

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: P982648

Luminaire Tested: 22CZ-LD5-44-UNV-L935-CD1-U

Issue Date: 04/23/2025

**Test Information**

Test Method: LM-79-2019  
Report Number: P982648  
Test Lab: INNOVATION CENTER(P3)  
Issue Date: 04/23/2025  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: METALUX  
Catalog Number: 22CZ-LD5-44-UNV-L935-CD1-U  
Description: METALUX CRUZE 2x2 4400LM PACKAGE 90CRI 3500K TROFFER STANDARD LENS  
Light Source: 3500K CCT, 90 CRI LEDS  
Ballast/Driver: -

**Summary**

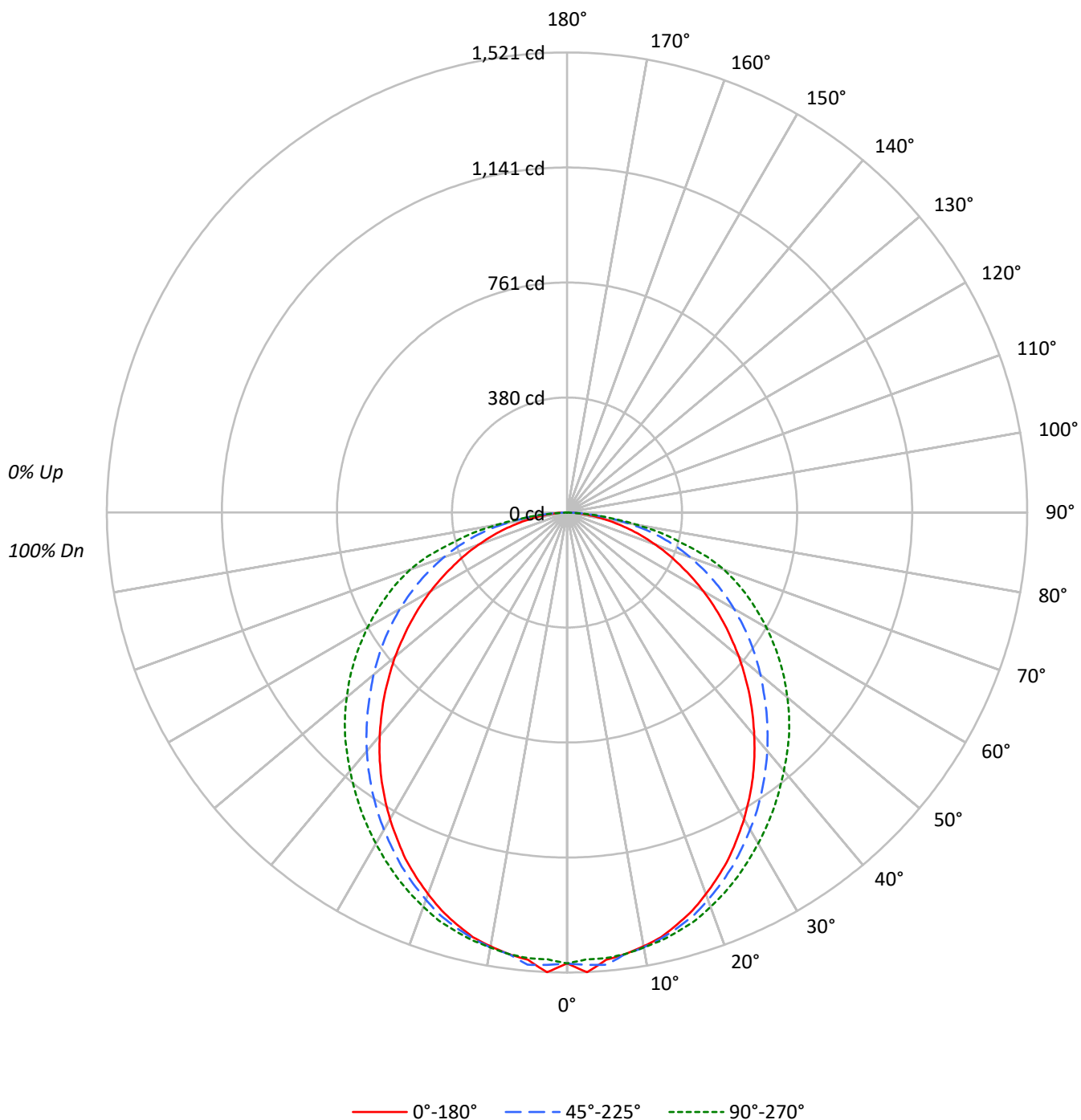
Lumens per Lamp: N/A  
Luminaire Lumens: 4177.0 lumens  
Efficiency: N/A  
Efficacy: 127.3 lumens/watt  
Spacing Criteria (0/90/45): 1.17 / 1.26 / 1.34  
Luminous Opening: Rectangular (W 2' x L: 2' x H: 0')  
CIE Type: Direct

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-L935-CD1-U

### Luminous Intensity Polar Plot



TEST NUMBER: P982648

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**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 | 104 | 99  | 95  | 106 | 101 | 97  | 94  | 97  | 94  | 91  |  | 93  | 90  | 88  |  | 89  | 87  | 85  | 83  |
| 2   | 98  | 90  | 83  | 77  | 96  | 88  | 82  | 76  | 84  | 79  | 74  |  | 81  | 77  | 73  |  | 78  | 74  | 71  | 69  |
| 3   | 90  | 79  | 70  | 64  | 87  | 77  | 69  | 63  | 74  | 68  | 62  |  | 71  | 66  | 61  |  | 69  | 64  | 60  | 58  |
| 4   | 82  | 70  | 61  | 54  | 80  | 68  | 60  | 54  | 66  | 59  | 53  |  | 64  | 57  | 52  |  | 61  | 56  | 51  | 49  |
| 5   | 75  | 62  | 53  | 46  | 73  | 61  | 53  | 46  | 59  | 51  | 46  |  | 57  | 50  | 45  |  | 55  | 49  | 45  | 43  |
| 6   | 70  | 56  | 47  | 41  | 68  | 55  | 47  | 40  | 53  | 46  | 40  |  | 52  | 45  | 40  |  | 50  | 44  | 39  | 37  |
| 7   | 65  | 51  | 42  | 36  | 63  | 50  | 42  | 36  | 48  | 41  | 35  |  | 47  | 40  | 35  |  | 46  | 40  | 35  | 33  |
| 8   | 60  | 46  | 38  | 32  | 58  | 46  | 38  | 32  | 44  | 37  | 32  |  | 43  | 36  | 31  |  | 42  | 36  | 31  | 29  |
| 9   | 56  | 43  | 34  | 29  | 55  | 42  | 34  | 29  | 41  | 34  | 29  |  | 40  | 33  | 28  |  | 39  | 33  | 28  | 26  |
| 10  | 53  | 39  | 31  | 26  | 51  | 39  | 31  | 26  | 38  | 31  | 26  |  | 37  | 30  | 26  |  | 36  | 30  | 26  | 24  |

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

|     | 0°   | 45°  | 90°  |
|-----|------|------|------|
| 0°  | 4012 | 4012 | 4012 |
| 5°  | 4011 | 4055 | 3995 |
| 10° | 3979 | 3990 | 3990 |
| 15° | 3927 | 3956 | 3989 |
| 20° | 3845 | 3903 | 3973 |
| 25° | 3752 | 3836 | 3950 |
| 30° | 3636 | 3762 | 3926 |
| 35° | 3517 | 3690 | 3916 |
| 40° | 3382 | 3618 | 3917 |
| 45° | 3246 | 3548 | 3950 |
| 50° | 3104 | 3495 | 3979 |
| 55° | 2955 | 3459 | 4031 |
| 60° | 2799 | 3433 | 4099 |
| 65° | 2625 | 3414 | 4204 |
| 70° | 2445 | 3404 | 4347 |
| 75° | 2218 | 3400 | 4118 |
| 80° | 1920 | 3146 | 3653 |
| 85° | 1633 | 2381 | 2319 |

**MAXIMUM LUMINANCE 45°-90°:**

Horizontal Angle: 90°

Vertical Angle: 70°

Luminance: 4347 cd/sqm

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**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 141.4  | 3.4       |
| 10°-20°   | 400.5  | 9.6       |
| 20°-30°   | 595.9  | 14.3      |
| 30°-40°   | 704.7  | 16.9      |
| 40°-50°   | 724.3  | 17.3      |
| 50°-60°   | 661.9  | 15.8      |
| 60°-70°   | 529.5  | 12.7      |
| 70°-80°   | 332.3  | 8.0       |
| 80°-90°   | 86.5   | 2.1       |
| 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°    | 1137.8 | 27.2      |
| 0°-40°    | 1842.5 | 44.1      |
| 0°-60°    | 3228.7 | 77.3      |
| 0°-90°    | 4177.0 | 100.0     |
| 90°-120°  | 0.0    | 0.0       |
| 90°-150°  | 0.0    | 0.0       |
| 90°-180°  | 0.0    | 0.0       |
| 0°-180°   | 4177.0 | 100.0     |

**CANDELA DISTRIBUTION:**

|     | 0°   | 22.5° | 45°  | 67.5° | 90°  | Flux |
|-----|------|-------|------|-------|------|------|
| 0°  | 1491 | 1491  | 1491 | 1491  | 1491 |      |
| 5°  | 1485 | 1485  | 1501 | 1491  | 1479 | 141  |
| 15° | 1410 | 1412  | 1420 | 1428  | 1432 | 397  |
| 25° | 1264 | 1272  | 1292 | 1314  | 1330 | 581  |
| 35° | 1070 | 1085  | 1123 | 1166  | 1192 | 669  |
| 45° | 853  | 875   | 932  | 1001  | 1038 | 658  |
| 55° | 630  | 660   | 737  | 819   | 859  | 563  |
| 65° | 412  | 449   | 536  | 618   | 660  | 409  |
| 75° | 213  | 254   | 327  | 376   | 396  | 227  |
| 85° | 53   | 67    | 77   | 75    | 75   | 61   |
| 90° | 0    | 0     | 0    | 0     | 0    |      |

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**CANDELA DISTRIBUTION (FULL):**

|       | 0°     | 22.5°  | 45°    | 67.5°  | 90°    |
|-------|--------|--------|--------|--------|--------|
| 0°    | 1491.0 | 1491.0 | 1491.0 | 1491.0 | 1491.0 |
| 2.5°  | 1521.4 | 1515.2 | 1497.0 | 1484.8 | 1478.8 |
| 5°    | 1484.8 | 1484.8 | 1501.0 | 1491.0 | 1478.8 |
| 7.5°  | 1472.6 | 1472.6 | 1472.6 | 1503.2 | 1472.6 |
| 10°   | 1456.3 | 1458.3 | 1460.3 | 1472.6 | 1460.3 |
| 12.5° | 1438.1 | 1438.1 | 1442.1 | 1446.1 | 1448.3 |
| 15°   | 1409.7 | 1411.7 | 1419.9 | 1427.9 | 1431.9 |
| 17.5° | 1379.3 | 1385.3 | 1395.5 | 1405.7 | 1413.7 |
| 20°   | 1342.6 | 1350.8 | 1363.0 | 1379.3 | 1387.3 |
| 22.5° | 1304.0 | 1312.2 | 1328.4 | 1346.6 | 1360.8 |
| 25°   | 1263.5 | 1271.5 | 1291.9 | 1314.2 | 1330.4 |
| 27.5° | 1216.7 | 1226.9 | 1251.3 | 1281.7 | 1298.0 |
| 30°   | 1170.0 | 1182.2 | 1210.6 | 1245.1 | 1263.5 |
| 32.5° | 1121.1 | 1135.4 | 1168.0 | 1206.4 | 1228.9 |
| 35°   | 1070.5 | 1084.7 | 1123.3 | 1166.0 | 1192.2 |
| 37.5° | 1017.6 | 1033.8 | 1076.5 | 1125.3 | 1153.8 |
| 40°   | 962.8  | 981.2  | 1029.8 | 1082.7 | 1115.1 |
| 42.5° | 907.9  | 928.3  | 981.2  | 1044.0 | 1076.5 |
| 45°   | 853.0  | 875.4  | 932.3  | 1001.4 | 1038.0 |
| 47.5° | 796.2  | 822.6  | 881.5  | 958.7  | 995.4  |
| 50°   | 741.5  | 767.7  | 834.8  | 914.1  | 950.5  |
| 52.5° | 684.6  | 715.1  | 786.1  | 867.2  | 905.9  |
| 55°   | 629.8  | 660.2  | 737.3  | 818.6  | 859.2  |
| 57.5° | 574.9  | 605.3  | 686.6  | 769.9  | 810.4  |
| 60°   | 520.0  | 552.5  | 637.8  | 719.1  | 761.7  |
| 62.5° | 465.2  | 499.6  | 587.1  | 670.2  | 710.9  |
| 65°   | 412.3  | 448.9  | 536.2  | 617.5  | 660.2  |
| 67.5° | 361.6  | 400.1  | 485.4  | 564.7  | 607.3  |
| 70°   | 310.8  | 349.4  | 432.7  | 509.8  | 552.5  |
| 72.5° | 262.1  | 300.6  | 381.9  | 450.9  | 483.4  |
| 75°   | 213.3  | 253.9  | 327.0  | 375.8  | 396.1  |
| 77.5° | 166.6  | 207.2  | 270.1  | 302.6  | 325.0  |
| 80°   | 123.9  | 158.4  | 203.0  | 227.5  | 235.7  |
| 82.5° | 85.3   | 113.7  | 142.2  | 148.4  | 152.4  |
| 85°   | 52.9   | 67.1   | 77.1   | 75.1   | 75.1   |
| 87.5° | 24.4   | 26.4   | 22.4   | 16.2   | 10.2   |
| 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: SP3-2508-516-6

Test Date: 09/03/2025

Luminaire Tested: 24CZ-LD5-65-S-UNV-L935-CD1-U

Data in this report applies to families of products including 24CZ-LD5-65-S-UNV-L935-CD1-U

### Test Information

Test Method: LM-79-2019  
 Report Number: SP3-2508-516-6  
 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-L935-CD1-U**  
 Description: 2X4 CRUZE SB 6500LM 935 SMOOTH LENS

### Spectral Parameters

CCT (K): 3412  
 CIE  $u'$ : 0.2386  
 CIE  $v'$ : 0.5111  
 Duv: -0.0015  
 CIE x: 0.4087  
 CIE y: 0.3890  
 CIE z: 0.2023  
 Peak Wavelength (nm): 630  
 Dominant Wavelength (nm): 581  
 Purity: 39.41044  
 R<sub>f</sub>: 92.6  
 R<sub>g</sub>: 102

CRI (Ra): 96.3  
 R1: 99.2  
 R2: 97.9  
 R3: 94.7  
 R4: 96.6  
 R5: 98.4  
 R6: 96.1  
 R7: 95.6  
 R8: 92.0  
 R9: 78.4  
 R10: 93.0  
 R11: 94.5  
 R12: 81.5  
 R13: 99.0  
 R14: 95.8  
 R15: 96.7



### Test Conditions

Stabilization Time: 20M  
 Operation Time: 1H 20M  
 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 3500K 4-step quadrangle

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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               | 112                                  | NR                             | 620               | 281                                  | NR                             | 750               | 6                                    | NR                             | 880               | 0                                    | NR                             |
| 365               | 0                                    | NR                             | 495               | 134                                  | NR                             | 625               | 286                                  | NR                             | 755               | 5                                    | NR                             | 885               | 0                                    | NR                             |
| 370               | 0                                    | NR                             | 500               | 157                                  | NR                             | 630               | 1000                                 | NR                             | 760               | 4                                    | NR                             | 890               | 0                                    | NR                             |
| 375               | 0                                    | NR                             | 505               | 178                                  | NR                             | 635               | 695                                  | NR                             | 765               | 4                                    | NR                             | 895               | 0                                    | NR                             |
| 380               | 0                                    | NR                             | 510               | 193                                  | NR                             | 640               | 181                                  | NR                             | 770               | 3                                    | NR                             | 900               | 0                                    | NR                             |
| 385               | 0                                    | NR                             | 515               | 206                                  | NR                             | 645               | 175                                  | NR                             | 775               | 3                                    | NR                             | 905               | 0                                    | NR                             |
| 390               | 0                                    | NR                             | 520               | 213                                  | NR                             | 650               | 156                                  | NR                             | 780               | 2                                    | NR                             | 910               | 0                                    | NR                             |
| 395               | 1                                    | NR                             | 525               | 219                                  | NR                             | 655               | 127                                  | NR                             | 785               | 2                                    | NR                             | 915               | 0                                    | NR                             |
| 400               | 2                                    | NR                             | 530               | 223                                  | NR                             | 660               | 108                                  | NR                             | 790               | 2                                    | NR                             | 920               | 0                                    | NR                             |
| 405               | 2                                    | NR                             | 535               | 226                                  | NR                             | 665               | 89                                   | NR                             | 795               | 2                                    | NR                             | 925               | 0                                    | NR                             |
| 410               | 4                                    | NR                             | 540               | 230                                  | NR                             | 670               | 84                                   | NR                             | 800               | 1                                    | NR                             | 930               | 0                                    | NR                             |
| 415               | 6                                    | NR                             | 545               | 235                                  | NR                             | 675               | 67                                   | NR                             | 805               | 1                                    | NR                             | 935               | 0                                    | NR                             |
| 420               | 11                                   | NR                             | 550               | 239                                  | NR                             | 680               | 57                                   | NR                             | 810               | 1                                    | NR                             | 940               | 0                                    | NR                             |
| 425               | 19                                   | NR                             | 555               | 243                                  | NR                             | 685               | 50                                   | NR                             | 815               | 1                                    | NR                             | 945               | 0                                    | NR                             |
| 430               | 34                                   | NR                             | 560               | 248                                  | NR                             | 690               | 42                                   | NR                             | 820               | 1                                    | NR                             | 950               | 0                                    | NR                             |
| 435               | 60                                   | NR                             | 565               | 253                                  | NR                             | 695               | 36                                   | NR                             | 825               | 1                                    | NR                             | 955               | 0                                    | NR                             |
| 440               | 106                                  | NR                             | 570               | 256                                  | NR                             | 700               | 31                                   | NR                             | 830               | 0                                    | NR                             | 960               | 0                                    | NR                             |
| 445               | 193                                  | NR                             | 575               | 260                                  | NR                             | 705               | 26                                   | NR                             | 835               | 0                                    | NR                             | 965               | 0                                    | NR                             |
| 450               | 283                                  | NR                             | 580               | 263                                  | NR                             | 710               | 22                                   | NR                             | 840               | 0                                    | NR                             | 970               | 0                                    | NR                             |
| 455               | 234                                  | NR                             | 585               | 266                                  | NR                             | 715               | 19                                   | NR                             | 845               | 0                                    | NR                             | 975               | 0                                    | NR                             |
| 460               | 157                                  | NR                             | 590               | 267                                  | NR                             | 720               | 16                                   | NR                             | 850               | 0                                    | NR                             | 980               | 0                                    | NR                             |
| 465               | 134                                  | NR                             | 595               | 266                                  | NR                             | 725               | 14                                   | NR                             | 855               | 0                                    | NR                             | 985               | 0                                    | NR                             |
| 470               | 107                                  | NR                             | 600               | 268                                  | NR                             | 730               | 12                                   | NR                             | 860               | 0                                    | NR                             | 990               | 0                                    | NR                             |
| 475               | 85                                   | NR                             | 605               | 269                                  | NR                             | 735               | 10                                   | NR                             | 865               | 0                                    | NR                             | 995               | 0                                    | NR                             |
| 480               | 85                                   | NR                             | 610               | 309                                  | NR                             | 740               | 8                                    | NR                             | 870               | 0                                    | NR                             | 1000              | 0                                    | NR                             |
| 485               | 96                                   | NR                             | 615               | 345                                  | NR                             | 745               | 7                                    | NR                             | 875               | 0                                    | NR                             |                   |                                      |                                |

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### Scotopic Flux vs. Wavelength



Scotopic Lumens: NR

S/P: 1.61

| λ (nm) | Power W <sup>^</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (φ/nm) |
|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|
| 360    | 0                        | NR            | 490    | 112                      | NR            | 620    | 281                      | NR            | 750    | 6                        | NR            | 880    | 0                        | NR            |
| 365    | 0                        | NR            | 495    | 134                      | NR            | 625    | 286                      | NR            | 755    | 5                        | NR            | 885    | 0                        | NR            |
| 370    | 0                        | NR            | 500    | 157                      | NR            | 630    | 1000                     | NR            | 760    | 4                        | NR            | 890    | 0                        | NR            |
| 375    | 0                        | NR            | 505    | 178                      | NR            | 635    | 695                      | NR            | 765    | 4                        | NR            | 895    | 0                        | NR            |
| 380    | 0                        | NR            | 510    | 193                      | NR            | 640    | 181                      | NR            | 770    | 3                        | NR            | 900    | 0                        | NR            |
| 385    | 0                        | NR            | 515    | 206                      | NR            | 645    | 175                      | NR            | 775    | 3                        | NR            | 905    | 0                        | NR            |
| 390    | 0                        | NR            | 520    | 213                      | NR            | 650    | 156                      | NR            | 780    | 2                        | NR            | 910    | 0                        | NR            |
| 395    | 1                        | NR            | 525    | 219                      | NR            | 655    | 127                      | NR            | 785    | 2                        | NR            | 915    | 0                        | NR            |
| 400    | 2                        | NR            | 530    | 223                      | NR            | 660    | 108                      | NR            | 790    | 2                        | NR            | 920    | 0                        | NR            |
| 405    | 2                        | NR            | 535    | 226                      | NR            | 665    | 89                       | NR            | 795    | 2                        | NR            | 925    | 0                        | NR            |
| 410    | 4                        | NR            | 540    | 230                      | NR            | 670    | 84                       | NR            | 800    | 1                        | NR            | 930    | 0                        | NR            |
| 415    | 6                        | NR            | 545    | 235                      | NR            | 675    | 67                       | NR            | 805    | 1                        | NR            | 935    | 0                        | NR            |
| 420    | 11                       | NR            | 550    | 239                      | NR            | 680    | 57                       | NR            | 810    | 1                        | NR            | 940    | 0                        | NR            |
| 425    | 19                       | NR            | 555    | 243                      | NR            | 685    | 50                       | NR            | 815    | 1                        | NR            | 945    | 0                        | NR            |
| 430    | 34                       | NR            | 560    | 248                      | NR            | 690    | 42                       | NR            | 820    | 1                        | NR            | 950    | 0                        | NR            |
| 435    | 60                       | NR            | 565    | 253                      | NR            | 695    | 36                       | NR            | 825    | 1                        | NR            | 955    | 0                        | NR            |
| 440    | 106                      | NR            | 570    | 256                      | NR            | 700    | 31                       | NR            | 830    | 0                        | NR            | 960    | 0                        | NR            |
| 445    | 193                      | NR            | 575    | 260                      | NR            | 705    | 26                       | NR            | 835    | 0                        | NR            | 965    | 0                        | NR            |
| 450    | 283                      | NR            | 580    | 263                      | NR            | 710    | 22                       | NR            | 840    | 0                        | NR            | 970    | 0                        | NR            |
| 455    | 234                      | NR            | 585    | 266                      | NR            | 715    | 19                       | NR            | 845    | 0                        | NR            | 975    | 0                        | NR            |
| 460    | 157                      | NR            | 590    | 267                      | NR            | 720    | 16                       | NR            | 850    | 0                        | NR            | 980    | 0                        | NR            |
| 465    | 134                      | NR            | 595    | 266                      | NR            | 725    | 14                       | NR            | 855    | 0                        | NR            | 985    | 0                        | NR            |
| 470    | 107                      | NR            | 600    | 268                      | NR            | 730    | 12                       | NR            | 860    | 0                        | NR            | 990    | 0                        | NR            |
| 475    | 85                       | NR            | 605    | 269                      | NR            | 735    | 10                       | NR            | 865    | 0                        | NR            | 995    | 0                        | NR            |
| 480    | 85                       | NR            | 610    | 309                      | NR            | 740    | 8                        | NR            | 870    | 0                        | NR            | 1000   | 0                        | NR            |
| 485    | 96                       | NR            | 615    | 345                      | NR            | 745    | 7                        | NR            | 875    | 0                        | NR            |        |                          |               |

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### Melanopic Flux vs. Wavelength



Melanopic Lumens: NR

M/P: 3.24

| 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       | 112                         | NR               | 620       | 281                         | NR               | 750       | 6                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 134                         | NR               | 625       | 286                         | NR               | 755       | 5                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 157                         | NR               | 630       | 1000                        | NR               | 760       | 4                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 178                         | NR               | 635       | 695                         | NR               | 765       | 4                           | NR               | 895       | 0                           | NR               |
| 380       | 0                           | NR               | 510       | 193                         | NR               | 640       | 181                         | NR               | 770       | 3                           | NR               | 900       | 0                           | NR               |
| 385       | 0                           | NR               | 515       | 206                         | NR               | 645       | 175                         | NR               | 775       | 3                           | NR               | 905       | 0                           | NR               |
| 390       | 0                           | NR               | 520       | 213                         | NR               | 650       | 156                         | NR               | 780       | 2                           | NR               | 910       | 0                           | NR               |
| 395       | 1                           | NR               | 525       | 219                         | NR               | 655       | 127                         | NR               | 785       | 2                           | NR               | 915       | 0                           | NR               |
| 400       | 2                           | NR               | 530       | 223                         | NR               | 660       | 108                         | NR               | 790       | 2                           | NR               | 920       | 0                           | NR               |
| 405       | 2                           | NR               | 535       | 226                         | NR               | 665       | 89                          | NR               | 795       | 2                           | NR               | 925       | 0                           | NR               |
| 410       | 4                           | NR               | 540       | 230                         | NR               | 670       | 84                          | NR               | 800       | 1                           | NR               | 930       | 0                           | NR               |
| 415       | 6                           | NR               | 545       | 235                         | NR               | 675       | 67                          | NR               | 805       | 1                           | NR               | 935       | 0                           | NR               |
| 420       | 11                          | NR               | 550       | 239                         | NR               | 680       | 57                          | NR               | 810       | 1                           | NR               | 940       | 0                           | NR               |
| 425       | 19                          | NR               | 555       | 243                         | NR               | 685       | 50                          | NR               | 815       | 1                           | NR               | 945       | 0                           | NR               |
| 430       | 34                          | NR               | 560       | 248                         | NR               | 690       | 42                          | NR               | 820       | 1                           | NR               | 950       | 0                           | NR               |
| 435       | 60                          | NR               | 565       | 253                         | NR               | 695       | 36                          | NR               | 825       | 1                           | NR               | 955       | 0                           | NR               |
| 440       | 106                         | NR               | 570       | 256                         | NR               | 700       | 31                          | NR               | 830       | 0                           | NR               | 960       | 0                           | NR               |
| 445       | 193                         | NR               | 575       | 260                         | NR               | 705       | 26                          | NR               | 835       | 0                           | NR               | 965       | 0                           | NR               |
| 450       | 283                         | NR               | 580       | 263                         | NR               | 710       | 22                          | NR               | 840       | 0                           | NR               | 970       | 0                           | NR               |
| 455       | 234                         | NR               | 585       | 266                         | NR               | 715       | 19                          | NR               | 845       | 0                           | NR               | 975       | 0                           | NR               |
| 460       | 157                         | NR               | 590       | 267                         | NR               | 720       | 16                          | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 134                         | NR               | 595       | 266                         | NR               | 725       | 14                          | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 107                         | NR               | 600       | 268                         | NR               | 730       | 12                          | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 85                          | NR               | 605       | 269                         | NR               | 735       | 10                          | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 85                          | NR               | 610       | 309                         | NR               | 740       | 8                           | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 96                          | NR               | 615       | 345                         | NR               | 745       | 7                           | NR               | 875       | 0                           | NR               |           |                             |                  |

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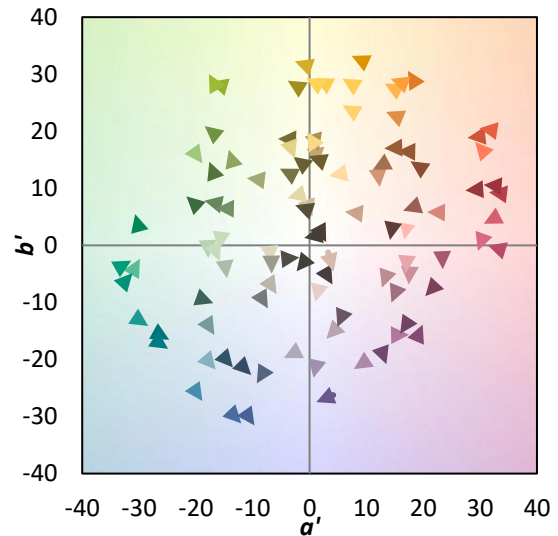
TM-30-18

### Summary

$R_f = 92.6$   
 $R_g = 102$   
 $CIE R_a = 96.3$   
 $R_9 = 78.4$



### Color Vector Graphics



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

|            |            |             |            |
|------------|------------|-------------|------------|
| CES01 = 86 | CES26 = 94 | CES51 = 97  | CES76 = 88 |
| CES02 = 63 | CES27 = 93 | CES52 = 96  | CES77 = 88 |
| CES03 = 32 | CES28 = 96 | CES53 = 95  | CES78 = 84 |
| CES04 = 70 | CES29 = 95 | CES54 = 95  | CES79 = 92 |
| CES05 = 50 | CES30 = 96 | CES55 = 95  | CES80 = 92 |
| CES06 = 51 | CES31 = 95 | CES56 = 98  | CES81 = 77 |
| CES07 = 43 | CES32 = 87 | CES57 = 98  | CES82 = 96 |
| CES08 = 42 | CES33 = 97 | CES58 = 98  | CES83 = 95 |
| CES09 = 29 | CES34 = 93 | CES59 = 100 | CES84 = 95 |
| CES10 = 75 | CES35 = 96 | CES60 = 94  | CES85 = 82 |
| CES11 = 58 | CES36 = 84 | CES61 = 95  | CES86 = 84 |
| CES12 = 64 | CES37 = 93 | CES62 = 90  | CES87 = 92 |
| CES13 = 44 | CES38 = 91 | CES63 = 95  | CES88 = 99 |
| CES14 = 74 | CES39 = 98 | CES64 = 95  | CES89 = 86 |
| CES15 = 72 | CES40 = 96 | CES65 = 92  | CES90 = 98 |
| CES16 = 48 | CES41 = 97 | CES66 = 93  | CES91 = 77 |
| CES17 = 49 | CES42 = 90 | CES67 = 92  | CES92 = 81 |
| CES18 = 56 | CES43 = 91 | CES68 = 91  | CES93 = 88 |
| CES19 = 71 | CES44 = 99 | CES69 = 92  | CES94 = 78 |
| CES20 = 67 | CES45 = 94 | CES70 = 89  | CES95 = 86 |
| CES21 = 86 | CES46 = 95 | CES71 = 85  | CES96 = 93 |
| CES22 = 78 | CES47 = 90 | CES72 = 95  | CES97 = 93 |
| CES23 = 91 | CES48 = 96 | CES73 = 84  | CES98 = 96 |
| CES24 = 90 | CES49 = 93 | CES74 = 91  | CES99 = 97 |
| CES25 = 71 | CES50 = 97 | CES75 = 86  |            |



Color Rendition by Hue-Angle Bin



**Measure Comparisons**


(END OF REPORT)