 31 | CES28 = 96  | CES53 = 95 | CES78 = 85 |
| CES04 = 69 | CES29 = 93  | CES54 = 89 | CES79 = 93 |
| CES05 = 48 | CES30 = 81  | CES55 = 86 | CES80 = 93 |
| CES06 = 50 | CES31 = 95  | CES56 = 90 | CES81 = 80 |
| CES07 = 41 | CES32 = 93  | CES57 = 87 | CES82 = 96 |
| CES08 = 40 | CES33 = 91  | CES58 = 87 | CES83 = 95 |
| CES09 = 29 | CES34 = 95  | CES59 = 96 | CES84 = 93 |
| CES10 = 73 | CES35 = 96  | CES60 = 89 | CES85 = 81 |
| CES11 = 56 | CES36 = 74  | CES61 = 89 | CES86 = 85 |
| CES12 = 62 | CES37 = 95  | CES62 = 78 | CES87 = 93 |
| CES13 = 42 | CES38 = 76  | CES63 = 89 | CES88 = 96 |
| CES14 = 74 | CES39 = 98  | CES64 = 84 | CES89 = 87 |
| CES15 = 71 | CES40 = 98  | CES65 = 86 | CES90 = 93 |
| CES16 = 47 | CES41 = 92  | CES66 = 81 | CES91 = 68 |
| CES17 = 48 | CES42 = 95  | CES67 = 80 | CES92 = 78 |
| CES18 = 56 | CES43 = 96  | CES68 = 85 | CES93 = 86 |
| CES19 = 70 | CES44 = 99  | CES69 = 85 | CES94 = 79 |
| CES20 = 65 | CES45 = 100 | CES70 = 84 | CES95 = 82 |
| CES21 = 85 | CES46 = 96  | CES71 = 75 | CES96 = 93 |
| CES22 = 77 | CES47 = 91  | CES72 = 92 | CES97 = 96 |
| CES23 = 91 | CES48 = 84  | CES73 = 80 | CES98 = 94 |
| CES24 = 90 | CES49 = 97  | CES74 = 89 | CES99 = 92 |
| CES25 = 70 | CES50 = 95  | CES75 = 78 |            |



Color Rendition by Hue-Angle Bin



**Measure Comparisons**



(END OF REPORT)