

Photometric Test Report

Relevant Standards

- ☒ IES LM-79-2008
- ☒ ANSI C82.77:2014

Prepared For

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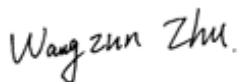
Test Date

2018/4/16

Issue Date

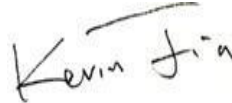
2018/4/16

Prepared By



Wangzun Zhu

Approved By



Kevin Jia

The results contained in this report pertain only to the tested sample.

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1.0 Test Summary

DLC Technical Requirements v4.3

| Outdoor - Architectural Flood and Spot Luminaires | | | | |
|---------------------------------------------------|---------------------------------|--------------|------------|---------------------|
| Requirement Category | Test Method | Requirements | Test value | Results (Fail/Pass) |
| Lamp Output (lm) | IES LM-79-2008 | 1000 | 1289 | P |
| Zonal Lumen Requirement (0°-90°) | IES LM-79-2008 | ≥85% | 100.00% | P |
| Minimum Luminaire Efficacy (lm/W) | IES LM-79-2008 | 90 | 93.6 | P |
| Allowable CCTs* (K) | IES LM-79-2008 | 5700 | 3001 | P |
| Minimum CRI | IES LM-79-2008 CIE 13.3-1995 | 65 | 70.5 | P |
| Power Factor | ANSI C82.77:2014 | 0.873 | 0.973 | F |
| Total Harmonic Distortion (A%) | ANSI C82.77:2014 | 25.00% | 14.04% | P |

2.0 Test List

| Test Item | Test | Test Date | Model Number | Sample No. |
|-----------|-------------------------|-----------|--------------|------------|
| 1 | Integrating Sphere Test | 2018/4/16 | HSLED13Y/D10 | B1 |
| 2 | Goniophotometer Test | 2018/4/16 | HSLED13Y/D10 | B1 |
| 3 | THD and PF Test | 2018/4/16 | HSLED13Y/D10 | B1 |

Remark(If any)

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3.0 Production Description

Luminaire Description:

Electrical Specification: 120V-277V,50/60HZ

Light source: LL725F1212-XXC

Manufacturer Of Light Source: Lustrous International Technology Company

Photos of Luminaire Characteristics



4.0 LM-79 Measurement and Test Results

4.1 Integrating Sphere Test

| | | | |
|---------------------|--------------|---------------------------|----|
| Model No. | HSLED13Y/D10 | Sample ID. | B1 |
| Operate time (Min.) | 90 | Stabilization time (Min.) | 45 |

Test Method

The samples were tested according to the IES LM-79-2008.

Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.

The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere.

The voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within ± 0.2 percent under load.

The sample was measured using 4π geometry and operated at rated voltage and was stabilized before measurement. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 1 nm intervals over the range of 380 to 780 nm.

Test Conditions

| Temperature ($^{\circ}\text{C}$) | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor |
|------------------------------------|---------------|----------------|-------------|-----------|--------------|
| 25.1 | 120.01 | 60 | 0.118 | 13.80 | 0.973 |

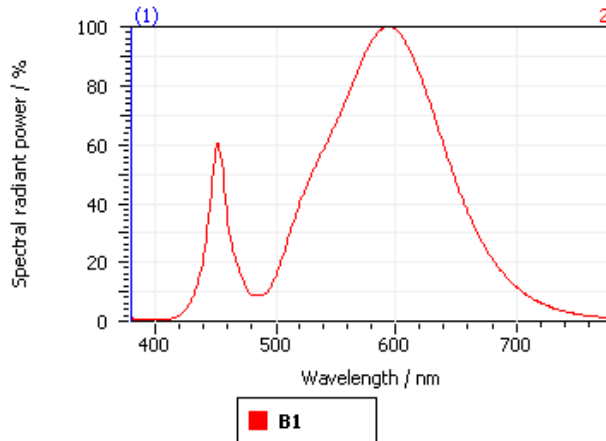
Test Result

| CCT (K) | CRI (Ra) | Duv |
|---------|----------|---------|
| 3001 | 70.5 | 2.3E-03 |

4.1 Integrating Sphere Test

Spectroradiometric Parameters

Results



Spectral values

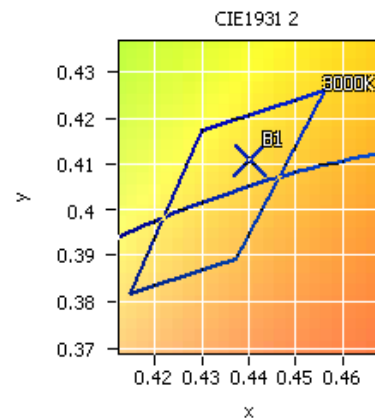
| | |
|--------------------|-----------|
| DominantWavelength | 582.05 nm |
| Purity | 0.555 |
| PeakWavelength | 594.16 nm |
| Width50%: | 117.75 nm |

Color Coordinates

Correlated Color Temperature 3001 K

x: 0.4402 u: 0.2497 u': 0.2497
y: 0.4109 v: 0.3497 v': 0.5245

| | | | |
|-----------------|------|-----------------|-------|
| ResultsCRICRI01 | 66.5 | ResultsCRICRI09 | -33.3 |
| ResultsCRICRI02 | 80.3 | ResultsCRICRI10 | 53.8 |
| ResultsCRICRI03 | 91.9 | ResultsCRICRI11 | 58.8 |
| ResultsCRICRI04 | 66.0 | ResultsCRICRI12 | 39.8 |
| ResultsCRICRI05 | 64.9 | ResultsCRICRI13 | 68.8 |
| ResultsCRICRI06 | 71.7 | ResultsCRICRI14 | 95.2 |
| ResultsCRICRI07 | 78.7 | ResultsCRICRI15 | 59.2 |
| ResultsCRICRI08 | 44.0 | ResultsCRICRI16 | 58.6 |
| ResultsCRI | 70.5 | | |



Nominal CCT: 3000K

PlanckDistance 2.3E-003

4.0 LM-79 Measurement and Test Results

4.3 Goniophotometer Test

| | | | |
|---------------------|--------------|---------------------------|----|
| Model No. | HSLED13Y/D10 | Sample ID. | B1 |
| Operate time (Min.) | 90 | Stabilization time (Min.) | 45 |

Test Method

The samples were tested according to the IES LM-79-2008.

Photometric parameters were measured using a type C goniophotometer and software.

The ambient temperature shall be maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, measured at a point not more than 1 m from the sample and at the same height as the sample.

The voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within ± 0.2 percent under load.

The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonal lumen were calculated from the software taken at 0.5° vertical intervals and 10° horizontal intervals.

Test Conditions

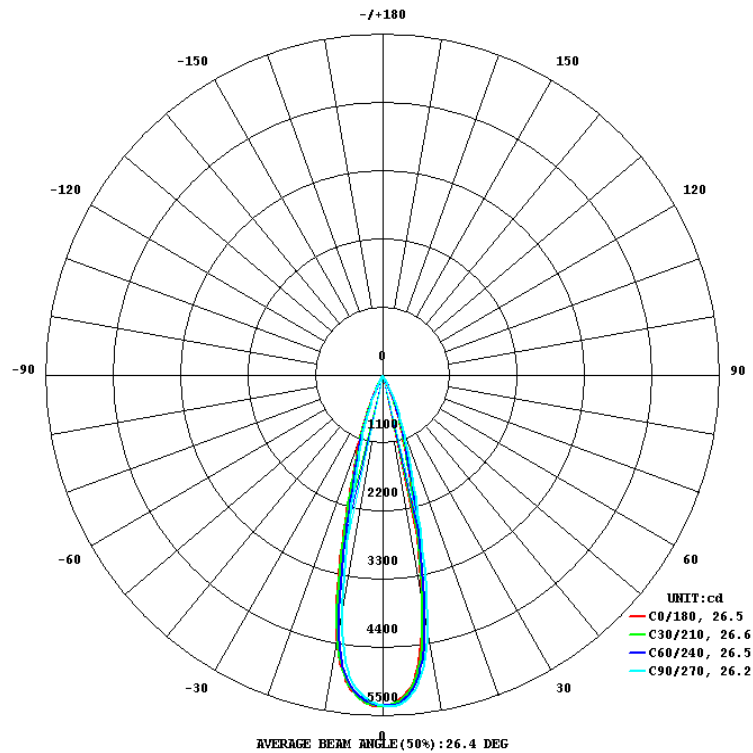
| Temperature ($^{\circ}\text{C}$) | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | Orientation |
|------------------------------------|---------------|----------------|-------------|-----------|--------------|-------------|
| 25.1 | 120.03 | 60 | 0.118 | 13.78 | 0.974 | Light Down |

Test Result

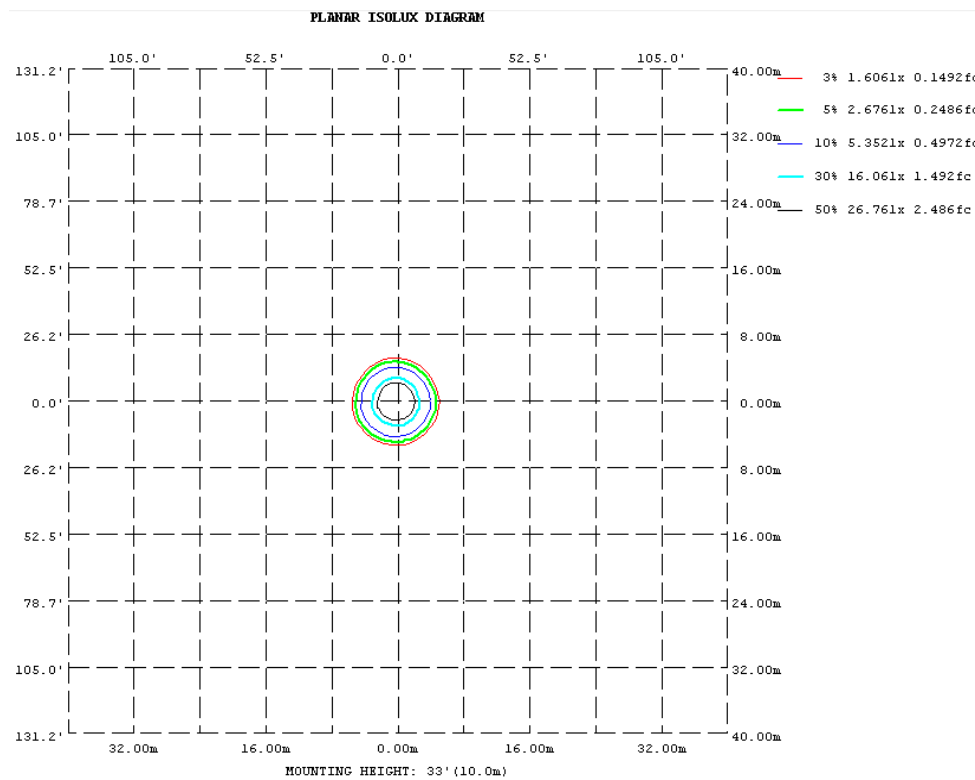
| Flux(lm) | Zonal Lumen Requirement (0° - 90°) | Field Angle(10%) | | Beam Angle(50%) | | Luminous Efficacy (lm/W) |
|----------|--------------------------------------------------------|-------------------|-----------------|-------------------|-----------------|--------------------------|
| | | Horizontal Spread | Vertical Spread | Horizontal Spread | Vertical Spread | |
| 1289 | 100.00% | 47.7 | 48.0 | 26.2 | 26.5 | 93.6 |

4.3 Goniophotometer Test

Light Distrubtion Curve



Isolux Plot



4.3 Goniophotometer Test

Zonal Lumen Summary

| ° | C0 | C45 | C90 | C135 | C180 | C225 | C270 | C315 |
|-----|-----------------------------------------------------|-------|-------|-------|-------|-------|--------|--------|
| 10 | 3698 | 3860 | 4233 | 4489 | 4346 | 4255 | 3880 | 3439 |
| 20 | 853.5 | 921.0 | 1073 | 1210 | 1179 | 1084 | 920.4 | 777.4 |
| 30 | 68.99 | 73.80 | 103.8 | 161.6 | 145.9 | 114.5 | 75.97 | 56.90 |
| 40 | 11.12 | 11.77 | 13.71 | 14.29 | 13.62 | 12.95 | 12.81 | 10.74 |
| 50 | 5.923 | 6.131 | 6.860 | 6.738 | 6.612 | 6.400 | 6.489 | 5.772 |
| 60 | 4.336 | 4.432 | 4.792 | 4.704 | 4.648 | 4.535 | 4.553 | 4.264 |
| 70 | 3.100 | 3.263 | 3.581 | 3.624 | 3.531 | 3.427 | 3.306 | 2.984 |
| 80 | 0.8947 | 1.026 | 1.229 | 1.521 | 1.342 | 1.230 | 0.8739 | 0.7364 |
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 160 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DEG | LUMINOUS INTENSITY:cd Less than 35% Percent = 2.9 % | | | | | | | |

4.3 Goniophotometer Test

ZONAL LUMEN SUMMARY

| | Zonal (lm) | | Total (lm) | Percent |
|-----------|------------|---------|------------|---------|
| 0 - 10 | 450.23 | 0 - 10 | 450.23 | 34.93% |
| 10 - 20 | 585.91 | 0 - 20 | 1036.14 | 80.38% |
| 20 - 30 | 211.11 | 0 - 30 | 1247.25 | 96.76% |
| 30 - 40 | 23.46 | 0 - 40 | 1270.70 | 98.58% |
| 40 - 50 | 6.84 | 0 - 50 | 1277.55 | 99.11% |
| 50 - 60 | 4.75 | 0 - 60 | 1282.30 | 99.48% |
| 60 - 70 | 3.89 | 0 - 70 | 1286.18 | 99.78% |
| 70 - 80 | 2.36 | 0 - 80 | 1288.54 | 99.97% |
| 80 - 90 | 0.44 | 0 - 90 | 1288.98 | 100.00% |
| 90 - 100 | 0.00 | 0 - 100 | 1288.98 | 100.00% |
| 100 - 110 | 0.00 | 0 - 110 | 1288.98 | 100.00% |
| 110 - 120 | 0.00 | 0 - 120 | 1288.98 | 100.00% |
| 120 - 130 | 0.00 | 0 - 130 | 1288.98 | 100.00% |
| 130 - 140 | 0.00 | 0 - 140 | 1288.98 | 100.00% |
| 140 - 150 | 0.00 | 0 - 150 | 1288.98 | 100.00% |
| 150 - 160 | 0.00 | 0 - 160 | 1288.98 | 100.00% |
| 160 - 170 | 0.00 | 0 - 170 | 1288.98 | 100.00% |
| 170 - 180 | 0.00 | 0 - 180 | 1288.98 | 100.00% |

4.3 Goniophotometer Test

Axial Candela

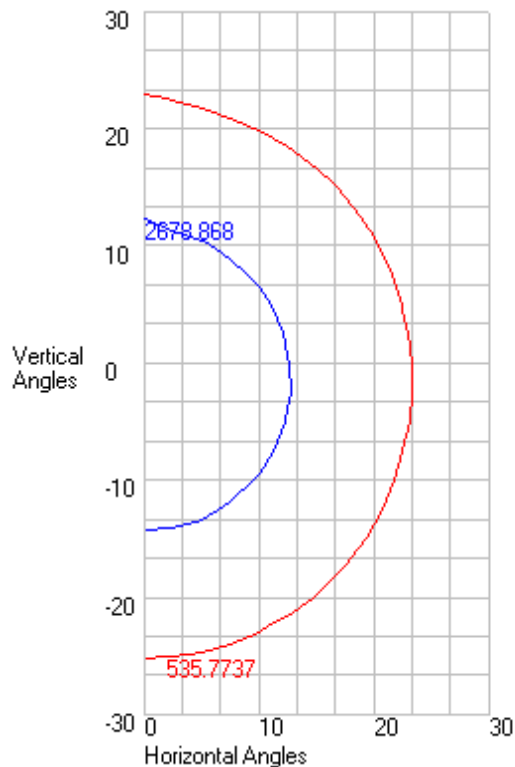
| DEG. | HOR. | DEG. | VERT. |
|-------|----------|-------|----------|
| 90 | 0 | 90 | 0 |
| 85 | 0.04 | 85 | 0.13 |
| 75 | 2.2 | 75 | 2.04 |
| 65 | 4 | 65 | 3.83 |
| 55 | 5.28 | 55 | 4.92 |
| 47.5 | 7.4 | 47.5 | 6.64 |
| 42.5 | 10.27 | 42.5 | 9.1 |
| 37.5 | 16.33 | 37.5 | 14.28 |
| 33 | 32.37 | 33 | 29.08 |
| 29 | 117.83 | 29 | 99.54 |
| 25.5 | 328.8 | 25.5 | 300.39 |
| 22.5 | 610.9 | 22.5 | 576.49 |
| 19.5 | 989.19 | 19.5 | 917.29 |
| 17 | 1373.37 | 17 | 1281.19 |
| 15 | 1807.81 | 15 | 1705.43 |
| 13 | 2514.82 | 13 | 2364.77 |
| 11 | 3433.6 | 11 | 3244.71 |
| 9 | 4260.07 | 9 | 4112.43 |
| 7 | 4792.41 | 7 | 4728.53 |
| 5 | 5073.66 | 5 | 5075.33 |
| 3 | 5227.61 | 3 | 5244.14 |
| 1 | 5312.21 | 1 | 5317.86 |
| 0 | 5332.816 | 0 | 5332.816 |
| -1 | 5345.04 | -1 | 5345.87 |
| -3 | 5313.31 | -3 | 5300.98 |
| -5 | 5195.93 | -5 | 5181.85 |
| -7 | 4959.2 | -7 | 4969.99 |
| -9 | 4541.43 | -9 | 4604.68 |
| -11 | 3837.78 | -11 | 4016.55 |
| -13 | 2922.5 | -13 | 3202.2 |
| -15 | 2168.62 | -15 | 2387.28 |
| -17 | 1592.87 | -17 | 1754.07 |
| -19.5 | 1143.06 | -19.5 | 1263.83 |
| -22.5 | 764.96 | -22.5 | 837.1 |
| -25.5 | 430.13 | -25.5 | 491.48 |
| -29 | 152.46 | -29 | 198.91 |
| -33 | 42.5 | -33 | 45.78 |
| -37.5 | 18.01 | -37.5 | 18.08 |
| -42.5 | 11 | -42.5 | 10.68 |
| -47.5 | 7.85 | -47.5 | 7.6 |
| -55 | 5.58 | -55 | 5.35 |
| -65 | 4.23 | -65 | 4.15 |
| -75 | 2.57 | -75 | 2.56 |
| -85 | 0.2 | -85 | 0.34 |
| -90 | 0 | -90 | 0 |

4.3 Goniophotometer Test

Characteristics

| | |
|------------------------------|-----------------|
| NEMA Type | 4 H x 4 V |
| Maximum Candela | 5357.737 |
| Maximum Candela Angle | -1 H -1 V |
| Horizontal Beam Angle (50%) | 26.5 |
| Vertical Beam Angle (50%) | 26.8 |
| Horizontal Field Angle (10%) | 48 |
| Vertical Field Angle (10%) | 48.2 |
| Lumens Per Lamp | N.A. (absolute) |
| Total Lamp Lumens | N.A. (absolute) |
| Beam Lumens | 700 |
| Beam Efficiency | N.A. |
| Field Lumens | 1164 |
| Field Efficiency | N.A. |
| Spill Lumens | 125 |
| Luminaire Lumens | 1289 |
| Total Efficiency | N.A. |
| Total Luminaire Watts | 13.7774 |
| Ballast Factor | 1 |

ISOCANDELA CURVES



Axial Candela

| | 0 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19.5 | 22.5 | 25.5 | 29 | 33 | 37.5 | 42.5 | 47.5 | 55 | 65 | 75 | 85 | 90 |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|-------|-------|-------|-------|-------|----|
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 0.13 | 0.125 | 0.116 | 0.107 | 0.097 | 0.088 | 0.078 | 0.061 | 0.05 | 0.046 | 0.041 | 0.036 | 0.031 | 0.025 | 0.016 | 0.005 | 0.001 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 2.04 | 2.025 | 1.994 | 1.964 | 1.906 | 1.858 | 1.805 | 1.749 | 1.701 | 1.668 | 1.627 | 1.567 | 1.495 | 1.4 | 1.289 | 1.138 | 0.958 | 0.755 | 0.454 | 0.147 | 0 | 0 | 0 |
| 65 | 3.83 | 3.823 | 3.81 | 3.786 | 3.762 | 3.733 | 3.7 | 3.659 | 3.624 | 3.59 | 3.544 | 3.473 | 3.397 | 3.263 | 3.106 | 2.894 | 2.616 | 2.301 | 1.727 | 0.827 | 0.155 | 0 | 0 |
| 55 | 4.92 | 4.913 | 4.898 | 4.862 | 4.827 | 4.785 | 4.742 | 4.701 | 4.661 | 4.622 | 4.566 | 4.488 | 4.407 | 4.293 | 4.154 | 3.978 | 3.763 | 3.484 | 2.913 | 1.792 | 0.498 | 0 | 0 |
| 47.5 | 6.64 | 6.618 | 6.575 | 6.47 | 6.367 | 6.247 | 6.116 | 6.025 | 5.923 | 5.809 | 5.656 | 5.465 | 5.261 | 5.026 | 4.776 | 4.525 | 4.268 | 4.015 | 3.532 | 2.449 | 0.827 | 0 | 0 |
| 42.5 | 9.1 | 9.047 | 8.94 | 8.689 | 8.451 | 8.191 | 7.953 | 7.801 | 7.592 | 7.32 | 7.014 | 6.661 | 6.242 | 5.813 | 5.37 | 4.977 | 4.62 | 4.292 | 3.833 | 2.809 | 1.052 | 0 | 0 |
| 37.5 | 14.28 | 14.167 | 13.791 | 13.314 | 12.808 | 12.066 | 11.525 | 11.022 | 10.526 | 10.016 | 9.421 | 8.546 | 7.802 | 7.036 | 6.272 | 5.612 | 5.032 | 4.598 | 4.068 | 3.109 | 1.282 | 0 | 0 |
| 33 | 29.08 | 28.501 | 26.688 | 24.528 | 22.237 | 20.52 | 19.126 | 17.45 | 16.03 | 14.751 | 13.339 | 11.443 | 8.629 | 7.45 | 6.393 | 5.515 | 4.896 | 4.258 | 3.327 | 1.469 | 0.004 | 0 | 0 |
| 29 | 99.54 | 96.117 | 85.081 | 71.703 | 57.857 | 48.699 | 40.881 | 34.44 | 28.597 | 24.229 | 19.881 | 16.206 | 13.352 | 10.911 | 8.87 | 7.303 | 6.046 | 5.216 | 4.42 | 3.484 | 1.623 | 0.007 | 0 |
| 25.5 | 300.39 | 291.57 | 262.701 | 226.329 | 191.235 | 164.334 | 131.914 | 95.456 | 68.733 | 49.556 | 34.108 | 23.683 | 17.816 | 13.751 | 10.504 | 8.228 | 6.592 | 5.523 | 4.564 | 3.607 | 1.744 | 0.011 | 0 |
| 22.5 | 576.49 | 561.158 | 512.919 | 454.661 | 398.541 | 345.285 | 287.822 | 227.681 | 177.7 | 124.11 | 68.685 | 37.749 | 24.491 | 17.123 | 12.405 | 9.179 | 7.131 | 5.805 | 4.68 | 3.686 | 1.841 | 0.017 | 0 |
| 19.5 | 917.29 | 896.632 | 828.756 | 744.343 | 678.76 | 600.878 | 510.42 | 422.243 | 332.744 | 248.022 | 160.878 | 71.646 | 36.382 | 21.626 | 14.484 | 10.321 | 7.642 | 6.097 | 4.789 | 3.761 | 1.926 | 0.022 | 0 |
| 17 | 1281.19 | 1253.39 | 1155.82 | 1049.58 | 964.62 | 857.786 | 743.036 | 623.39 | 502.466 | 385.101 | 256.978 | 136.695 | 54.842 | 27.162 | 16.536 | 11.207 | 8.112 | 6.334 | 4.88 | 3.816 | 1.988 | 0.026 | 0 |
| 15 | 1705.43 | 1651.15 | 1490.30 | 1366.12 | 1253.48 | 1099.12 | 957.784 | 804.242 | 664.023 | 513.885 | 351.021 | 195.03 | 79.651 | 33 | 18.452 | 12.085 | 8.526 | 6.512 | 4.95 | 3.854 | 2.038 | 0.029 | 0 |
| 13 | 2364.77 | 2266.58 | 1964.13 | 1769.24 | 1575.11 | 1395.47 | 1198.28 | 1000.70 | 821.584 | 650.654 | 451.927 | 259.518 | 121.372 | 41.096 | 20.599 | 12.986 | 8.888 | 6.687 | 5.02 | 3.884 | 2.07 | 0.032 | 0 |
| 11 | 3244.71 | 3101.64 | 2657.58 | 2429.79 | 2076.17 | 1741.37 | 1463.24 | 1224.11 | 997.814 | 790.945 | 559.142 | 330.18 | 165.419 | 50.522 | 23.172 | 13.765 | 9.171 | 6.85 | 5.076 | 3.911 | 2.103 | 0.039 | 0 |
| 9 | 4112.43 | 3958.81 | 3547.59 | 3209.94 | 2752.69 | 2236.51 | 1786.20 | 1443.10 | 1176.50 | 932.165 | 667.43 | 398.702 | 204.988 | 62.955 | 25.494 | 14.414 | 9.47 | 6.996 | 5.129 | 3.935 | 2.132 | 0.039 | 0 |
| 7 | 4728.53 | 4602.71 | 4317.10 | 4038.91 | 3493.47 | 2852.76 | 2196.89 | 1693.62 | 1354.28 | 1067.61 | 767.07 | 462.985 | 241.281 | 76.925 | 27.414 | 15.079 | 9.729 | 7.124 | 5.176 | 3.955 | 2.155 | 0.04 | 0 |
| 5 | 5075.33 | 4986.94 | 4824.56 | 4582.22 | 4156.35 | 3451.38 | 2688.70 | 1971.96 | 1503.02 | 1194.17 | 855.014 | 523.585 | 277.312 | 91.07 | 29.425 | 15.551 | 9.951 | 7.233 | 5.216 | 3.973 | 2.189 | 0.04 | 0 |
| 3 | 5244.14 | 5178.25 | 5082.65 | 4879.44 | 4522.55 | 3917.80 | 3074.43 | 2241.41 | 1655.46 | 1291.57 | 926.395 | 570.199 | 305.503 | 105.009 | 31.049 | 15.973 | 10.183 | 7.349 | 5.258 | 3.991 | 2.194 | 0.04 | 0 |
| 1 | 5317.86 | 5285.83 | 5200.85 | 5044.98 | 4751.38 | 4208.01 | 3376.37 | 2466.34 | 1780.00 | 1359.72 | 978.026 | 604.122 | 325.007 | 115.688 | 32.169 | 16.268 | 10.241 | 7.383 | 5.273 | 3.997 | 2.198 | 0.04 | 0 |
| 0 | 5332.81 | 5312.21 | 5227.61 | 5073.66 | 4792.41 | 4260.07 | 3433.6 | 2514.82 | 1807.81 | 1373.37 | 989.19 | 610.9 * | 328.8 | 117.83 | 32.37 | 16.33 | 10.27 | 7.4 | 5.28 | 4 | 2.2 | 0.04 | 0 |
| -1 | 5345.87 | 5323.21 | 5238.17 | 5104.13 | 4831.29 | 4314.30 | 3493.14 | 2569.61 | 1840.4 | 1387.33 | 999.34 | 618.162 | 332.668 | 119.522 | 32.536 | 16.348 | 10.266 | 7.395 | 5.276 | 3.999 | 2.201 | 0.04 | 0 |
| -3 | 5300.98 | 5288.86 | 5215.04 | 5073.43 | 4787.12 | 4248.80 | 3429.44 | 2534.01 | 1821.29 | 1373.69 | 988.995 | 611.278 | 327.884 | 115.357 | 32.1 | 16.205 | 10.259 | 7.384 | 5.269 | 3.997 | 2.204 | 0.04 | 0 |
| -5 | 5181.85 | 5179.95 | 5100.95 | 4953.75 | 4645.11 | 4036.55 | 3254.79 | 2391.50 | 1735.57 | 1329.72 | 955.365 | 589.121 | 312.836 | 104.939 | 31.028 | 15.914 | 10.073 | 7.289 | 5.234 | 3.983 | 2.207 | 0.041 | 0 |
| -7 | 4969.99 | 4967.68 | 4872.06 | 4693 * | 4291.45 | 3657.24 | 2899.34 | 2154.91 | 1599.36 | 1254.59 | 897.917 | 547.213 | 287.473 | 92.422 | 29.428 | 15.548 | 9.892 | 7.198 | 5.2 | 3.97 | 2.18 | 0.041 | 0 |
| -9 | 4604.68 | 4603.58 | 4483.42 | 4224.85 | 3769.07 | 3149.67 | 2470.63 | 1867.48 | 1449.27 | 1144.46 | 821.229 | 493.596 | 254.291 | 78.567 | 27.878 | 14.887 | 9.666 | 7.087 | 5.158 | 3.954 | 2.164 | 0.041 | 0 |
| -11 | 4016.55 | 4015.30 | 3862.71 | 3578.94 | 3112.39 | 2562.51 | 2027.95 | 1582.98 | 1291.84 | 1015.53 | 726.462 | 430.964 | 217.269 | 64.309 | 25.457 | 14.311 | 9.397 | 6.957 | 5.112 | 3.934 | 2.142 | 0.041 | 0 |
| -13 | 3202.2 | 3197.90 | 3045.71 | 2769.44 | 2419.01 | 2009.93 | 1633.57 | 1358.96 | 1105.26 | 880.245 | 620.746 | 359.62 | 176.81 | 52.318 | 22.792 | 13.647 | 9.146 | 6.811 | 5.062 | 3.912 | 2.116 | 0.034 | 0 |
| -15 | 2387.28 | 2383.16 | 2269.72 | 2076.49 | 1831.55 | 1568.39 | 1352.93 | 1133.42 | 942.429 | 739.369 | 570.974 | 285.401 | 130.953 | 41.4 | 20.491 | 12.867 | 8.816 | 6.65 | 4.998 | 3.886 | 2.091 | 0.031 | 0 |
| -17 | 1754.07 | 1748.92 | 1674.63 | 1557.40 | 1418.23 | 1265.74 | 1092.83 | 928.61 | 762.16 | 590.189 | 395.908 | 214.56 | 86.082 | 33.651 | 18.406 | 11.99 | 8.424 | 6.479 | 4.934 | 3.853 | 2.047 | 0.028 | 0 |
| -19.5 | 1263.83 | 1261.2 | 1219.40 | 1151.56 | 1052.86 | 945.989 | 823.901 | 688.951 | 548.692 | 412.464 | 266.379 | 136.953 | 53.243 | 26.262 | 16.056 | 11.045 | 7.98 | 6.259 | 4.851 | 3.808 | 1.994 | 0.024 | 0 |
| -22.5 | 837.1 * | 835.423 | 809.263 | 767.569 | 701.328 | 617.916 | 523.747 | 421.568 | 323.173 | 233.292 | 145.878 | 62.131 | 32.825 | 20.419 | 13.823 | 9.867 | 7.484 | 5.984 | 4.74 | 3.747 | 1.919 | 0.019 | 0 |
| -25.5 | 491.48 | 489.89 | 469.479 | 436.41 | 390.555 | 334.731 | 274.172 | 213.692 | 161.325 | 105.345 | 59.197 | 33.709 | 22.658 | 15.977 | 11.78 | 8.892 | 6.945 | 5.712 | 4.628 | 3.682 | 1.832 | 0.012 | 0 |
| -29 | 198.91 | 197.762 | 187.847 | 171.859 | 148.911 | 120.115 | 92.026 | 69.628 | 50.62 | 38.205 | 28.067 | 21.033 | 16.107 | 12.909 | 9.927 | 7.929 | 6.389 | 5.404 | 4.498 | 3.574 | 1.726 | 0.009 | 0 |
| -33 | 45.78 | 45.563 | 43.674 | 40.725 | 37.003 | 33.443 | 29.475 | 25.383 | 22.192 | 19.486 | 16.637 | 14.179 | 11.966 | 9.979 | 8.333 | 6.945 | 5.833 | 5.082 | 4.351 | 3.436 | 1.58 | 0.005 | 0 |
| -37.5 | 18.08 | 18.049 | 17.751 | 17.274 | 16.72 | 15.838 | 14.995 | 14.221 | 13.392 | 12.453 | 11.278 | 10.043 | 9.016 | 7.998 | 6.981 | 6.081 | 5.318 | 4.772 | 4.181 | 3.248 | 1.405 | 0 | 0 |
| -42.5 | 10.68 | 10.668 | 10.645 | 10.426 | 10.217 | 9.964 | 9.662 | 9.376 | 9.019 | 8.588 | 8.114 | 7.591 | 7.041 | 6.475 | 5.895 | 5.349 | 4.866 | 4.464 | 3.972 | 2.999 | 1.182 | 0 | 0 |
| -47.5 | 7.6 | 7.591 | 7.573 | 7.462 | 7.362 | 7.243 | 7.108 | 6.948 | 6.773 | 6.591 | 6.351 | 6.074 | 5.786 | 5.476 | 5.144 | 4.825 | 4.493 | 4.205 | 3.732 | 2.679 | 0.954 | 0 | 0 |
| -55 | 5.35 | 5.347 | 5.34 | 5.306 | 5.274 | 5.232 | 5.187 | 5.138 | 5.08 | 5.016 | 4.93 | 4.826 | 4.721 | 4.585 | 4.427 | 4.253 | 4.034 | 3.768 | 3.223 | 2.071 | 0.613 | 0 | 0 |
| -65 | 4.15 | 4.148 | 4.143 | 4.129 | 4.115 | 4.097 | 4.077 | 4.053 | 4.027 | 3.998 | 3.957 | 3.891 | 3.824 | 3.718 | 3.576 | 3.38 | 3.106 | 2.78 | 2.153 | 1.096 | 0.215 | 0 | 0 |
| -75 | 2.56 | 2.558 | 2.554 | 2.55 | 2.518 | 2.496 | 2.47 | 2.439 | 2.409 | 2.369 | 2.317 | 2.244 | 2.16 | 2.05 | 1.915 | 1.724 | 1.487 | 1.213 | 0.766 | 0.266 | 0 | 0 | 0 |
| -85 | 0.34 | 0.339 | 0.338 | 0.337 | 0.335 | 0.334 | 0.333 | 0.316 | 0.31 | 0.297 | 0.28 | 0.259 | 0.236 | 0.207 | 0.168 | 0.125 | 0.075 | 0.033 | 0.002 | 0 | 0 | 0 | 0 |
| -90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

LUMEN TABULATION

| | 0 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 20 | 23 | 26 | 29 | 33 | 38 | 43 | 48 | 55 | 65 | 75 | 85 | 90 | Total |
|------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-----|-----|----|----|----|----|----|----|----|-------|
| 90 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 85 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 75 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 65 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 55 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 47.5 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 42.5 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 37.5 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 33 | | 0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 29 | | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 25.5 | | 0.2 | 0.4 | 0.4 | 0.3 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 22.5 | | 0.4 | 0.8 | 0.7 | 0.6 | 0.6 | 0.5 | 0.4 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 19.5 | | 0.68 * | 1.31 * | 1.23 * | 1.12 * | 1 | 0.9 | 0.7 | 0.6 | 0.4 | 0.4 | 0.3 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 17 | | 0.83 * | 1.61 * | 1.51 * | 1.40 * | 1.26 * | 1.11 * | 0.95 * | 0.8 | 0.6 | 0.5 | 0.4 | 0.2 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 15 | | 0.90 * | 1.74 * | 1.63 * | 1.50 * | 1.35 * | 1.18 * | 1.01 * | 0.85 * | 0.7 | 0.6 | 0.5 | 0.2 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 13 | | 1.23 * | 2.34 * | 2.15 * | 1.95 * | 1.72 * | 1.50 * | 1.27 * | 1.06 * | 0.86 * | 0.8 | 0.6 | 0.3 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 11 | | 1.69 * | 3.19 * | 2.91 * | 2.60 * | 2.23 * | 1.88 * | 1.57 * | 1.29 * | 1.04 * | 0.99 * | 0.8 | 0.4 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 9 | | 2.22 * | 4.21 * | 3.86 * | 3.43 * | 2.90 * | 2.38 * | 1.92 * | 1.54 * | 1.23 * | 1.17 * | 0.9 | 0.5 | 0.3 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 7 | | 2.67 * | 5.15 * | 4.82 * | 4.34 * | 3.68 * | 2.98 * | 2.33 * | 1.82 * | 1.43 * | 1.35 * | 1.10 * | 0.6 | 0.3 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 5 | | 2.97 * | 5.80 * | 5.55 * | 5.13 * | 4.45 * | 3.62 * | 2.79 * | 2.11 * | 1.62 * | 1.52 * | 1.24 * | 0.7 | 0.4 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3 | | 3.13 * | 6.17 * | 5.99 * | 5.64 * | 5.04 * | 4.18 * | 3.23 * | 2.39 * | 1.80 * | 1.67 * | 1.35 * | 0.8 | 0.4 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 1 | | 3.21 * | 6.36 * | 6.22 * | 5.93 * | 5.41 * | 4.59 * | 3.57 * | 2.63 * | 1.94 * | 1.78 * | 1.44 * | 0.9 | 0.5 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 0 | | 1.62 * | 3.22 * | 3.15 * | 3.02 * | 2.79 * | 2.40 * | 1.88 * | 1.38 * | 1.01 * | 0.92 * | 0.74 * | 0.4 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

| | | | | | | | | | | | | | | | | | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|---|-------|
| -1 | 1.63 * | 3.23 * | 3.17 * | 3.04 * | 2.81 * | 2.43 * | 1.91 * | 1.40 * | 1.02 * | 0.93 * | 0.75 * | 0.5 | 0.3 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -3 | 3.24 * | 6.45 * | 6.32 * | 6.06 * | 5.60 * | 4.84 * | 3.82 * | 2.81 * | 2.05 * | 1.85 * | 1.50 * | 0.9 | 0.5 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -5 | 3.20 * | 6.37 * | 6.23 * | 5.96 * | 5.46 * | 4.69 * | 3.69 * | 2.72 * | 1.99 * | 1.81 * | 1.47 * | 0.9 | 0.5 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -7 | 3.10 * | 6.18 * | 6.03 * | 5.72 * | 5.17 * | 4.37 * | 3.41 * | 2.52 * | 1.88 * | 1.72 * | 1.40 * | 0.8 | 0.5 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -9 | 2.93 * | 5.84 * | 5.67 * | 5.29 * | 4.68 * | 3.88 * | 3.01 * | 2.26 * | 1.72 * | 1.60 * | 1.30 * | 0.8 | 0.4 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -11 | 2.64 * | 5.28 * | 5.09 * | 4.65 * | 4.02 * | 3.28 * | 2.56 * | 1.97 * | 1.53 * | 1.44 * | 1.17 * | 0.7 | 0.3 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -13 | 2.22 * | 4.44 * | 4.25 * | 3.83 * | 3.26 * | 2.67 * | 2.13 * | 1.69 * | 1.34 * | 1.27 * | 1 | 0.6 | 0.3 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -15 | 1.72 * | 3.44 * | 3.29 * | 2.97 * | 2.55 * | 2.13 * | 1.75 * | 1.42 * | 1.15 * | 1.09 * | 0.9 | 0.5 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -17 | 1.27 * | 2.55 * | 2.47 * | 2.26 * | 1.98 * | 1.70 * | 1.43 * | 1.19 * | 0.96 * | 0.90 * | 0.7 | 0.4 | 0.2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -20 | 1.16 * | 2.32 * | 2.26 * | 2.10 * | 1.88 * | 1.65 * | 1.41 * | 1.17 * | 0.94 * | 0.9 | 0.6 | 0.3 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -23 | 0.96 * | 1.93 * | 1.89 * | 1.78 * | 1.61 * | 1.42 * | 1.20 * | 1 | 0.8 | 0.7 | 0.5 | 0.2 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -26 | 0.61 * | 1.22 * | 1.20 * | 1.13 * | 1 | 0.9 | 0.7 | 0.6 | 0.4 | 0.4 | 0.2 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -29 | 0.4 | 0.7 | 0.7 | 0.7 | 0.6 | 0.5 | 0.4 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -33 | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -38 | 0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| -90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Total | 47 | 93 | 90 | 83 | 74 | 63 | 50 | 38 | 29 | 27 | 22 | 12 | 6.8 | 3.1 | 1.7 | 1.2 | 0.9 | 1 | 0.8 | 0.3 | 0.1 | 0 | 644.8 |

5.0 THD and PF Test

| | | | |
|-----------|--------------|------------|----|
| Model No. | HSLED13Y/D10 | Sample ID. | B1 |
|-----------|--------------|------------|----|

Test Method

The samples were tested according to the ANSI C82.77:2002.

The total harmonic distortion shall be measured to the 40th order.

The ambient temperature condition was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. The sample measurements were made using a digital power meter and power supply. The sample was operated at rated voltage and was stabilized before measurement. The total harmonic distortion were calculated.

Test Results

| Temperature (°C) | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD |
|------------------|---------------|----------------|-------------|-----------|--------------|--------|
| 25.1 | 120.01 | 60 | 0.118 | 13.80 | 0.973 | 14.04% |

6.0 Equipment Information

| Test Equipment | | | |
|----------------|-------------------------------------------------------------------------------------------------|------------|-----------------|
| Equipment ID | Equipment Name | Last | Calibration Due |
| DLF107 | Integrating Sphere System | 2017/12/28 | 2018/12/27 |
| DLF108 | Auxiliary Lamp | 2017/12/28 | 2018/12/27 |
| DLF122 | Measurement Standard Lamp Standard Lamp Type: 220 V, 0.4720 A, Tungsten, Omni-derectional | 2017/12/28 | 2018/12/27 |
| DLF116 | AC Power Source | 2017/12/28 | 2018/12/27 |
| DLF113 | Power Meter | 2017/12/28 | 2018/12/27 |
| DLF112 | Temperature Recorder | 2017/12/28 | 2018/12/27 |
| DLF114 | Temperature & Humidity Datalogger | 2017/12/28 | 2018/12/27 |
| DLF101 | Goniophotometer | 2017/12/28 | 2018/12/27 |
| DLF125 | Standard Lamp Standard Lamp Type: 76.58 V, 6.7875 A, Tungsten, Omni-derectional | 2017/12/28 | 2018/12/27 |
| DLF104 | AC Power Source | 2017/12/28 | 2018/12/27 |
| DLF507 | DC Power Source | 2017/12/28 | 2018/12/27 |
| DLF102 | Power Meter | 2017/12/28 | 2018/12/27 |
| DLF111 | Temperature & Humidity Datalogger | 2017/12/28 | 2018/12/27 |
| DLF119 | Power Meter | 2017/12/28 | 2018/12/27 |
| DLF031 | Temperature data logger | 2017/12/28 | 2018/12/27 |
| DLF022 | Digital power meter | 2017/12/28 | 2018/12/27 |
| DLF003 | Temperature & Humidity Datalogger | 2017/12/28 | 2018/12/27 |

***** End of Test Report*****