



LM-79-08 Test Report

for

Philips (China) Investment Co., Ltd.

Building 9, Lane 888, Tianlin Road
Shanghai, China

InstantFit LEDtube

Model: 9290002881 (2 lamps+ballast ICN-2P32-N)

Laboratory: Leading Testing Laboratories

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Report No.: HZ14040022b

Review by:

April Zou

Engineer: April Zou
Apr. 16, 2014

Approved by:



Manager: Jim Zhang
Apr. 16, 2014

Test Summary

Sample Tested: 9290002881 (2 lamps+ballast ICN-2P32-N)

Photometric and Electrical Measurements for two lamps

| Voltage (V AC) | Current (A) | Test power (W) (ballast + 2 tubes) | Power Factor | Total Luminous Flux (lm) | Luminous Efficacy (lm/W) | Total Harmonic Distortion |
|----------------|-------------|------------------------------------|--------------|--------------------------|--------------------------|---------------------------|
| 120.0 | 0.313 | 37.5 | 0.9974 | 4040.0 | 107.7 | 5.91 |

Photometric and Colorimetric Measurements for each lamp

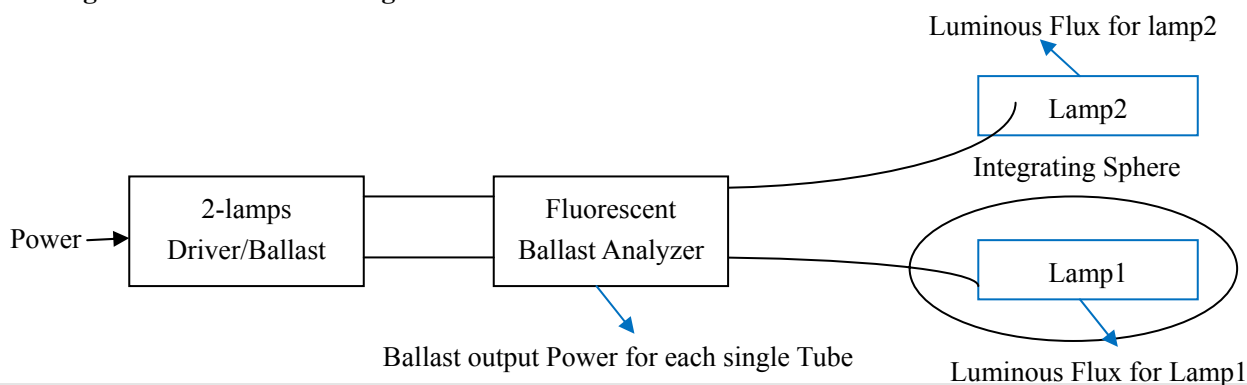
| Sample Number | Luminous Flux(lm) | Test power (W)(bare tube) | Efficiency for single Tube (lm/W) | Correlated Color Temperature (K) |
|---------------|--------------------------|---------------------------|-----------------------------------|----------------------------------|
| 1# | 1997.0 | 15.7 | 127.2 | 3467 |
| 2# | 2043.0 | 16.0 | 137.8 | 3475 |
| Sample Number | Color Rendering Index Ra | Color Rendering Index R9 | Chromaticity Coordinate x | Chromaticity Coordinate y |
| 1# | 81.0 | 13.6 | 0.4086 | 0.3957 |
| 2# | 81.1 | 14.1 | 0.4079 | 0.3947 |

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Luminous Efficacy=(Luminous Flux for lamp1+ Luminous Flux for lamp2)/Power

Test figure is shown as following:



Test specifications:

Date of Receipt : Apr. 15, 2014

Date of Test : Apr. 15, 2014

Test item : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

Reference Standard : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

The Ballast output Power for single Tube was tested using the Fluorescent Ballast Analyzer as per Client's requirement.

TABLE OF CONTENT

| | |
|--|----|
| LM-79-08 Test Report..... | 1 |
| Test Summary..... | 2 |
| Sample Photos | 4 |
| TEST RESULTS | 5 |
| Spectral Power Distribution of 1# tube - Sphere Spectroradiometer Method | 7 |
| Chromaticity Diagram of 1# tube - Sphere Spectroradiometer Method..... | 8 |
| Nominal CCT Quadrangles of 1# tube – Sphere Spectroradiometer Method | 9 |
| Zonal Lumen Tabulation- Goniophotometer Method | 10 |
| Illuminance Plots- Goniophotometer Method | 11 |
| Luminous Intensity Distribution Plots- Goniophotometer Method..... | 12 |
| Luminous Intensity Data- Goniophotometer Method..... | 13 |
| EQUIPMENT LIST | 15 |
| TEST METHODS | 15 |
| Seasoning of SSL Product..... | 15 |
| Sphere-Spectroradiometer Method- Photometric and Electrical Measurements..... | 15 |
| Goniophotometer Method | 16 |
| Photometric and Electrical Measurements..... | 16 |
| Color Characteristics Measurements..... | 16 |
| Color Spatial Uniformity | 16 |

Sample Photos

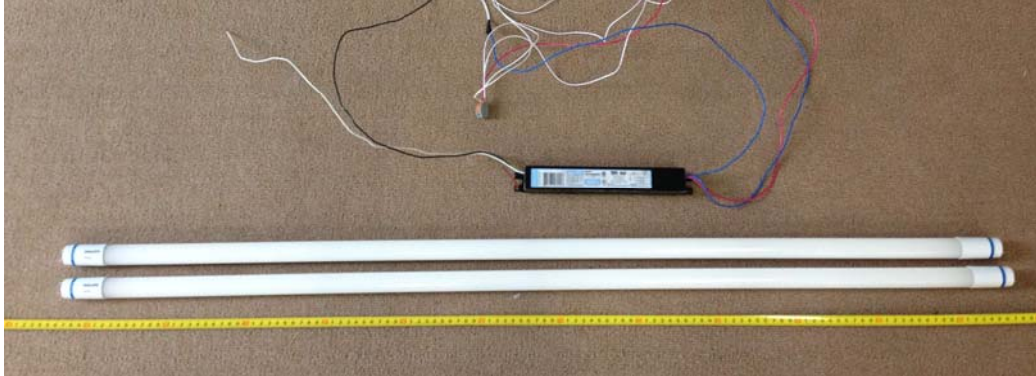


Figure 1- Overview of the sample

Equipment Under Test (EUT)

| | |
|----------------------------|---|
| Name | : InstantFit LEDtube |
| Model | : 9290002881 (2 lamps+ballast ICN-2P32-N) |
| Electrical Ratings | : 12V AC, 50Hz, 16.5W |
| Product Description | : G13 base, 4 foot fixed ends tube, 16.5T8/48-3500 IF 10/1 LED tubes supplied by a high frequency fluorescent lamp ballast: PHILIPS ICN-2P32-N |
| Manufacturer | : Philips (China) Investment Co., Ltd. |
| Address | : Building 9, Lane 888, Tianlin Road Shanghai, China |

TEST RESULTS

Test ambient temperature was 24.3°C

Base orientation was light down. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 70 minutes, and the total operating time including stabilization was 105 minutes.

Sphere-Spectroradiometer Method

| Parameter | Result | | | Special Color Rendering Indices | | |
|--|------------------|------------------|--------|---------------------------------|------|------|
| | 1# | 2# | 1# | | 1# | 2# |
| Test Voltage (V) | 120.0 | | 277.0 | | | |
| Voltage frequency (Hz) | 60 | | 60 | R1 | 78.8 | 79 |
| Test Current (A) | 0.313 | | 0.135 | R2 | 86.3 | 86.5 |
| Power Factor | 0.9974 | | 0.9831 | R3 | 92.3 | 92.3 |
| Test Power (W) (ballast + 2 tubes) | 37.5 | | 36.9 | R4 | 79.7 | 79.8 |
| Luminous Efficacy (lm/W) | 107.7 | | / | R5 | 78.1 | 78.3 |
| THD A% | 5.91 | | 9.65 | R6 | 80.6 | 80.7 |
| Total Luminous Flux (lm) | 1997.0 | 2043.0 | | R7 | 86.8 | 86.8 |
| Test power (W) (bare tube) | 15.7 | 16.0 | | R8 | 65.5 | 65.6 |
| Efficiency for single Tube (lm/W) | 127.2 | 137.8 | | R9 | 13.6 | 14.1 |
| Color Rendering Index (CRI) | 81.0 | 81.1 | | R10 | 67.6 | 67.8 |
| R9 | 13.6 | 14.1 | | R11 | 76.8 | 76.9 |
| Correlated Color Temperature (CCT) (K) | 3467 | 3475 | | R12 | 58.2 | 58.5 |
| Chromaticity (Chroma x, Chroma y) | (0.4086, 0.3957) | (0.4079, 0.3947) | | R13 | 80.1 | 80.2 |
| Chromaticity (Chroma u, Chroma v) | (0.2358, 0.3425) | (0.2357, 0.3422) | | R14 | 95.5 | 95.5 |
| Chromaticity (Chroma u', Chroma v') | (0.2358, 0.5138) | (0.2357, 0.5133) | | | | |
| Duv | 0.0012 | 0.0009 | | | | |

Table 2: Test data per Sphere-Spectroradiometer Method

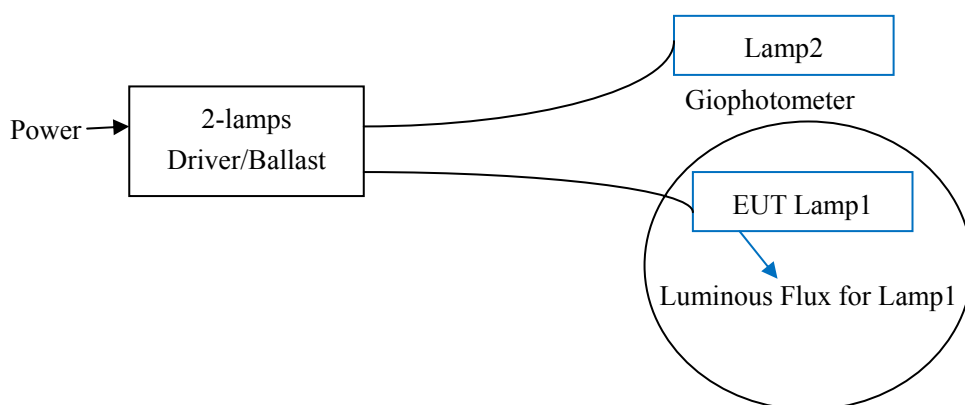
Note: According to CIE 1976 (u',v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

Goniophotometer Method

The photometric distance is 2.475m.

Luminous data was taken at 0.5°vertical intervals and 5°horizontal intervals.

Test figure is shown as following:



Note: One lamp was tested in Giophotometer system. The total electrical input data was recorded before the ballast and divided by 2 in table below to be used as the input data of the tested one lamp.

| Parameter | Result |
|--|-----------------------------------|
| Test Voltage (V) | 120.1 |
| Voltage frequency (Hz) | 60 |
| Test Current (A) | 0.323 |
| Power Factor | 0.9971 |
| Test Power (W) (ballast + 2 tubes)/2 | 19.3 |
| Luminous Efficacy (lm/W) | 103.6 |
| Total Luminous Flux (lm) (Single tube) | 1999.9 |
| Test power (W) (bare tube) | 15.7 |
| Luminous Efficacy (lm/W) (bare tube) | 127.4 |
| Beam Angle (°) | 115.0 (0°-180°)/ 162.6 (90°-270°) |
| Center Beam Candle Power (cd) | 454 |
| Maximum Beam Candle Power (cd) | 454.2 (At: C=320.0, Gamma=0.5) |
| Spacing Criteria | 1.28 (0°-180°)/ 1.38(90°-270°) |
| Zonal Lumens in the 0°-60°Zone | 56.75% |
| Zonal Lumens in the 60°-90°Zone | 29.53% |
| Zonal Lumens in the 90°-120°Zone | 11.31% |
| Zonal Lumens in the 120°-180°Zone | 2.41% |

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution of 1# tube - Sphere Spectroradiometer Method

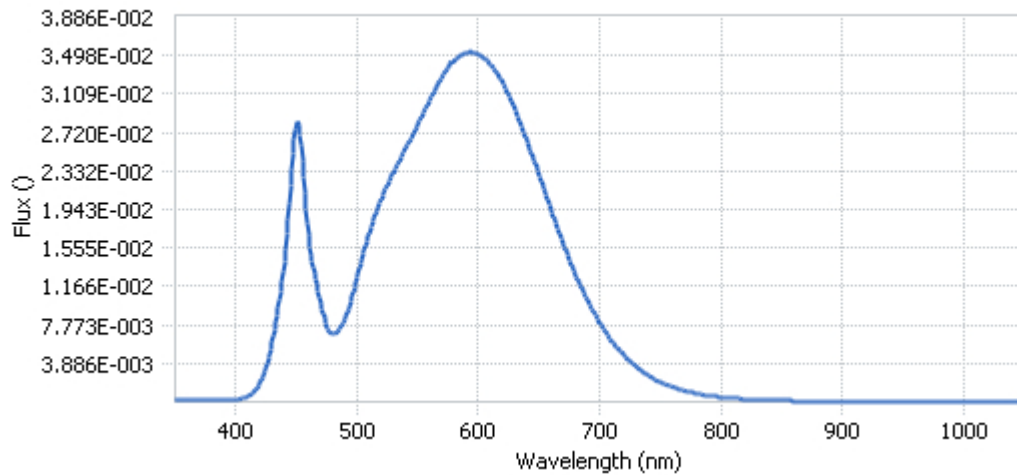
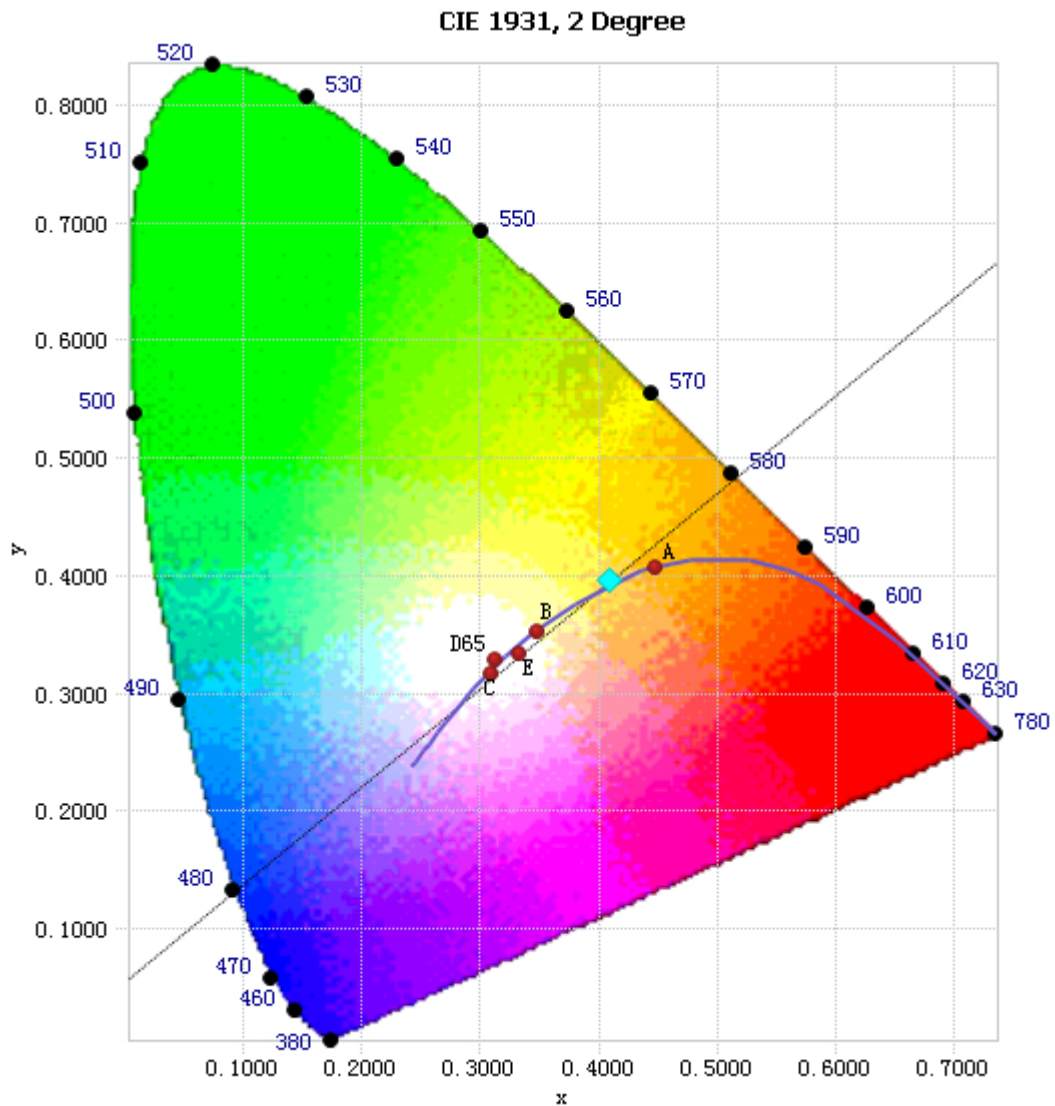


Chart 1: Spectral Power Distribution

| Spectral Distribution over Visible Wavelength | | | | | | | |
|---|----------------|--------|----------------|--------|----------------|--------|----------------|
| WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) |
| 380 | 1.84E-04 | 485 | 7.26E-03 | 590 | 3.52E-02 | 695 | 9.05E-03 |
| 385 | 2.07E-04 | 490 | 8.37E-03 | 595 | 3.53E-02 | 700 | 8.00E-03 |
| 390 | 2.06E-04 | 495 | 1.02E-02 | 600 | 3.51E-02 | 705 | 7.03E-03 |
| 395 | 2.17E-04 | 500 | 1.25E-02 | 605 | 3.47E-02 | 710 | 6.12E-03 |
| 400 | 2.46E-04 | 505 | 1.50E-02 | 610 | 3.41E-02 | 715 | 5.38E-03 |
| 405 | 3.63E-04 | 510 | 1.71E-02 | 615 | 3.32E-02 | 720 | 4.71E-03 |
| 410 | 5.53E-04 | 515 | 1.89E-02 | 620 | 3.22E-02 | 725 | 4.11E-03 |
| 415 | 1.05E-03 | 520 | 2.05E-02 | 625 | 3.10E-02 | 730 | 3.57E-03 |
| 420 | 1.93E-03 | 525 | 2.20E-02 | 630 | 2.96E-02 | 735 | 3.09E-03 |
| 425 | 3.54E-03 | 530 | 2.32E-02 | 635 | 2.80E-02 | 740 | 2.68E-03 |
| 430 | 6.02E-03 | 535 | 2.43E-02 | 640 | 2.65E-02 | 745 | 2.31E-03 |
| 435 | 9.50E-03 | 540 | 2.56E-02 | 645 | 2.47E-02 | 750 | 2.01E-03 |
| 440 | 1.42E-02 | 545 | 2.68E-02 | 650 | 2.30E-02 | 755 | 1.74E-03 |
| 445 | 2.19E-02 | 550 | 2.81E-02 | 655 | 2.12E-02 | 760 | 1.53E-03 |
| 450 | 2.83E-02 | 555 | 2.93E-02 | 660 | 1.94E-02 | 765 | 1.30E-03 |
| 455 | 2.43E-02 | 560 | 3.05E-02 | 665 | 1.77E-02 | 770 | 1.13E-03 |
| 460 | 1.68E-02 | 565 | 3.17E-02 | 670 | 1.60E-02 | 775 | 9.77E-04 |
| 465 | 1.29E-02 | 570 | 3.27E-02 | 675 | 1.44E-02 | 780 | 8.37E-04 |
| 470 | 9.99E-03 | 575 | 3.37E-02 | 680 | 1.29E-02 | | |
| 475 | 7.55E-03 | 580 | 3.44E-02 | 685 | 1.15E-02 | | |
| 480 | 6.88E-03 | 585 | 3.49E-02 | 690 | 1.03E-02 | | |

Table 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram of 1# tube - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4086, 0.3957)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles of 1# tube – Sphere Spectroradiometer Method

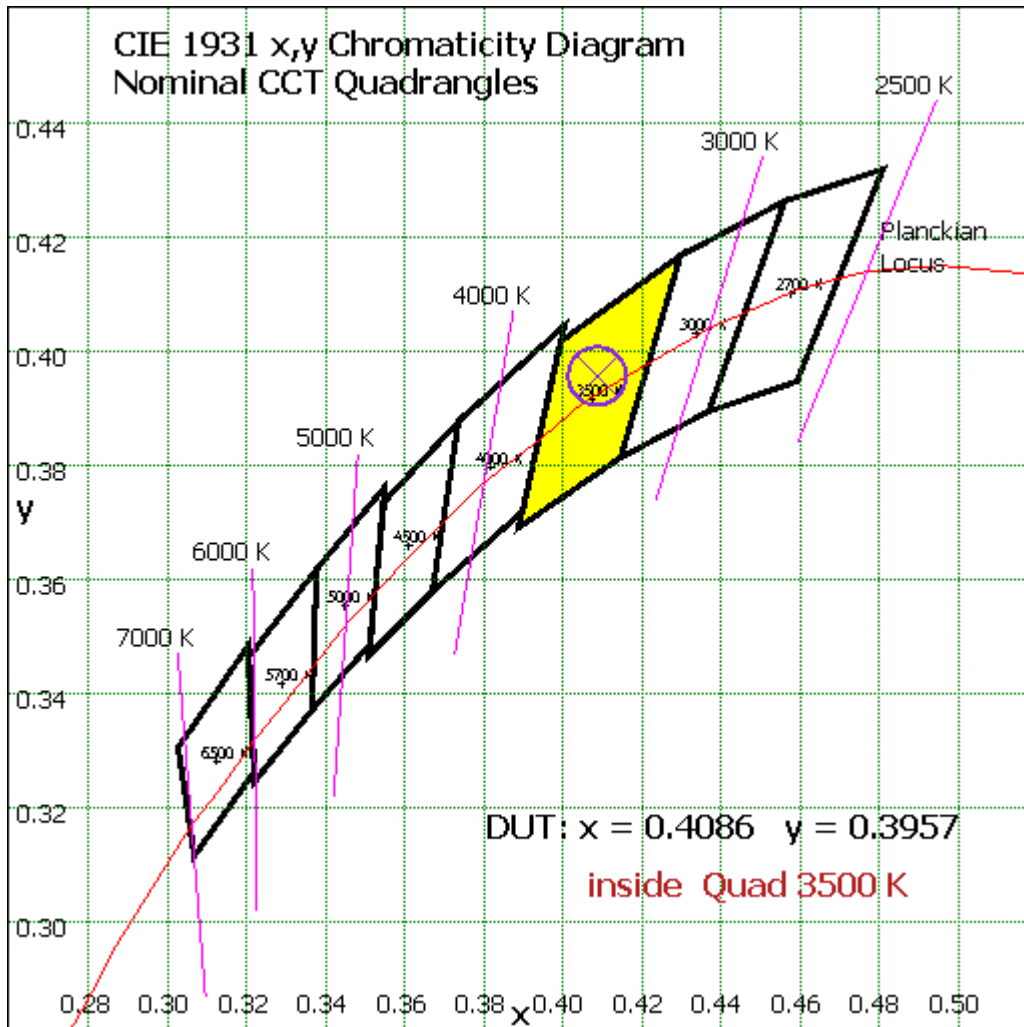


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

| $\gamma(^{\circ})$ | Lumens | % Total |
|--------------------|---------|---------|
| 0- 10 | 43.067 | 2.15% |
| 10- 20 | 124.756 | 6.24% |
| 20- 30 | 193.504 | 9.68% |
| 30- 40 | 242.271 | 12.11% |
| 40- 50 | 266.485 | 13.33% |
| 50- 60 | 264.853 | 13.24% |
| 60- 70 | 240.195 | 12.01% |
| 70- 80 | 199.152 | 9.96% |
| 80- 90 | 151.248 | 7.56% |
| 90-100 | 108.527 | 5.43% |
| 100-110 | 73.127 | 3.66% |
| 110-120 | 44.567 | 2.23% |
| 120-130 | 25.181 | 1.26% |
| 130-140 | 12.962 | 0.65% |
| 140-150 | 5.991 | 0.30% |
| 150-160 | 2.754 | 0.14% |
| 160-170 | 1.003 | 0.05% |
| 170-180 | 0.211 | 0.01% |
| Total | 1999.9 | 100% |

| $\gamma(^{\circ})$ | Lumens | % Total |
|--------------------|----------|---------|
| 0- 60 | 1134.936 | 56.75% |
| 60- 90 | 590.595 | 29.53% |
| 0-90 | 1725.531 | 86.28% |
| 90- 180 | 274.323 | 13.72% |
| 0- 180 | 1999.9 | 100% |

Table 4: Zonal Lumen Data

Illuminance Plots- Goniophotometer Method

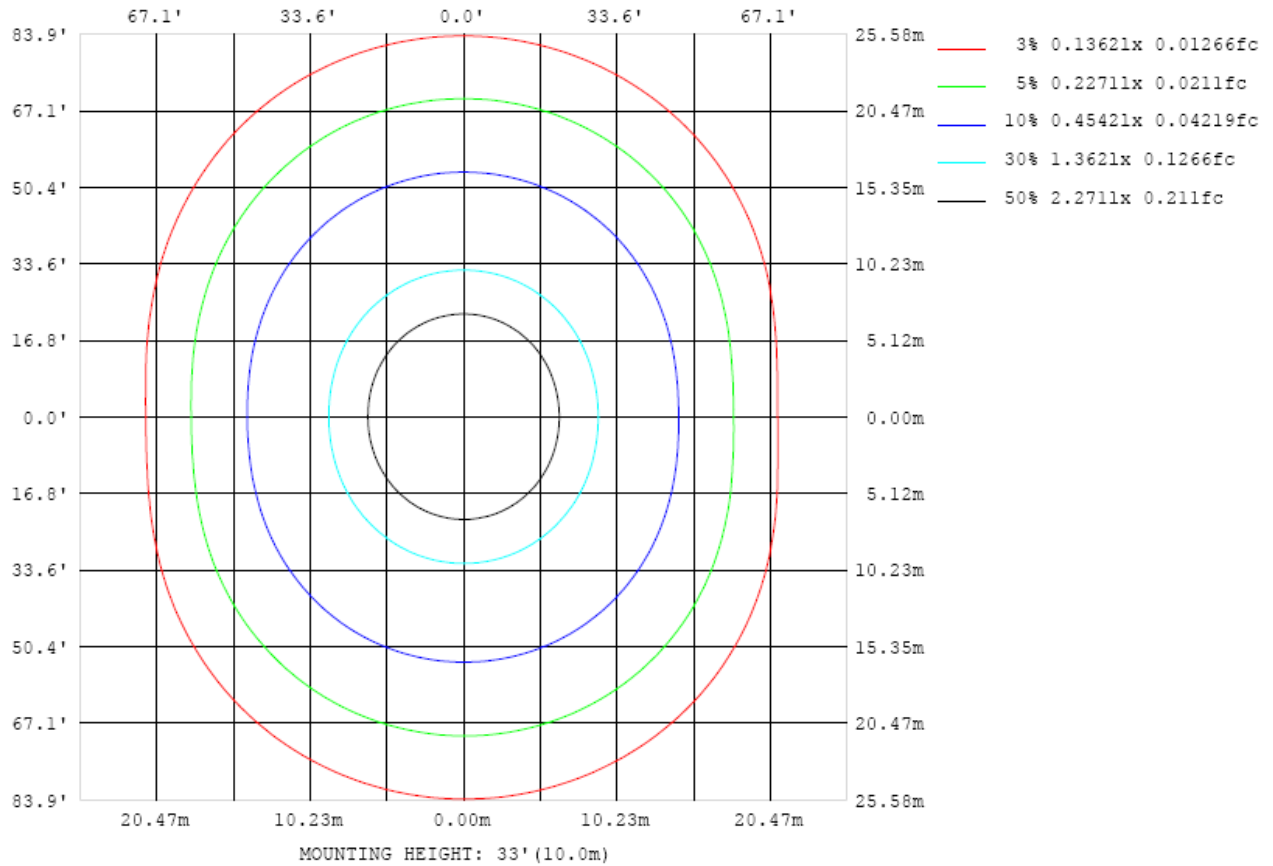


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

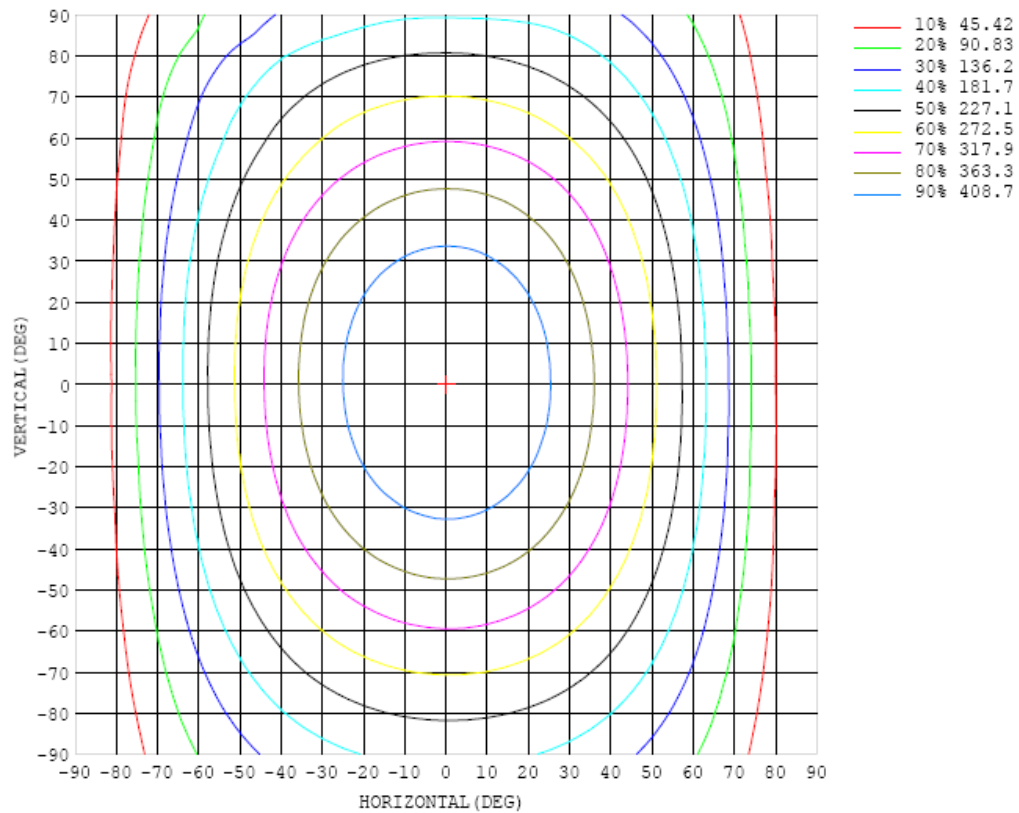


Chart 5: Isocandela Plot

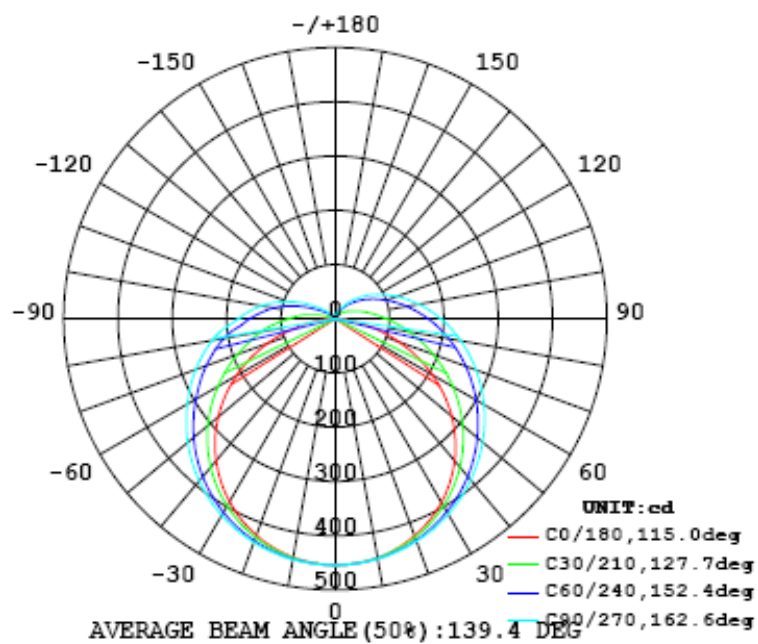


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

| C (DEG) y (DEG) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 |
| 5 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 453 | 452 | 453 | 453 | 453 | 453 | 453 | 453 | 453 | 453 |
| 10 | 447 | 447 | 447 | 447 | 447 | 448 | 448 | 448 | 448 | 448 | 448 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 |
| 15 | 438 | 439 | 439 | 439 | 439 | 439 | 440 | 440 | 441 | 441 | 442 | 442 | 443 | 443 | 443 | 444 | 444 | 444 | 444 |
| 20 | 426 | 426 | 426 | 427 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 434 | 435 | 436 | 436 | 436 | 437 | 437 |
| 25 | 410 | 410 | 411 | 412 | 413 | 414 | 415 | 417 | 418 | 419 | 421 | 423 | 424 | 424 | 426 | 427 | 427 | 427 | 427 |
| 30 | 391 | 391 | 392 | 393 | 394 | 396 | 398 | 400 | 403 | 405 | 407 | 409 | 411 | 413 | 414 | 415 | 415 | 416 | 416 |
| 35 | 368 | 368 | 369 | 371 | 373 | 376 | 379 | 382 | 385 | 388 | 391 | 393 | 396 | 398 | 400 | 401 | 402 | 403 | 403 |
| 40 | 342 | 342 | 344 | 346 | 349 | 353 | 357 | 361 | 365 | 369 | 372 | 376 | 379 | 382 | 384 | 386 | 387 | 388 | 388 |
| 45 | 312 | 313 | 315 | 319 | 323 | 328 | 333 | 338 | 343 | 348 | 353 | 357 | 361 | 364 | 367 | 369 | 371 | 371 | 372 |
| 50 | 280 | 281 | 284 | 288 | 294 | 300 | 306 | 313 | 319 | 326 | 331 | 337 | 341 | 345 | 349 | 351 | 353 | 354 | 354 |
| 55 | 244 | 246 | 250 | 256 | 263 | 271 | 279 | 287 | 294 | 302 | 309 | 315 | 321 | 325 | 329 | 332 | 334 | 335 | 335 |
| 60 | 206 | 208 | 213 | 221 | 230 | 240 | 250 | 260 | 269 | 278 | 286 | 293 | 299 | 305 | 309 | 312 | 314 | 316 | 316 |
| 65 | 166 | 169 | 176 | 186 | 197 | 209 | 220 | 232 | 243 | 253 | 263 | 271 | 277 | 283 | 288 | 292 | 294 | 296 | 296 |
| 70 | 125 | 128 | 137 | 150 | 163 | 178 | 192 | 205 | 217 | 229 | 239 | 248 | 255 | 262 | 267 | 271 | 274 | 275 | 276 |
| 75 | 83.4 | 87.1 | 100 | 115 | 131 | 148 | 164 | 179 | 193 | 205 | 216 | 225 | 233 | 240 | 246 | 250 | 253 | 255 | 255 |
| 80 | 45.1 | 51.5 | 67.0 | 83.8 | 102 | 121 | 138 | 154 | 169 | 182 | 193 | 204 | 212 | 219 | 225 | 229 | 232 | 234 | 235 |
| 85 | 14.4 | 23.6 | 39.7 | 58.2 | 77.8 | 96.6 | 115 | 131 | 147 | 160 | 172 | 182 | 191 | 198 | 204 | 209 | 212 | 214 | 215 |
| 90 | 0.60 | 8.45 | 22.0 | 39.5 | 58.7 | 77.2 | 94.7 | 111 | 126 | 140 | 152 | 162 | 171 | 178 | 184 | 189 | 192 | 194 | 194 |
| 95 | 0.52 | 4.09 | 12.8 | 27.1 | 44.0 | 61.2 | 77.9 | 93.5 | 108 | 121 | 133 | 143 | 152 | 159 | 165 | 170 | 173 | 175 | 175 |
| 100 | 0.09 | 2.28 | 8.78 | 19.6 | 33.4 | 48.4 | 63.6 | 78.2 | 91.6 | 104 | 115 | 125 | 133 | 141 | 146 | 151 | 154 | 156 | 156 |
| 105 | 0.05 | 1.79 | 6.69 | 14.8 | 25.8 | 38.5 | 51.7 | 65.0 | 77.6 | 88.8 | 99.0 | 108 | 116 | 123 | 128 | 133 | 136 | 137 | 138 |
| 110 | 0.25 | 1.83 | 5.48 | 11.7 | 20.5 | 31.0 | 42.2 | 53.6 | 64.8 | 75.3 | 84.8 | 93.1 | 101 | 107 | 112 | 116 | 119 | 120 | 121 |
| 115 | 0.63 | 1.82 | 4.59 | 9.52 | 16.6 | 25.1 | 34.4 | 44.3 | 54.0 | 63.3 | 71.8 | 79.6 | 86.2 | 91.6 | 96.3 | 100 | 103 | 104 | 105 |
| 120 | 0.91 | 1.89 | 3.94 | 7.73 | 13.4 | 20.4 | 28.1 | 36.2 | 44.6 | 52.7 | 60.3 | 67.2 | 73.3 | 78.4 | 82.6 | 86.0 | 88.3 | 89.4 | 89.5 |
| 125 | 1.14 | 1.91 | 3.61 | 6.71 | 11.0 | 16.5 | 23.0 | 29.8 | 36.6 | 43.4 | 50.0 | 56.0 | 61.3 | 65.9 | 69.7 | 72.7 | 74.9 | 76.2 | 76.6 |
| 130 | 1.22 | 1.77 | 3.19 | 5.54 | 9.00 | 13.3 | 18.3 | 23.9 | 29.8 | 35.4 | 40.8 | 45.9 | 50.4 | 54.4 | 57.7 | 60.4 | 62.3 | 63.4 | 63.7 |
| 135 | 1.28 | 1.81 | 3.03 | 4.91 | 7.50 | 10.8 | 14.7 | 19.0 | 23.5 | 28.3 | 33.0 | 37.2 | 40.8 | 44.0 | 46.8 | 49.1 | 50.7 | 51.7 | 52.0 |
| 140 | 1.34 | 1.85 | 2.84 | 4.28 | 6.12 | 8.77 | 11.8 | 15.0 | 18.5 | 22.1 | 25.7 | 29.1 | 32.3 | 35.1 | 37.4 | 39.2 | 40.5 | 41.3 | 41.5 |
| 145 | 1.52 | 1.87 | 2.60 | 3.75 | 5.26 | 7.10 | 9.38 | 11.7 | 14.4 | 17.1 | 19.7 | 22.2 | 24.5 | 26.6 | 28.5 | 30.0 | 31.1 | 31.8 | 32.0 |
| 150 | 1.57 | 1.83 | 2.41 | 3.30 | 4.44 | 5.78 | 7.35 | 9.02 | 10.9 | 12.9 | 14.7 | 16.6 | 18.3 | 19.8 | 21.1 | 22.2 | 23.0 | 23.5 | 23.6 |
| 155 | 1.63 | 1.84 | 2.24 | 2.88 | 3.70 | 4.63 | 5.72 | 6.91 | 8.17 | 9.44 | 10.8 | 12.1 | 13.3 | 14.3 | 15.2 | 16.0 | 16.5 | 16.9 | 17.0 |
| 160 | 1.73 | 1.88 | 2.15 | 2.56 | 3.06 | 3.69 | 4.41 | 5.19 | 6.02 | 6.84 | 7.67 | 8.46 | 9.17 | 9.85 | 10.4 | 10.8 | 11.2 | 11.5 | 11.7 |
| 165 | 1.78 | 1.87 | 2.04 | 2.29 | 2.62 | 2.95 | 3.34 | 3.82 | 4.32 | 4.78 | 5.26 | 5.72 | 6.15 | 6.53 | 6.86 | 7.12 | 7.32 | 7.44 | 7.48 |
| 170 | 1.82 | 1.86 | 1.95 | 2.07 | 2.22 | 2.39 | 2.60 | 2.81 | 3.01 | 3.20 | 3.41 | 3.64 | 3.87 | 4.07 | 4.23 | 4.37 | 4.46 | 4.52 | 4.54 |
| 175 | 1.80 | 1.84 | 1.88 | 1.93 | 1.97 | 2.01 | 2.05 | 2.10 | 2.17 | 2.24 | 2.31 | 2.38 | 2.43 | 2.48 | 2.52 | 2.56 | 2.58 | 2.60 | 2.61 |
| 180 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 |

Table 5: Luminous Intensity Data

Table--2

UNIT: cd

| C (DEG) y (DEG) | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 | 454 |
| 5 | 453 | 453 | 453 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 |
| 10 | 449 | 449 | 449 | 449 | 449 | 449 | 448 | 448 | 448 | 447 | 447 | 447 | 447 | 447 | 447 | 446 | 446 | 447 | 447 |
| 15 | 444 | 444 | 443 | 443 | 442 | 442 | 441 | 441 | 440 | 440 | 439 | 439 | 438 | 438 | 438 | 437 | 437 | 437 | 438 |
| 20 | 436 | 436 | 436 | 435 | 434 | 434 | 432 | 432 | 430 | 429 | 428 | 427 | 426 | 426 | 425 | 425 | 425 | 425 | 425 |
| 25 | 427 | 426 | 426 | 425 | 424 | 423 | 421 | 419 | 418 | 416 | 415 | 413 | 412 | 410 | 410 | 409 | 409 | 409 | 409 |
| 30 | 416 | 415 | 414 | 413 | 411 | 409 | 408 | 406 | 403 | 401 | 399 | 396 | 394 | 392 | 391 | 390 | 390 | 389 | 390 |
| 35 | 402 | 401 | 400 | 399 | 397 | 394 | 392 | 389 | 386 | 383 | 380 | 377 | 374 | 371 | 370 | 368 | 367 | 367 | 368 |
| 40 | 388 | 386 | 385 | 383 | 381 | 378 | 374 | 370 | 367 | 363 | 359 | 355 | 351 | 348 | 345 | 343 | 342 | 341 | 342 |
| 45 | 371 | 370 | 368 | 366 | 363 | 359 | 355 | 350 | 346 | 341 | 336 | 331 | 326 | 321 | 318 | 315 | 313 | 313 | 314 |
| 50 | 353 | 352 | 350 | 347 | 344 | 339 | 334 | 329 | 323 | 317 | 311 | 305 | 298 | 293 | 288 | 284 | 282 | 281 | 283 |
| 55 | 335 | 333 | 331 | 327 | 323 | 319 | 313 | 306 | 299 | 292 | 285 | 277 | 269 | 262 | 256 | 251 | 248 | 247 | 249 |
| 60 | 315 | 313 | 311 | 307 | 302 | 297 | 290 | 283 | 275 | 266 | 257 | 248 | 239 | 230 | 222 | 216 | 212 | 210 | 213 |
| 65 | 295 | 293 | 290 | 286 | 281 | 275 | 268 | 259 | 250 | 240 | 230 | 219 | 208 | 197 | 187 | 179 | 174 | 173 | 175 |
| 70 | 275 | 273 | 269 | 265 | 259 | 253 | 245 | 236 | 225 | 214 | 202 | 190 | 177 | 164 | 151 | 141 | 135 | 133 | 136 |
| 75 | 254 | 252 | 249 | 244 | 238 | 231 | 222 | 213 | 201 | 189 | 176 | 162 | 147 | 131 | 117 | 104 | 94.5 | 92.6 | 97.0 |
| 80 | 234 | 232 | 228 | 223 | 217 | 210 | 201 | 190 | 179 | 166 | 151 | 136 | 119 | 102 | 84.4 | 69.2 | 57.2 | 53.8 | 59.7 |
| 85 | 214 | 211 | 208 | 203 | 196 | 189 | 180 | 169 | 157 | 144 | 129 | 112 | 94.9 | 76.9 | 58.0 | 40.3 | 26.3 | 21.2 | 28.4 |
| 90 | 194 | 191 | 188 | 183 | 177 | 169 | 160 | 149 | 137 | 123 | 109 | 92.4 | 75.8 | 57.2 | 38.2 | 21.4 | 7.45 | 2.10 | 10.3 |
| 95 | 174 | 172 | 168 | 163 | 157 | 150 | 141 | 130 | 118 | 105 | 90.9 | 75.6 | 59.0 | 42.0 | 25.3 | 11.6 | 2.64 | 0.16 | 3.67 |
| 100 | 155 | 153 | 150 | 145 | 139 | 131 | 123 | 113 | 101 | 88.5 | 75.3 | 60.8 | 45.9 | 31.3 | 18.0 | 7.58 | 1.69 | 0.42 | 0.57 |
| 105 | 137 | 135 | 132 | 127 | 121 | 114 | 106 | 96.4 | 86.0 | 74.8 | 62.4 | 49.4 | 36.4 | 24.1 | 13.5 | 5.69 | 1.43 | 0.63 | 1.40 |
| 110 | 120 | 118 | 115 | 111 | 105 | 98.6 | 91.2 | 82.7 | 73.0 | 62.5 | 51.5 | 40.4 | 29.3 | 19.1 | 10.6 | 4.70 | 1.45 | 0.87 | 1.55 |
| 115 | 104 | 102 | 99.1 | 95.2 | 90.4 | 84.8 | 77.9 | 70.1 | 61.5 | 52.3 | 42.7 | 32.9 | 23.6 | 15.4 | 8.55 | 3.95 | 1.49 | 0.93 | 1.64 |
| 120 | 89.0 | 87.6 | 85.2 | 81.8 | 77.4 | 72.0 | 65.8 | 59.0 | 51.4 | 43.3 | 35.0 | 26.9 | 19.2 | 12.4 | 7.07 | 3.46 | 1.56 | 0.91 | 1.67 |
| 125 | 76.0 | 74.5 | 72.2 | 69.1 | 65.1 | 60.3 | 54.9 | 48.9 | 42.4 | 35.6 | 28.7 | 21.9 | 15.6 | 10.2 | 6.07 | 3.13 | 1.61 | 1.07 | 1.56 |
| 130 | 63.2 | 61.9 | 59.9 | 57.2 | 53.8 | 49.8 | 45.1 | 40.0 | 34.6 | 29.0 | 23.1 | 17.5 | 12.6 | 8.47 | 5.25 | 2.92 | 1.64 | 1.17 | 1.33 |
| 135 | 51.6 | 50.5 | 48.8 | 46.5 | 43.6 | 40.3 | 36.5 | 32.2 | 27.6 | 22.9 | 18.3 | 14.1 | 10.3 | 7.09 | 4.54 | 2.80 | 1.72 | 1.26 | 1.37 |
| 140 | 41.2 | 40.3 | 39.0 | 37.1 | 34.7 | 31.8 | 28.6 | 25.0 | 21.5 | 18.0 | 14.5 | 11.3 | 8.41 | 5.97 | 4.10 | 2.65 | 1.74 | 1.38 | 1.42 |
| 145 | 31.8 | 31.1 | 29.9 | 28.3 | 26.4 | 24.3 | 21.9 | 19.3 | 16.7 | 14.0 | 11.4 | 9.06 | 6.93 | 5.08 | 3.60 | 2.52 | 1.82 | 1.51 | 1.51 |
| 150 | 23.5 | 23.0 | 22.1 | 21.0 | 19.7 | 18.2 | 16.5 | 14.6 | 12.7 | 10.8 | 8.95 | 7.24 | 5.70 | 4.34 | 3.18 | 2.34 | 1.82 | 1.59 | 1.58 |
| 155 | 16.9 | 16.5 | 16.0 | 15.2 | 14.3 | 13.2 | 12.0 | 10.7 | 9.45 | 8.16 | 6.91 | 5.76 | 4.68 | 3.72 | 2.89 | 2.26 | 1.85 | 1.61 | 1.57 |
| 160 | 11.6 | 11.3 | 10.9 | 10.4 | 9.85 | 9.17 | 8.43 | 7.66 | 6.85 | 6.05 | 5.26 | 4.47 | 3.73 | 3.08 | 2.58 | 2.17 | 1.88 | 1.70 | 1.63 |
| 165 | 7.44 | 7.32 | 7.13 | 6.87 | 6.54 | 6.16 | 5.75 | 5.30 | 4.83 | 4.33 | 3.82 | 3.34 | 2.95 | 2.61 | 2.31 | 2.06 | 1.89 | 1.74 | 1.64 |
| 170 | 4.53 | 4.47 | 4.37 | 4.24 | 4.06 | 3.85 | 3.64 | 3.41 | 3.20 | 3.00 | 2.80 | 2.59 | 2.39 | 2.22 | 2.09 | 1.98 | 1.88 | 1.79 | 1.73 |
| 175 | 2.60 | 2.59 | 2.56 | 2.53 | 2.49 | 2.44 | 2.39 | 2.32 | 2.25 | 2.19 | 2.12 | 2.07 | 2.02 | 1.98 | 1.95 | 1.91 | 1.87 | 1.84 | 1.82 |
| 180 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 | 1.83 |

Table 6: Luminous Intensity Data

EQUIPMENT LIST

| Test Equipment | Model | Equipment No. | Calibration Date | Calibration Due date |
|-----------------------------------|----------|---------------|------------------|----------------------|
| Goniophotometer system | GO-R5000 | HZTE011-01 | Sep. 18, 2013 | Sep. 17, 2014 |
| Digital Power Meter | PF2010A | HZTE028-01 | Sep. 18, 2013 | Sep. 17, 2014 |
| AC Power Supply | PCR 500L | HZTE001-08 | Sep. 18, 2013 | Sep. 17, 2014 |
| DC Power Supply | WY12010 | HZTE004-03 | Sep. 18, 2013 | Sep. 17, 2014 |
| Temperature Meter | TES1310 | HZTE017-01 | Sep. 18, 2013 | Sep. 17, 2014 |
| Standard source | D908 | HZTE012-01 | Sep. 18, 2013 | Sep. 17, 2014 |
| Integrate Sphere system | 2M | HZTE015-01 | Sep. 18, 2013 | Sep. 17, 2014 |
| Digital Power Meter | WT210 | HZTE008-01 | Sep. 18, 2013 | Sep. 17, 2014 |
| AC Power Supply | PCR 500L | HZTE001-07 | Sep. 18, 2013 | Sep. 17, 2014 |
| DC Power Supply | 6154 | HZTE004-04 | Sep. 18, 2013 | Sep. 17, 2014 |
| Temperature and humidity recorder | JR900 | HZTE018-01 | Sep. 18, 2013 | Sep. 17, 2014 |
| Standard source | SCL-1400 | HZTE012-02 | Sep. 18, 2013 | Sep. 17, 2014 |
| Fluorescent Ballast Analyzer | HB-6B | HZTE002-01 | Sep. 18, 2013 | Sep. 17, 2014 |

Table 7: Test Equipment List

TEST METHODS

Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is 4π . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expanded uncertainty is 1.06% with a coverage factor $k=2$.

Goniophotometer Method

Photometric and Electrical Measurements

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 1.94% with a coverage factor $k=2$.

Color Characteristics Measurements

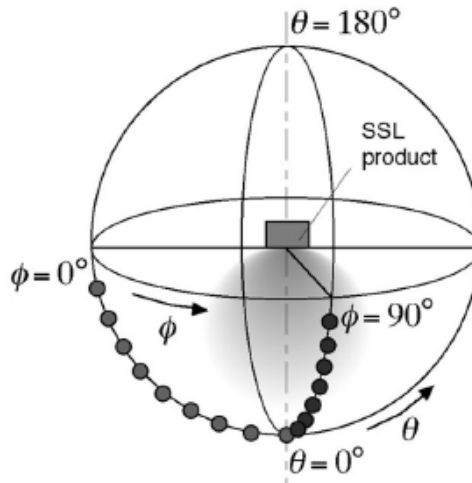
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ($C=0^\circ/180^\circ$ and $C=90^\circ/270^\circ$) and at 10° or less intervals for vertical angle until

the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate was calculated from these points. The data was then analyzed to check for delta color differences of the u' , v' chromaticity coordinates. The spatial non-uniformity of chromaticity, $\Delta u'v'$, is determined as the maximum deviation (distance on the CIE (u' , v') diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



*** End of Report ***

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