

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: P983071

Luminaire Tested: 24CZ-LD5-45SE-UNV-L830-RDP-CD1-U

Issue Date: 04/23/2025

**Test Information**

Test Method: LM-79-2019  
Report Number: P983071  
Test Lab: INNOVATION CENTER(P3)  
Issue Date: 04/23/2025  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: METALUX  
Catalog Number: 24CZ-LD5-45SE-UNV-L830-RDP-CD1-U  
Description: METALUX CRUZE 2x4 4500LM STANDARD EFFICACY PACKAGE 80CRI 3000K TROFFER LENS WITH FILM INSERT  
Light Source: 3000K CCT, 80 CRI LEDS  
Ballast/Driver: -

**Summary**

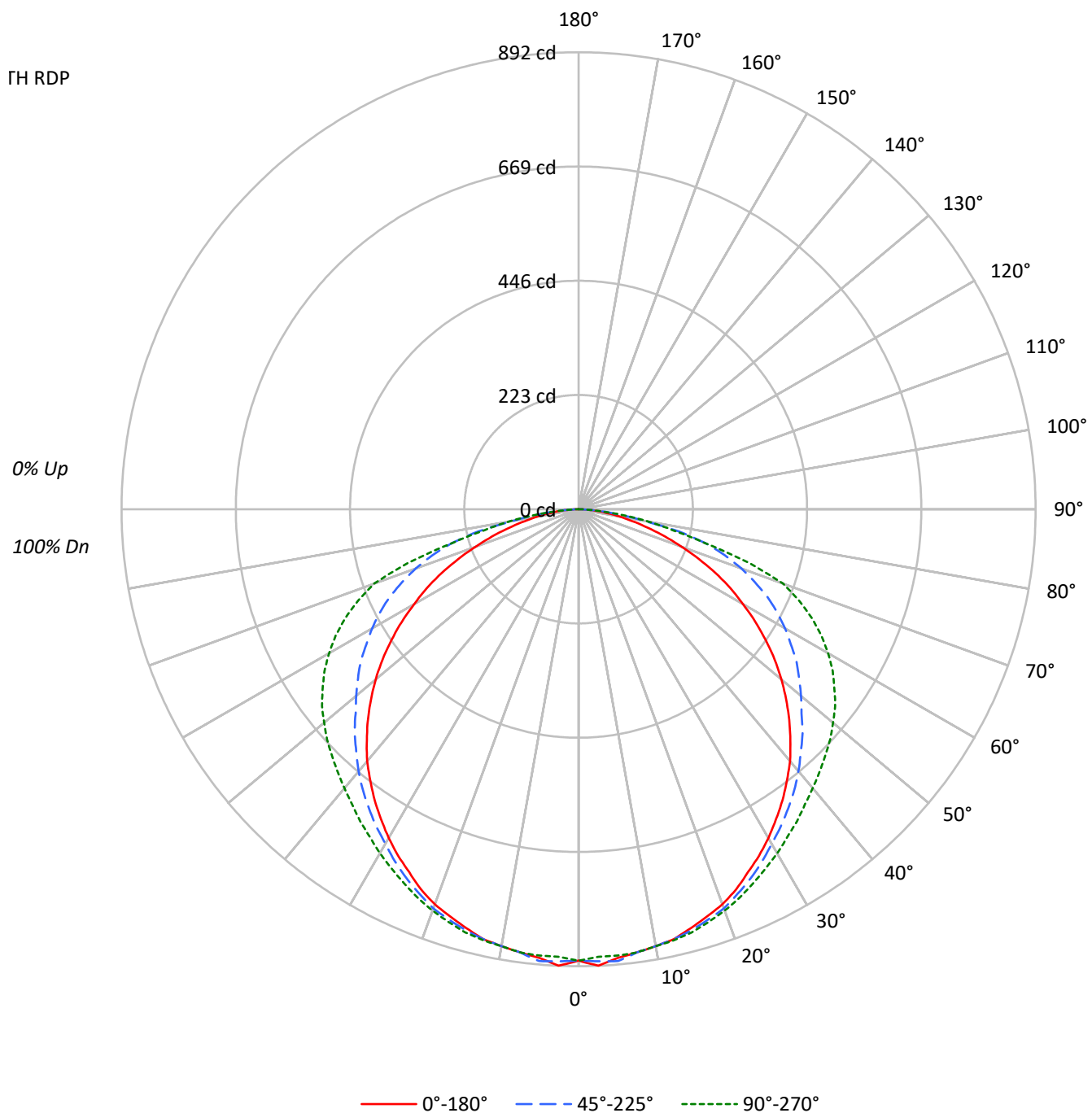
Lumens per Lamp: N/A  
Luminaire Lumens: 2774.0 lumens  
Efficiency: N/A  
Efficacy: 79.3 lumens/watt  
Spacing Criteria (0/90/45): 1.25 / 1.31 / 1.41  
Luminous Opening: Rectangular (W 2' x L: 4' x H: 0')  
CIE Type: Direct

Input Watts (W): 35  
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

TEST NUMBER: P983071

CATALOG NUMBER: 24CZ-LD5-45SE-UNV-L830-RDP-CD1-U

### Luminous Intensity Polar Plot



TEST NUMBER: P983071

CATALOG NUMBER: 24CZ-LD5-45SE-UNV-L830-RDP-CD1-U

**COEFFICIENT OF UTILIZATION - ZONAL CAVITY METHOD:**

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|
| RF  | 20  |     |     |     | 20  |     |     |     |     | 20  |     |     |     |     | 20  |     |     |     |    | 20 |
| RC  | 80  |     |     |     | 70  |     |     |     |     | 50  |     |     |     |     | 30  |     |     |     |    | 10 |
| RW  | 70  | 50  | 30  | 10  | 70  | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30 | 10 |
| 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°  | 1186 | 1186 | 1186 |
| 5°  | 1187 | 1196 | 1181 |
| 10° | 1183 | 1183 | 1183 |
| 15° | 1179 | 1185 | 1191 |
| 20° | 1175 | 1188 | 1194 |
| 25° | 1161 | 1180 | 1196 |
| 30° | 1151 | 1171 | 1205 |
| 35° | 1139 | 1171 | 1221 |
| 40° | 1128 | 1173 | 1249 |
| 45° | 1107 | 1177 | 1295 |
| 50° | 1082 | 1186 | 1357 |
| 55° | 1046 | 1218 | 1430 |
| 60° | 997  | 1252 | 1513 |
| 65° | 940  | 1296 | 1598 |
| 70° | 839  | 1330 | 1670 |
| 75° | 728  | 1332 | 1321 |
| 80° | 618  | 985  | 1068 |
| 85° | 533  | 665  | 599  |

**MAXIMUM LUMINANCE 45°-90°:**

Horizontal Angle: 90°

Vertical Angle: 70°

Luminance: 1670 cd/sqm

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CATALOG NUMBER: 24CZ-LD5-45SE-UNV-L830-RDP-CD1-U

**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 83.7   | 3.0       |
| 10°-20°   | 240.2  | 8.7       |
| 20°-30°   | 366.1  | 13.2      |
| 30°-40°   | 448.0  | 16.1      |
| 40°-50°   | 482.0  | 17.4      |
| 50°-60°   | 466.9  | 16.8      |
| 60°-70°   | 395.5  | 14.3      |
| 70°-80°   | 239.1  | 8.6       |
| 80°-90°   | 52.6   | 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°    | 690.0  | 24.9      |
| 0°-40°    | 1138.0 | 41.0      |
| 0°-60°    | 2086.8 | 75.2      |
| 0°-90°    | 2774.0 | 100.0     |
| 90°-120°  | 0.0    | 0.0       |
| 90°-150°  | 0.0    | 0.0       |
| 90°-180°  | 0.0    | 0.0       |
| 0°-180°   | 2774.0 | 100.0     |

**CANDELA DISTRIBUTION:**

|     | 0°  | 22.5° | 45° | 67.5° | 90° | Flux |
|-----|-----|-------|-----|-------|-----|------|
| 0°  | 881 | 881   | 881 | 881   | 881 |      |
| 5°  | 879 | 879   | 885 | 881   | 875 | 84   |
| 15° | 847 | 849   | 851 | 853   | 855 | 239  |
| 25° | 782 | 786   | 795 | 801   | 806 | 361  |
| 35° | 694 | 698   | 713 | 732   | 743 | 434  |
| 45° | 582 | 592   | 618 | 657   | 681 | 448  |
| 55° | 446 | 465   | 519 | 580   | 610 | 398  |
| 65° | 295 | 328   | 407 | 472   | 502 | 291  |
| 75° | 140 | 190   | 256 | 261   | 254 | 150  |
| 85° | 34  | 41    | 43  | 41    | 39  | 39   |
| 90° | 0   | 0     | 0   | 0     | 0   |      |

TEST NUMBER: P983071

CATALOG NUMBER: 24CZ-LD5-45SE-UNV-L830-RDP-CD1-U

**CANDELA DISTRIBUTION (FULL):**

|       | 0°    | 22.5° | 45°   | 67.5° | 90°   |
|-------|-------|-------|-------|-------|-------|
| 0°    | 881.1 | 881.1 | 881.1 | 881.1 | 881.1 |
| 2.5°  | 891.9 | 889.7 | 883.2 | 878.9 | 874.6 |
| 5°    | 878.9 | 878.9 | 885.4 | 881.1 | 874.6 |
| 7.5°  | 872.5 | 872.5 | 872.5 | 883.2 | 872.5 |
| 10°   | 866.0 | 868.2 | 866.0 | 874.6 | 866.0 |
| 12.5° | 859.5 | 859.5 | 859.5 | 861.7 | 861.7 |
| 15°   | 846.6 | 848.8 | 850.9 | 853.1 | 855.2 |
| 17.5° | 833.7 | 835.8 | 840.1 | 842.3 | 844.5 |
| 20°   | 820.8 | 822.9 | 829.4 | 829.4 | 833.7 |
| 22.5° | 803.5 | 803.5 | 812.2 | 814.3 | 820.8 |
| 25°   | 782.0 | 786.3 | 794.9 | 801.4 | 805.7 |
| 27.5° | 762.6 | 766.9 | 775.5 | 784.1 | 790.6 |
| 30°   | 741.1 | 745.4 | 754.0 | 766.9 | 775.5 |
| 32.5° | 717.4 | 721.7 | 734.6 | 749.7 | 758.3 |
| 35°   | 693.7 | 698.0 | 713.0 | 732.4 | 743.2 |
| 37.5° | 667.8 | 674.3 | 691.5 | 713.0 | 726.0 |
| 40°   | 642.0 | 648.4 | 667.8 | 691.5 | 710.9 |
| 42.5° | 611.8 | 620.4 | 642.0 | 674.3 | 695.8 |
| 45°   | 581.7 | 592.4 | 618.3 | 657.0 | 680.7 |
| 47.5° | 549.3 | 560.1 | 590.3 | 639.8 | 665.7 |
| 50°   | 517.0 | 529.9 | 566.5 | 620.4 | 648.4 |
| 52.5° | 482.5 | 495.5 | 542.8 | 601.0 | 631.2 |
| 55°   | 445.9 | 465.3 | 519.2 | 579.5 | 609.6 |
| 57.5° | 409.3 | 430.9 | 491.2 | 555.8 | 588.1 |
| 60°   | 370.5 | 396.4 | 465.3 | 529.9 | 562.3 |
| 62.5° | 333.9 | 361.9 | 437.3 | 501.9 | 534.3 |
| 65°   | 295.1 | 327.5 | 407.2 | 471.8 | 501.9 |
| 67.5° | 254.2 | 295.1 | 372.7 | 435.2 | 465.3 |
| 70°   | 213.3 | 260.7 | 338.2 | 396.4 | 424.4 |
| 72.5° | 176.6 | 226.2 | 299.4 | 349.0 | 349.0 |
| 75°   | 140.0 | 189.6 | 256.3 | 260.7 | 254.2 |
| 77.5° | 107.7 | 155.1 | 200.3 | 183.1 | 187.4 |
| 80°   | 79.7  | 118.5 | 127.1 | 133.6 | 137.9 |
| 82.5° | 53.9  | 79.7  | 81.9  | 86.2  | 86.2  |
| 85°   | 34.5  | 41.0  | 43.1  | 41.0  | 38.8  |
| 87.5° | 15.1  | 17.3  | 12.9  | 8.6   | 6.5   |
| 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: SP3-2508-516-5

Test Date: 09/03/2025

Luminaire Tested: 24CZ-LD5-65-S-UNV-L930-CD1-U

Data in this report applies to families of products including 24CZ-LD5-65-S-UNV-L930-CD1-U

### Test Information

Test Method: LM-79-2019  
 Report Number: SP3-2508-516-5  
 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-L930-CD1-U**  
 Description: 2X4 CRUZE SB 6500LM 930 SMOOTH LENS

### Spectral Parameters

CCT (K): 2988  
 CIE  $u'$ : 0.2517  
 CIE  $v'$ : 0.5189  
 Duv: -0.0019  
 CIE x: 0.4350  
 CIE y: 0.3986  
 CIE z: 0.1665  
 Peak Wavelength (nm): 630  
 Dominant Wavelength (nm): 583  
 Purity: 50.17903  
 R<sub>f</sub>: 91.6  
 R<sub>g</sub>: 101.1

CRI (Ra): 94.3  
 R1: 96.3  
 R2: 97.6  
 R3: 97.5  
 R4: 95.8  
 R5: 96.1  
 R6: 96.2  
 R7: 91.6  
 R8: 83.5  
 R9: 61.9  
 R10: 93.0  
 R11: 96.3  
 R12: 85.8  
 R13: 96.7  
 R14: 97.5  
 R15: 91.8



### Test Conditions

Stabilization Time: 21M  
 Operation Time: 1H 21M  
 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**



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### Photopic Flux vs. Wavelength



### Photopic Lumens: NR

| $\lambda$<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               | 101                                  | NR                             | 620               | 329                                  | NR                             | 750               | 8                                    | NR                             | 880               | 0                                    | NR                             |
| 365               | 0                                    | NR                             | 495               | 121                                  | NR                             | 625               | 331                                  | NR                             | 755               | 7                                    | NR                             | 885               | 0                                    | NR                             |
| 370               | 0                                    | NR                             | 500               | 143                                  | NR                             | 630               | 1000                                 | NR                             | 760               | 6                                    | NR                             | 890               | 0                                    | NR                             |
| 375               | 0                                    | NR                             | 505               | 161                                  | NR                             | 635               | 709                                  | NR                             | 765               | 5                                    | NR                             | 895               | 0                                    | NR                             |
| 380               | 0                                    | NR                             | 510               | 176                                  | NR                             | 640               | 220                                  | NR                             | 770               | 4                                    | NR                             | 900               | 0                                    | NR                             |
| 385               | 0                                    | NR                             | 515               | 189                                  | NR                             | 645               | 210                                  | NR                             | 775               | 3                                    | NR                             | 905               | 0                                    | NR                             |
| 390               | 0                                    | NR                             | 520               | 196                                  | NR                             | 650               | 188                                  | NR                             | 780               | 3                                    | NR                             | 910               | 0                                    | NR                             |
| 395               | 1                                    | NR                             | 525               | 203                                  | NR                             | 655               | 156                                  | NR                             | 785               | 2                                    | NR                             | 915               | 0                                    | NR                             |
| 400               | 1                                    | NR                             | 530               | 208                                  | NR                             | 660               | 134                                  | NR                             | 790               | 2                                    | NR                             | 920               | 0                                    | NR                             |
| 405               | 2                                    | NR                             | 535               | 213                                  | NR                             | 665               | 112                                  | NR                             | 795               | 2                                    | NR                             | 925               | 0                                    | NR                             |
| 410               | 3                                    | NR                             | 540               | 219                                  | NR                             | 670               | 104                                  | NR                             | 800               | 1                                    | NR                             | 930               | 0                                    | NR                             |
| 415               | 6                                    | NR                             | 545               | 226                                  | NR                             | 675               | 85                                   | NR                             | 805               | 1                                    | NR                             | 935               | 0                                    | NR                             |
| 420               | 10                                   | NR                             | 550               | 233                                  | NR                             | 680               | 72                                   | NR                             | 810               | 1                                    | NR                             | 940               | 0                                    | NR                             |
| 425               | 17                                   | NR                             | 555               | 241                                  | NR                             | 685               | 63                                   | NR                             | 815               | 1                                    | NR                             | 945               | 0                                    | NR                             |
| 430               | 30                                   | NR                             | 560               | 250                                  | NR                             | 690               | 53                                   | NR                             | 820               | 1                                    | NR                             | 950               | 0                                    | NR                             |
| 435               | 53                                   | NR                             | 565               | 260                                  | NR                             | 695               | 46                                   | NR                             | 825               | 1                                    | NR                             | 955               | 0                                    | NR                             |
| 440               | 92                                   | NR                             | 570               | 270                                  | NR                             | 700               | 39                                   | NR                             | 830               | 1                                    | NR                             | 960               | 0                                    | NR                             |
| 445               | 160                                  | NR                             | 575               | 280                                  | NR                             | 705               | 33                                   | NR                             | 835               | 1                                    | NR                             | 965               | 0                                    | NR                             |
| 450               | 214                                  | NR                             | 580               | 289                                  | NR                             | 710               | 28                                   | NR                             | 840               | 0                                    | NR                             | 970               | 0                                    | NR                             |
| 455               | 183                                  | NR                             | 585               | 298                                  | NR                             | 715               | 24                                   | NR                             | 845               | 0                                    | NR                             | 975               | 0                                    | NR                             |
| 460               | 133                                  | NR                             | 590               | 305                                  | NR                             | 720               | 20                                   | NR                             | 850               | 0                                    | NR                             | 980               | 0                                    | NR                             |
| 465               | 111                                  | NR                             | 595               | 309                                  | NR                             | 725               | 17                                   | NR                             | 855               | 0                                    | NR                             | 985               | 0                                    | NR                             |
| 470               | 91                                   | NR                             | 600               | 314                                  | NR                             | 730               | 15                                   | NR                             | 860               | 0                                    | NR                             | 990               | 0                                    | NR                             |
| 475               | 77                                   | NR                             | 605               | 318                                  | NR                             | 735               | 13                                   | NR                             | 865               | 0                                    | NR                             | 995               | 0                                    | NR                             |
| 480               | 76                                   | NR                             | 610               | 356                                  | NR                             | 740               | 11                                   | NR                             | 870               | 0                                    | NR                             | 1000              | 0                                    | NR                             |
| 485               | 86                                   | NR                             | 615               | 390                                  | NR                             | 745               | 9                                    | NR                             | 875               | 0                                    | NR                             |                   |                                      |                                |

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### Scotopic Flux vs. Wavelength



Scotopic Lumens: NR

S/P: 1.43

| λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(Φ/nm) |
|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|
| 360       | 0                           | NR               | 490       | 101                         | NR               | 620       | 329                         | NR               | 750       | 8                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 121                         | NR               | 625       | 331                         | NR               | 755       | 7                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 143                         | NR               | 630       | 1000                        | NR               | 760       | 6                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 161                         | NR               | 635       | 709                         | NR               | 765       | 5                           | NR               | 895       | 0                           | NR               |
| 380       | 0                           | NR               | 510       | 176                         | NR               | 640       | 220                         | NR               | 770       | 4                           | NR               | 900       | 0                           | NR               |
| 385       | 0                           | NR               | 515       | 189                         | NR               | 645       | 210                         | NR               | 775       | 3                           | NR               | 905       | 0                           | NR               |
| 390       | 0                           | NR               | 520       | 196                         | NR               | 650       | 188                         | NR               | 780       | 3                           | NR               | 910       | 0                           | NR               |
| 395       | 1                           | NR               | 525       | 203                         | NR               | 655       | 156                         | NR               | 785       | 2                           | NR               | 915       | 0                           | NR               |
| 400       | 1                           | NR               | 530       | 208                         | NR               | 660       | 134                         | NR               | 790       | 2                           | NR               | 920       | 0                           | NR               |
| 405       | 2                           | NR               | 535       | 213                         | NR               | 665       | 112                         | NR               | 795       | 2                           | NR               | 925       | 0                           | NR               |
| 410       | 3                           | NR               | 540       | 219                         | NR               | 670       | 104                         | NR               | 800       | 1                           | NR               | 930       | 0                           | NR               |
| 415       | 6                           | NR               | 545       | 226                         | NR               | 675       | 85                          | NR               | 805       | 1                           | NR               | 935       | 0                           | NR               |
| 420       | 10                          | NR               | 550       | 233                         | NR               | 680       | 72                          | NR               | 810       | 1                           | NR               | 940       | 0                           | NR               |
| 425       | 17                          | NR               | 555       | 241                         | NR               | 685       | 63                          | NR               | 815       | 1                           | NR               | 945       | 0                           | NR               |
| 430       | 30                          | NR               | 560       | 250                         | NR               | 690       | 53                          | NR               | 820       | 1                           | NR               | 950       | 0                           | NR               |
| 435       | 53                          | NR               | 565       | 260                         | NR               | 695       | 46                          | NR               | 825       | 1                           | NR               | 955       | 0                           | NR               |
| 440       | 92                          | NR               | 570       | 270                         | NR               | 700       | 39                          | NR               | 830       | 1                           | NR               | 960       | 0                           | NR               |
| 445       | 160                         | NR               | 575       | 280                         | NR               | 705       | 33                          | NR               | 835       | 1                           | NR               | 965       | 0                           | NR               |
| 450       | 214                         | NR               | 580       | 289                         | NR               | 710       | 28                          | NR               | 840       | 0                           | NR               | 970       | 0                           | NR               |
| 455       | 183                         | NR               | 585       | 298                         | NR               | 715       | 24                          | NR               | 845       | 0                           | NR               | 975       | 0                           | NR               |
| 460       | 133                         | NR               | 590       | 305                         | NR               | 720       | 20                          | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 111                         | NR               | 595       | 309                         | NR               | 725       | 17                          | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 91                          | NR               | 600       | 314                         | NR               | 730       | 15                          | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 77                          | NR               | 605       | 318                         | NR               | 735       | 13                          | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 76                          | NR               | 610       | 356                         | NR               | 740       | 11                          | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 86                          | NR               | 615       | 390                         | NR               | 745       | 9                           | NR               | 875       | 0                           | NR               |           |                             |                  |

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### Melanopic Flux vs. Wavelength



Melanopic Lumens: NR

M/P: 2.8

| 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       | 101                         | NR               | 620       | 329                         | NR               | 750       | 8                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 121                         | NR               | 625       | 331                         | NR               | 755       | 7                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 143                         | NR               | 630       | 1000                        | NR               | 760       | 6                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 161                         | NR               | 635       | 709                         | NR               | 765       | 5                           | NR               | 895       | 0                           | NR               |
| 380       | 0                           | NR               | 510       | 176                         | NR               | 640       | 220                         | NR               | 770       | 4                           | NR               | 900       | 0                           | NR               |
| 385       | 0                           | NR               | 515       | 189                         | NR               | 645       | 210                         | NR               | 775       | 3                           | NR               | 905       | 0                           | NR               |
| 390       | 0                           | NR               | 520       | 196                         | NR               | 650       | 188                         | NR               | 780       | 3                           | NR               | 910       | 0                           | NR               |
| 395       | 1                           | NR               | 525       | 203                         | NR               | 655       | 156                         | NR               | 785       | 2                           | NR               | 915       | 0                           | NR               |
| 400       | 1                           | NR               | 530       | 208                         | NR               | 660       | 134                         | NR               | 790       | 2                           | NR               | 920       | 0                           | NR               |
| 405       | 2                           | NR               | 535       | 213                         | NR               | 665       | 112                         | NR               | 795       | 2                           | NR               | 925       | 0                           | NR               |
| 410       | 3                           | NR               | 540       | 219                         | NR               | 670       | 104                         | NR               | 800       | 1                           | NR               | 930       | 0                           | NR               |
| 415       | 6                           | NR               | 545       | 226                         | NR               | 675       | 85                          | NR               | 805       | 1                           | NR               | 935       | 0                           | NR               |
| 420       | 10                          | NR               | 550       | 233                         | NR               | 680       | 72                          | NR               | 810       | 1                           | NR               | 940       | 0                           | NR               |
| 425       | 17                          | NR               | 555       | 241                         | NR               | 685       | 63                          | NR               | 815       | 1                           | NR               | 945       | 0                           | NR               |
| 430       | 30                          | NR               | 560       | 250                         | NR               | 690       | 53                          | NR               | 820       | 1                           | NR               | 950       | 0                           | NR               |
| 435       | 53                          | NR               | 565       | 260                         | NR               | 695       | 46                          | NR               | 825       | 1                           | NR               | 955       | 0                           | NR               |
| 440       | 92                          | NR               | 570       | 270                         | NR               | 700       | 39                          | NR               | 830       | 1                           | NR               | 960       | 0                           | NR               |
| 445       | 160                         | NR               | 575       | 280                         | NR               | 705       | 33                          | NR               | 835       | 1                           | NR               | 965       | 0                           | NR               |
| 450       | 214                         | NR               | 580       | 289                         | NR               | 710       | 28                          | NR               | 840       | 0                           | NR               | 970       | 0                           | NR               |
| 455       | 183                         | NR               | 585       | 298                         | NR               | 715       | 24                          | NR               | 845       | 0                           | NR               | 975       | 0                           | NR               |
| 460       | 133                         | NR               | 590       | 305                         | NR               | 720       | 20                          | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 111                         | NR               | 595       | 309                         | NR               | 725       | 17                          | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 91                          | NR               | 600       | 314                         | NR               | 730       | 15                          | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 77                          | NR               | 605       | 318                         | NR               | 735       | 13                          | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 76                          | NR               | 610       | 356                         | NR               | 740       | 11                          | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 86                          | NR               | 615       | 390                         | NR               | 745       | 9                           | NR               | 875       | 0                           | NR               |           |                             |                  |

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TM-30-18

### Summary

$R_f = 91.6$   
 $R_g = 101.1$   
 CIE  $R_a = 94.3$   
 $R_9 = 61.9$



### Color Vector Graphics



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

|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 92 | CES51 = 97 | CES76 = 89 |
| CES02 = 63 | CES27 = 95 | CES52 = 96 | CES77 = 85 |
| CES03 = 32 | CES28 = 96 | CES53 = 94 | CES78 = 86 |
| CES04 = 70 | CES29 = 92 | CES54 = 97 | CES79 = 89 |
| CES05 = 51 | CES30 = 99 | CES55 = 96 | CES80 = 91 |
| CES06 = 51 | CES31 = 93 | CES56 = 96 | CES81 = 72 |
| CES07 = 44 | CES32 = 85 | CES57 = 96 | CES82 = 96 |
| CES08 = 42 | CES33 = 94 | CES58 = 96 | CES83 = 93 |
| CES09 = 29 | CES34 = 93 | CES59 = 99 | CES84 = 96 |
| CES10 = 76 | CES35 = 96 | CES60 = 95 | CES85 = 80 |
| CES11 = 59 | CES36 = 87 | CES61 = 95 | CES86 = 78 |
| CES12 = 65 | CES37 = 94 | CES62 = 93 | CES87 = 91 |
| CES13 = 44 | CES38 = 96 | CES63 = 94 | CES88 = 97 |
| CES14 = 74 | CES39 = 98 | CES64 = 95 | CES89 = 82 |
| CES15 = 72 | CES40 = 95 | CES65 = 91 | CES90 = 98 |
| CES16 = 48 | CES41 = 96 | CES66 = 93 | CES91 = 81 |
| CES17 = 50 | CES42 = 92 | CES67 = 92 | CES92 = 78 |
| CES18 = 57 | CES43 = 90 | CES68 = 92 | CES93 = 87 |
| CES19 = 72 | CES44 = 99 | CES69 = 93 | CES94 = 73 |
| CES20 = 67 | CES45 = 94 | CES70 = 89 | CES95 = 85 |
| CES21 = 86 | CES46 = 94 | CES71 = 88 | CES96 = 92 |
| CES22 = 79 | CES47 = 88 | CES72 = 95 | CES97 = 94 |
| CES23 = 92 | CES48 = 95 | CES73 = 85 | CES98 = 94 |
| CES24 = 91 | CES49 = 92 | CES74 = 90 | CES99 = 93 |
| CES25 = 72 | CES50 = 97 | CES75 = 88 |            |



Color Rendition by Hue-Angle Bin



**Measure Comparisons**



(END OF REPORT)