

# Photometric Test Report

## Relevant Standards

- ☒ IES LM-79-2008
- ☒ ANSI C82.77:2017

## Prepared For

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**DLF2110111**

## Report Number

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## Test Date

**2021/10/28**

## Issue Date

**2021/11/1**

## Prepared By



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## Approved By



Kevin Jia

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## 1.0 Test Summary

DLC Technical Requirements v5.1

| Outdoor - Architectural Flood and Spot Luminaires                    |                                 |                      |                |            |
|--|---------------------------------|----------------------|----------------|------------|
| Requirement Category   | Test Method                     | Requirements         |                | Test value |
| Luminaire Output (lm)<br>(Goniophotometer - Section 4.2)             | IES LM-79-2008                  | 1000                 |                | 19048      |
| Minimum Luminaire Efficacy (lm/W)<br>(Goniophotometer - Section 4.2) | IES LM-79-2008                  | Standard<br>105      | Premium<br>120 | 161.6      |
| Power (Input Wattage) (W)<br>(Goniophotometer - Section 4.2)         | IES LM-79-2008                  | Worst Case           |                | 117.9      |
| Total Harmonic Distortion (A%)<br>(THD & PF - section 4.3)           | ANSI C82.77:2014                | 20.00%               | 120V           | 5.97%      |
|  |                                 | 20.00%               | 277V           | 16.15%     |
| Power Factor<br>(THD & PF - section 4.3)                             | ANSI C82.77:2014                | 0.9                  | 120V           | 0.994      |
|  |                                 | 0.9                  | 277V           | 0.869      |
| Allowable CCTs* (K)<br>(Integrating Sphere - Section 4.1)            | IES LM-79-2008                  | 7 step               | 5029±355       | 5043       |
|  |                                 | 4 step               | 5029±220       |            |
| Minimum CRI<br>(Integrating Sphere - Section 4.1)                    | IES LM-79-2008<br>CIE 13.3-1995 | ≥70                  |                | 82         |
| Minimum R9<br>(Integrating Sphere - Section 4.1)                     | IES LM-79-2008<br>CIE 13.3-1995 | ≥-40                 |                | 0          |
| Minimum Rf<br>(Integrating Sphere - Section 4.1)                     | ANSI/IES TM-30-18               | ≥70                  |                | 83         |
| Minimum Rg<br>(Integrating Sphere - Section 4.1)                     | ANSI/IES TM-30-18               | ≥89                  |                | 96         |
| Minimum IES Rcs,h1<br>(Integrating Sphere - Section 4.1)             | ANSI/IES TM-30-18               | -18%≤IES Rcs,h1≤+23% |                | -13%       |
| Zonal Lumen Requirement (0°-90°)<br>(Goniophotometer - Section 4.2)  | IES LM-79-2008                  | 85%                  |                | 99.89%     |
| Input Voltage (V)  |                                 |                      |                |            |
| (Goniophotometer - Section 4.2)                                      | IES LM-79-2008                  | Worst Case           |                | 120        |
| (Goniophotometer - Section 4.2)                                      |                                 | Non-Worst Case       |                | 277        |
| Input Current (A)  |                                 |                      |                |            |
| (Goniophotometer - Section 4.2)                                      | IES LM-79-2008                  | Worst Case           |                | 0.996      |
| (Goniophotometer - Section 4.2)                                      |                                 | Non-Worst Case       |                | 0.481      |
| Power (Input Wattage - W)  |                                 |                      |                |            |
| (Goniophotometer - Section 4.2)                                      | IES LM-79-2008                  | Worst Case           |                | 117.9      |
| (Goniophotometer - Section 4.2)                                      |                                 | Non-Worst Case       |                | 116.0      |

## 2.0 Test List

| Test Item | Test                    | Test Date  | Model Number          | Sample No. |
|-----------|-------------------------|------------|-----------------------|------------|
| 1         | Integrating Sphere Test | 2021/10/28 | FFLEDL @ 120W / 5000K | L1         |
| 2         | Goniophotometer Test    | 2021/10/28 | FFLEDL @ 120W / 5000K | L1         |
| 3         | THD and PF Test         | 2021/10/28 | FFLEDL @ 120W / 5000K | L1         |

### Remark(If any)

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- 2、 The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report apply to the test sample(s) mentioned above at the time of the testing period only and are not to be used to indicate applicability to other similar products. This report does not imply that the product(s) has met the criteria for certification.

## 3.0 Production Description

**Luminaire Description:** FFLEDL @ 120W / 5000K

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

### Photos of Luminaire Characteristics



## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test

|                     |                       |                           |      |
|---------------------|-----------------------|---------------------------|------|
| Model No.           | FFLEDL @ 120W / 5000K | Sample ID.                | L1   |
| Operate time (Min.) | 90                    | Stabilization time (Min.) | 45   |
| Temperature (°C)    | 25.4                  | Humidity (%RH)            | 54.0 |

#### 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  $\pm 0.2$  percent under load.

The sample was measured using  $4\pi$  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 Result

| Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor |
|---------------|----------------|-------------|-----------|--------------|
| 119.96        | 60             | 0.992       | 118.3     | 0.994        |
| 276.96        | 60             | 0.484       | 116.6     | 0.869        |

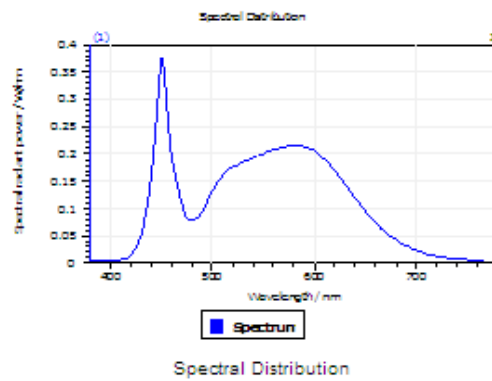
#### Test Result

| CCT (K) | CRI | R9 | Duv    |
|---------|-----|----|--------|
| 5043    | 82  | 0  | 0.0026 |

| Rf | Rg | IES Rcs,h1 |
|----|----|------------|
| 83 | 96 | -13%       |

## 4.1 Integrating Sphere Test

### Results

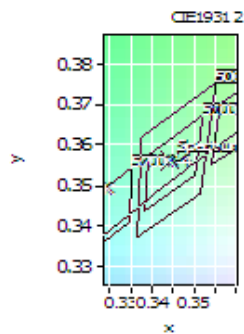


#### Spectral values

DominantWavelength 589.63 nm  
Purity 0.102  
PeakWavelength 450.79 nm  
Radiant Power 41.79 W  
Width50%:

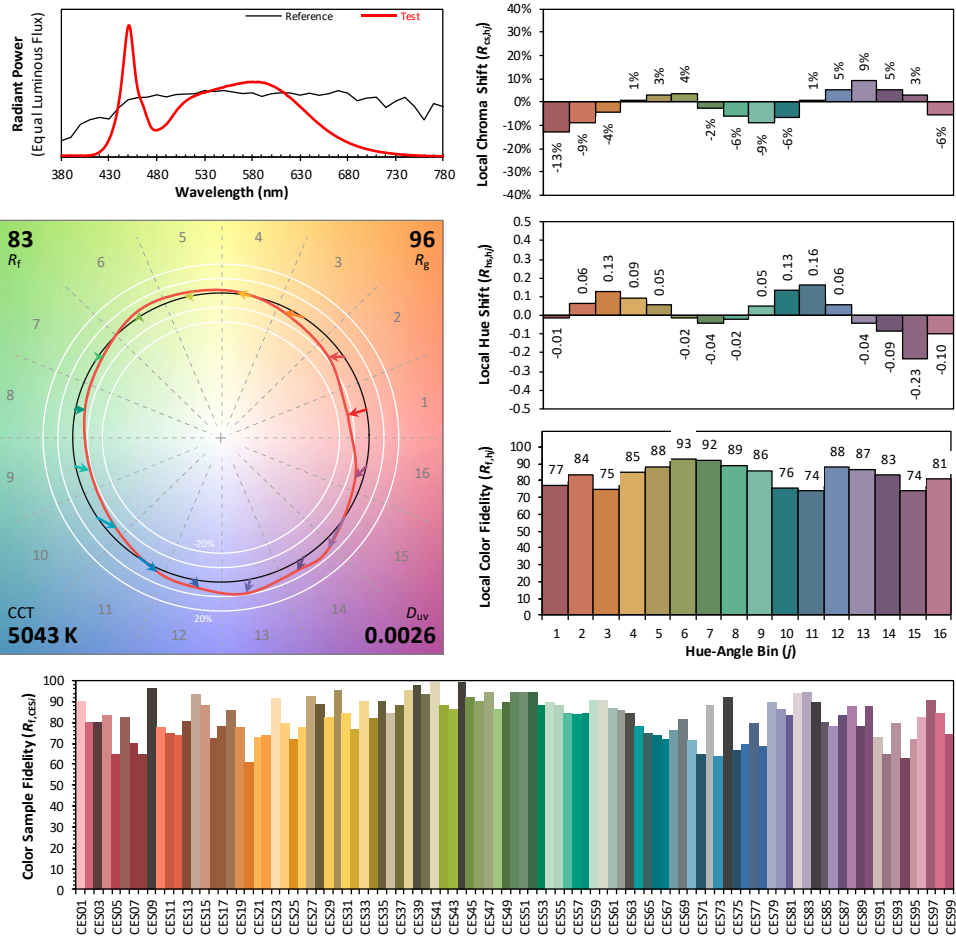
#### Color Coordinates

Correlated Color Temperat 5043 K  
x: 0.3444 u: 0.2091 u': 0.2091  
y: 0.3562 v: 0.3245 v': 0.4868  
CRI01 79.3 CRI09 -0.4  
CRI02 86.8 CRI10 69.1  
CRI03 92.1 CRI11 80.6  
CRI04 81.3 CRI12 60.5  
CRI05 80.5 CRI13 81.2  
CRI06 82.1 CRI14 95.8  
CRI07 85.6 CRI15 73.0  
CRI08 64.4 CRI16 71.8  
ResultsCRI 81.5



PlanckDistance 2.6E-003

## 4.1 Integrating Sphere Test



**Notes:** This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.3444  
 $y$  0.3562  
 $u'$  0.2091  
 $v'$  0.4868

CIE 13.3-1995  
(CRI)  
 $R_a$  82  
 $R_g$  1

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.0

## 4.0 LM-79 Measurement and Test Results

### 4.2 Goniophotometer Test

|                     |                       |                           |      |
|---------------------|-----------------------|---------------------------|------|
| Model No.           | FFLEDL @ 120W / 5000K | Sample ID.                | L1   |
| Operate time (Min.) | 90                    | Stabilization time (Min.) | 45   |
| Temperature (°C)    | 25.3                  | Humidity (%RH)            | 54.0 |

#### 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  $\pm 0.2$  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  $0.5^{\circ}$  vertical intervals and  $10^{\circ}$  horizontal intervals.

#### Test Conditions

| Condition      | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor |
|----------------|---------------|----------------|-------------|-----------|--------------|
| WORST CASE     | 120.05        | 60             | 0.996       | 117.9     | 0.986        |
| NON-WORST CASE | 277.02        | 60             | 0.481       | 116.0     | 0.870        |

#### Test Result

| Flux (lm) | Field Angle(10%) |         | Beam Angle(50%) |         | Luminous Efficacy (lm/W) |
|-----------|------------------|---------|-----------------|---------|--------------------------|
|           | C0-180           | C90-270 | C0-180          | C90-270 |                          |
| 19048     | 118.9            | 153.0   | 90.4            | 113.2   | 161.6                    |

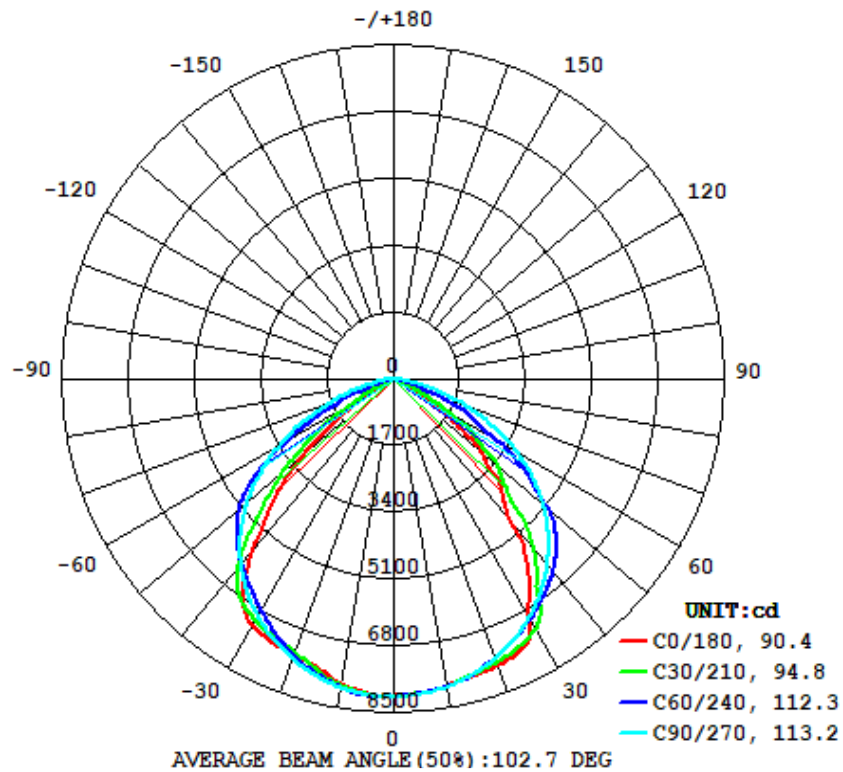
Zonal Lumen Requirement  
( $0^{\circ}$ - $90^{\circ}$ )

99.89%

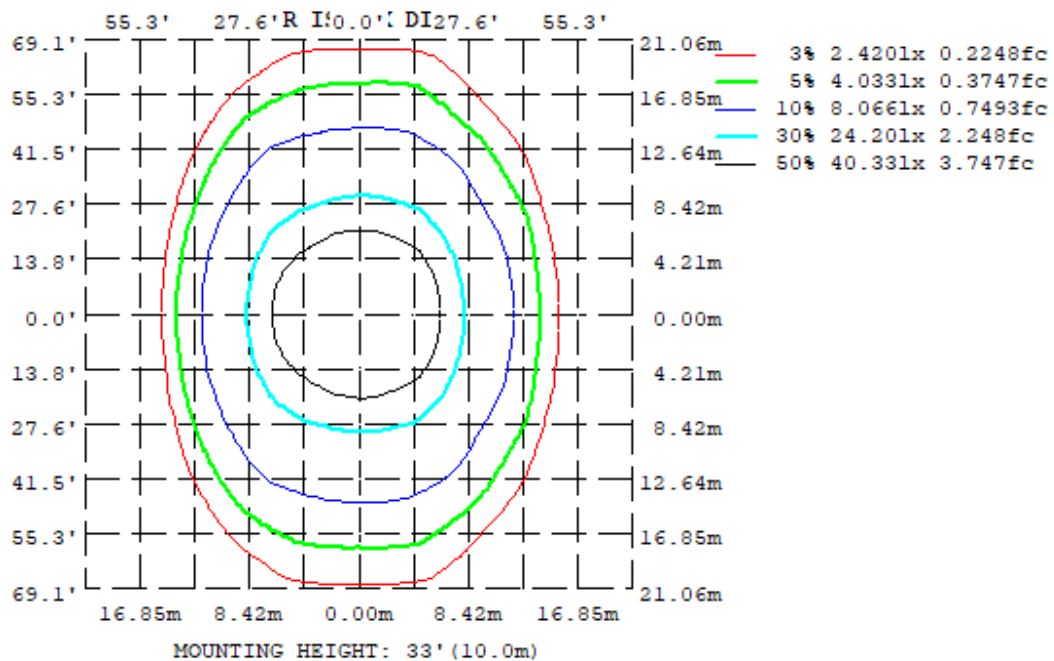


## 4.2 Goniophotometer Test

Light Distrubtion Curve



Isolux Plot





## 4.2 Goniophotometer Test

### Zonal Lumen Summary

| $\gamma$ | C0                    | C45   | C90   | C135  | C180   | C225  | C270   | C315   |
|----------|-----------------------|-------|-------|-------|--------|-------|--------|--------|
| 10       | 7924                  | 7951  | 7945  | 7914  | 7881   | 7931  | 7972   | 7988   |
| 20       | 7767                  | 7599  | 7571  | 7417  | 7462   | 7411  | 7587   | 7620   |
| 30       | 6956                  | 7215  | 6990  | 6974  | 7249   | 6927  | 6972   | 7235   |
| 40       | 4679                  | 6142  | 6161  | 6433  | 5609   | 6357  | 6104   | 5974   |
| 50       | 3016                  | 4107  | 5065  | 4628  | 3183   | 4583  | 4918   | 3787   |
| 60       | 768.2                 | 2240  | 3605  | 2312  | 643.4  | 2192  | 3408   | 2146   |
| 70       | 28.87                 | 264.2 | 1934  | 227.4 | 101.2  | 214.6 | 1756   | 203.5  |
| 80       | 0.7765                | 2.923 | 429.5 | 53.43 | 14.47  | 43.21 | 287.5  | 0.8447 |
| 90       | 0.4816                | 1.017 | 1.146 | 2.138 | 0.2318 | 1.737 | 0.5421 | 0.4421 |
| 100      | 0.6193                | 1.251 | 1.512 | 1.881 | 3.366  | 1.639 | 1.478  | 0.8399 |
| 110      | 1.333                 | 2.031 | 2.624 | 1.988 | 1.106  | 1.909 | 2.493  | 1.615  |
| 120      | 2.394                 | 2.817 | 3.342 | 2.674 | 1.799  | 2.479 | 3.151  | 2.296  |
| 130      | 3.762                 | 3.617 | 4.236 | 3.639 | 3.049  | 3.373 | 4.158  | 3.315  |
| 140      | 4.858                 | 4.655 | 4.888 | 4.586 | 4.719  | 4.933 | 5.175  | 4.819  |
| 150      | 5.701                 | 5.650 | 5.128 | 5.419 | 5.587  | 5.682 | 5.911  | 5.878  |
| 160      | 6.261                 | 5.948 | 5.500 | 5.759 | 6.695  | 6.211 | 6.062  | 6.380  |
| 170      | 6.318                 | 5.917 | 5.577 | 5.838 | 6.160  | 6.092 | 5.665  | 5.729  |
| 180      | 7.090                 | 6.555 | 6.100 | 6.641 | 7.041  | 6.711 | 6.287  | 6.483  |
| DEG      | LUMINOUS INTENSITY:cd |       |       |       |        |       |        |        |

|         | Zonal (lm) |         | Total (lm) | Percent |
|---------|------------|---------|------------|---------|
| 0-10    | 765.94     | 0 - 10  | 765.94     | 4.02%   |
| 10-20   | 2195.95    | 0 - 20  | 2961.88    | 15.55%  |
| 20-30   | 3400.83    | 0 - 30  | 6362.72    | 33.40%  |
| 30-40   | 4121.35    | 0 - 40  | 10484.06   | 55.04%  |
| 40-50   | 3927.34    | 0 - 50  | 14411.40   | 75.66%  |
| 50-60   | 2891.01    | 0 - 60  | 17302.41   | 90.84%  |
| 60-70   | 1348.39    | 0 - 70  | 18650.80   | 97.92%  |
| 70-80   | 354.25     | 0 - 80  | 19005.05   | 99.78%  |
| 80-90   | 22.23      | 0 - 90  | 19027.28   | 99.89%  |
| 90-100  | 2.03       | 0 - 100 | 19029.32   | 99.90%  |
| 100-110 | 1.63       | 0 - 110 | 19030.95   | 99.91%  |
| 110-120 | 2.17       | 0 - 120 | 19033.12   | 99.92%  |
| 120-130 | 2.77       | 0 - 130 | 19035.90   | 99.94%  |
| 130-140 | 3.29       | 0 - 140 | 19039.19   | 99.96%  |
| 140-150 | 3.29       | 0 - 150 | 19042.49   | 99.97%  |
| 150-160 | 2.74       | 0 - 160 | 19045.23   | 99.99%  |
| 160-170 | 1.71       | 0 - 170 | 19046.94   | 100.00% |
| 170-180 | 0.58       | 0 - 180 | 19047.52   | 100.00% |

## 4.2 Goniophotometer Test

### Axial Candela

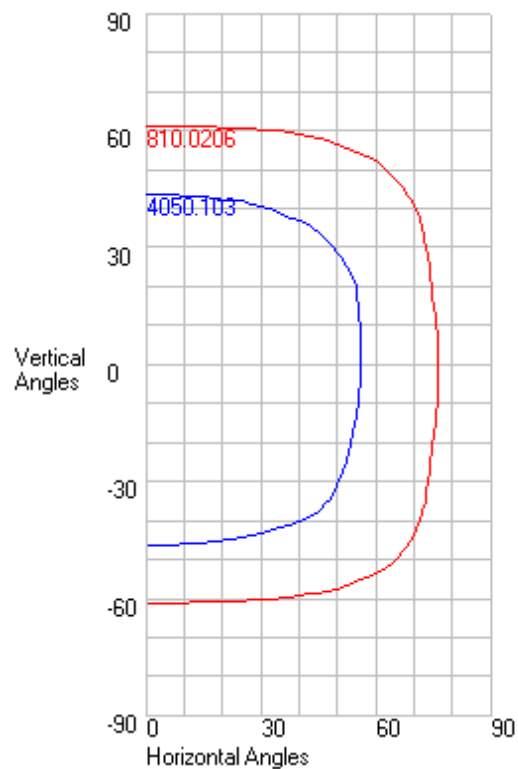
| DEG.  | HOR.     | DEG.  | VERT.    |
|-------|----------|-------|----------|
| 90    | 0.541    | 90    | 0.481    |
| 85    | 14.34    | 85    | 0.75     |
| 75    | 947.45   | 75    | 2.91     |
| 65    | 2580.33  | 65    | 126.16   |
| 55    | 4206.25  | 55    | 1869.48  |
| 47.5  | 5242.45  | 47.5  | 3372.875 |
| 42.5  | 5838.505 | 42.5  | 4236.05  |
| 37.5  | 6348.27  | 37.5  | 5569.65  |
| 33    | 6739.45  | 33    | 6462.14  |
| 29    | 7046.61  | 29    | 7288.17  |
| 25.5  | 7284.55  | 25.5  | 7630.79  |
| 22.5  | 7461.39  | 22.5  | 7726.57  |
| 19.5  | 7610.49  | 19.5  | 7773.475 |
| 17    | 7722.22  | 17    | 7807.35  |
| 15    | 7804.43  | 15    | 7836.15  |
| 13    | 7879.03  | 13    | 7857.01  |
| 11    | 7944.76  | 11    | 7890.05  |
| 9     | 7997.97  | 9     | 7958.78  |
| 7     | 8039.53  | 7     | 8015.71  |
| 5     | 8069.29  | 5     | 8028.94  |
| 3     | 8084.39  | 3     | 8025.81  |
| 1     | 8089     | 1     | 8045.94  |
| 0     | 8080.341 | 0     | 8080.341 |
| -1    | 8080.98  | -1    | 8070.34  |
| -3    | 8063.3   | -3    | 8075.04  |
| -5    | 8041.01  | -5    | 8035.51  |
| -7    | 8010.96  | -7    | 7974.3   |
| -9    | 7969.04  | -9    | 7919.3   |
| -11   | 7920.35  | -11   | 7834.49  |
| -13   | 7854.18  | -13   | 7710.97  |
| -15   | 7782.72  | -15   | 7617.12  |
| -17   | 7710.13  | -17   | 7544.66  |
| -19.5 | 7596.73  | -19.5 | 7472.775 |
| -22.5 | 7448.48  | -22.5 | 7436.875 |
| -25.5 | 7279.825 | -25.5 | 7392.305 |
| -29   | 7065.34  | -29   | 7288.15  |
| -33   | 6764.94  | -33   | 7025.02  |
| -37.5 | 6393.35  | -37.5 | 6254.63  |
| -42.5 | 5909.94  | -42.5 | 4929.96  |
| -47.5 | 5362.44  | -47.5 | 3793.48  |
| -55   | 4379.54  | -55   | 1801.65  |
| -65   | 2777.16  | -65   | 172.62   |
| -75   | 1125.36  | -75   | 57.75    |
| -85   | 39.67    | -85   | 12.48    |
| -90   | 1.152    | -90   | 0.236    |

## 4.2 Goniophotometer Test

### Characteristics

|                              |                 |
|------------------------------|-----------------|
| NEMA Type                    | 7 H x 6 V       |
| Maximum Candela              | 8100.206        |
| Maximum Candela Angle        | -1 H -3 V       |
| Horizontal Beam Angle (50%)  | 113.1           |
| Vertical Beam Angle (50%)    | 90.1            |
| Horizontal Field Angle (10%) | 154.3           |
| Vertical Field Angle (10%)   | 122.3           |
| Lumens Per Lamp              | N.A. (absolute) |
| Total Lamp Lumens            | N.A. (absolute) |
| Beam Lumens                  | 15002           |
| Beam Efficiency              | N.A.            |
| Field Lumens                 | 18756           |
| Field Efficiency             | N.A.            |
| Spill Lumens                 | 293             |
| Luminaire Lumens             | 19048           |
| Total Efficiency             | N.A.            |
| Total Luminaire Watts        | 117.87          |
| 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    | 0.481      | 0.474      | 0.461      | 0.448      | 0.434      | 0.421      | 0.408      | 0.395      | 0.381      | 0.382      | 0.384      | 0.386      | 0.388      | 0.39       | 0.401      | 0.416      | 0.432      | 0.446      | 0.461      | 0.467      | 0.46      | 0.513  | 0.54  |
| 85    | 0.75       | 0.746      | 0.738      | 0.73       | 0.722      | 0.714      | 0.706      | 0.696      | 0.687      | 0.685      | 0.682      | 0.679      | 0.677      | 0.674      | 0.682      | 0.695      | 0.703      | 0.714      | 0.738      | 0.68       | 0.515     | 0.534  | 0.54  |
| 75    | 2.91       | 2.885      | 2.835      | 2.786      | 2.558      | 2.408      | 2.247      | 2.078      | 2.068      | 2.408      | 2.453      | 2.312      | 2.158      | 1.608      | 3.246      | 2.94       | 1.426      | 4.073      | 2.82       | 5.613      | 0.695     | 0.603  | 0.54  |
| 65    | 126.16     | 130.025    | 137.752    | 140.03     | 141.596    | 140.218    | 135.465    | 126.916    | 125.892    | 132.025    | 137.979    | 135.649    | 119.555    | 118.201    | 136.924    | 130.479    | 87.228     | 139.348    | 70.837     | 91.859     | 16.069    | 0.726  | 0.54  |
| 55    | 1869.48 *  | 1879.838 * | 1900.542 * | 1891.06 *  | 1882.849 * | 1865.117 * | 1837.971 * | 1828.353 * | 1830.517 * | 1807.743 * | 1753.586 * | 1684.641 * | 1620.067 * | 1597.638 * | 1535.307 * | 1359.07 *  | 1197.713 * | 1032.805 * | 756.994    | 411.236    | 70.466    | 0.842  | 0.54  |
| 47.5  | 3372.875 * | 3389.151 * | 3408.872 * | 3409.596 * | 3389.155 * | 3357.565 * | 3310.933 * | 3289.524 * | 3296 *     | 3309.775 * | 3258.287 * | 3093.073 * | 2999.66 *  | 2962.252 * | 2865.041 * | 2558.298 * | 2328.168 * | 2016.126 * | 1569.194 * | 809.357    | 189.344   | 1.071  | 0.54  |
| 42.5  | 4236.05 *  | 4242.135 * | 4245.946 * | 4237.939 * | 4217.378 * | 4189.28 *  | 4172.268 * | 4166.801 * | 4118.371 * | 4057.646 * | 3972.829 * | 3939.887 * | 3934.372 * | 3714.737 * | 3442.616 * | 3385.163 * | 3085.475 * | 2562.02 *  | 2114.803 * | 1170.465 * | 294.895   | 1.252  | 0.54  |
| 37.5  | 5569.65 *  | 5580.811 * | 5588.65 *  | 5578.231 * | 5561.794 * | 5496.721 * | 5462.892 * | 5392.16 *  | 5317.113 * | 5245.714 * | 5192.211 * | 5015.363 * | 4810.611 * | 4736.826 * | 4492.894 * | 4071.572 * | 3842.72 *  | 3355.889 * | 2637.729 * | 1518.493 * | 401.937   | 1.445  | 0.54  |
| 33    | 6462.14 *  | 6470.808 * | 6468.122 * | 6451.444 * | 6420.118 * | 6394.926 * | 6334.651 * | 6268.484 * | 6203.085 * | 6133.521 * | 6079.822 * | 5912.27 *  | 5724.631 * | 5547.444 * | 5306.079 * | 4989.223 * | 4480.027 * | 3904.305 * | 3049.038 * | 1794.817 * | 494.992   | 3.532  | 0.54  |
| 29    | 7288.17 *  | 7303.864 * | 7296.327 * | 7273.43 *  | 7244.126 * | 7164.431 * | 7078.461 * | 7053.866 * | 7012.685 * | 6842.711 * | 6675.329 * | 6644.514 * | 6526.548 * | 6074.382 * | 5852.938 * | 5627.264 * | 4922.98 *  | 4311.919 * | 3408.09 *  | 1985.789 * | 574.608   | 5.569  | 0.54  |
| 25.5  | 7630.79 *  | 7632.193 * | 7630.311 * | 7622.647 * | 7600.714 * | 7552.713 * | 7495.252 * | 7434.819 * | 7361.315 * | 7271.343 * | 7149.379 * | 7000.792 * | 6829.742 * | 6539.581 * | 6195.928 * | 5955.307 * | 5306.555 * | 4598.838 * | 3720.331 * | 2133.77 *  | 646.62    | 7.224  | 0.54  |
| 22.5  | 7726.57 *  | 7727.527 * | 7726.798 * | 7723.287 * | 7694.368 * | 7648.832 * | 7598.658 * | 7539.44 *  | 7464.365 * | 7383.92 *  | 7277.745 * | 7128.391 * | 6939.612 * | 6707.881 * | 6423.607 * | 6052.362 * | 5507.672 * | 4798.287 * | 3954.37 *  | 2248.01 *  | 702.348   | 8.536  | 0.54  |
| 19.5  | 7773.475 * | 7775.039 * | 7775.998 * | 7773.637 * | 7739.785 * | 7697.885 * | 7649.678 * | 7588.064 * | 7517.487 * | 7438.186 * | 7335.862 * | 7186.919 * | 7006.168 * | 6774.941 * | 6500.638 * | 6120.848 * | 5600.705 * | 4962.211 * | 4038.187 * | 2354.909 * | 752.452   | 9.741  | 0.54  |
| 17    | 7807.35 *  | 7811.022 * | 7814.281 * | 7807.014 * | 7774.761 * | 7735.635 * | 7683.141 * | 7620.371 * | 7550.282 * | 7473.915 * | 7368.259 * | 7222.054 * | 7043.164 * | 6822.183 * | 6541.129 * | 6162.332 * | 5655.719 * | 5074.94 *  | 4096.248 * | 2429.576 * | 790.362   | 10.658 | 0.54  |
| 15    | 7836.15 *  | 7840.983 * | 7846.308 * | 7834.643 * | 7804.553 * | 7765.272 * | 7710.383 * | 7646.945 * | 7580.907 * | 7501.509 * | 7394.05 *  | 7245.871 * | 7079.106 * | 6861.567 * | 6570.266 * | 6185.455 * | 5685.281 * | 5121.144 * | 4134.182 * | 2476.94 *  | 818.189 * | 11.329 | 0.54  |
| 13    | 7857.01 *  | 7864.322 * | 7874.129 * | 7860.352 * | 7832.933 * | 7792.961 * | 7737.784 * | 7675.72 *  | 7611.605 * | 7531.221 * | 7417.517 * | 7278.889 * | 7124.006 * | 6898.49 *  | 6594.97 *  | 6203.505 * | 5729.116 * | 5160.022 * | 4168.691 * | 2513.958 * | 843.699 * | 11.943 | 0.54  |
| 11    | 7890.05 *  | 7903.525 * | 7917.495 * | 7904.264 * | 7874.549 * | 7834.838 * | 7774.814 * | 7721.819 * | 7652.893 * | 7564.912 * | 7451.508 * | 7325.02 *  | 7165.739 * | 6931.468 * | 6616.604 * | 6229.672 * | 5758.057 * | 5191.494 * | 4189.863 * | 2543.302 * | 866.808 * | 13.604 | 0.541 |
| 9     | 7958.78 *  | 7975.045 * | 7983.814 * | 7968.604 * | 7938.952 * | 7895.282 * | 7838.929 * | 7776.722 * | 7700.37 *  | 7611.182 * | 7503.153 * | 7369.857 * | 7204.635 * | 6958.83 *  | 6654.407 * | 6267.277 * | 5788.626 * | 5216.585 * | 4208.14 *  | 2565.231 * | 887.437 * | 13.737 | 0.541 |
| 7     | 8015.71 *  | 8030.594 * | 8034.624 * | 8017.152 * | 7990.218 * | 7942.201 * | 7890.271 * | 7823.354 * | 7739.548 * | 7653.99 *  | 7546.754 * | 7409.046 * | 7237.681 * | 6992.173 * | 6683.778 * | 6303.011 * | 5812.42 *  | 5235.369 * | 4219.99 *  | 2580.027 * | 905.503 * | 13.87  | 0.541 |
| 5     | 8028.94 *  | 8049.008 * | 8048.195 * | 8032.766 * | 8000.849 * | 7959.678 * | 7907.331 * | 7837.6 *   | 7761.418 * | 7681.689 * | 7578.585 * | 7437.459 * | 7263.182 * | 7019.86 *  | 6710.47 *  | 6322.292 * | 5829.47 *  | 5247.303 * | 4225.087 * | 2588.004 * | 929.809 * | 14.004 | 0.541 |
| 3     | 8025.81 *  | 8059.342 * | 8051.779 * | 8033.477 * | 8006.67 *  | 7961.311 * | 7904.199 * | 7846.588 * | 7779.705 * | 7703.434 * | 7597.471 * | 7452.571 * | 7278.279 * | 7037.824 * | 6728.557 * | 6338.848 * | 5839.11 *  | 5251.455 * | 4231.703 * | 2595.971 * | 936.855 * | 14.138 | 0.541 |
| 1     | 8045.94 *  | 8079.83 *  | 8068.306 * | 8054.271 * | 8026.506 * | 7985.889 * | 7935.132 * | 7871.923 * | 7799.779 * | 7719.476 * | 7608.33 *  | 7460.664 * | 7284.736 * | 7047.266 * | 6739.058 * | 6347.267 * | 5840.801 * | 5247.528 * | 4214.741 * | 2585.547 * | 943.917 * | 14.34  | 0.541 |
| 0     | 8080.341 * | 8089 *     | 8084.39 *  | 8069.29 *  | 8039.53 *  | 7997.97 *  | 7944.76 *  | 7879.03 *  | 7804.43 *  | 7722.22 *  | 7610.49 *  | 7461.39 *  | 7284.55 *  | 7046.61 *  | 6739.45 *  | 6348.27 *  | 5838.505 * | 5242.45 *  | 4206.25 *  | 2580.33 *  | 947.45 *  | 14.34  | 0.541 |
| -1    | 8070.34 *  | 8087.114 * | 8092.534 * | 8078.714 * | 8048.407 * | 8006.421 * | 7951.765 * | 7884.238 * | 7807.873 * | 7723.797 * | 7608.46 *  | 7456.751 * | 7278.378 * | 7041.552 * | 6734.253 * | 6341.423 * | 5830.896 * | 5236.897 * | 4206.152 * | 2585.784 * | 947.036 * | 14.347 | 0.541 |
| -3    | 8075.04 *  | 8083.662 * | 8085.923 * | 8075.533 * | 8042.443 * | 8001.969 * | 7952.732 * | 7881.54 *  | 7801.932 * | 7715.052 * | 7596.83 *  | 7440.241 * | 7258.927 * | 7020.861 * | 6714.201 * | 6321.014 * | 5809.141 * | 5219.54 *  | 4205.955 * | 2596.681 * | 946.21 *  | 14.361 | 0.541 |
| -5    | 8035.51 *  | 8045.461 * | 8042.113 * | 8031.933 * | 8001.597 * | 7960.877 * | 7907.508 * | 7841.094 * | 7771.125 * | 7692.371 * | 7574.432 * | 7415.128 * | 7230.024 * | 6992.13 *  | 6686.728 * | 6291.569 * | 5778.679 * | 5194.04 *  | 4182.348 * | 2590.279 * | 945.384 * | 14.375 | 0.541 |
| -7    | 7974.3 *   | 7981 *     | 7979.166 * | 7965.476 * | 7935.672 * | 7899.944 * | 7845.529 * | 7779.682 * | 7714.179 * | 7637.12 *  | 7524.569 * | 7370.764 * | 7191.523 * | 6954.462 * | 6650.921 * | 6258.382 * | 5739.567 * | 5160.651 * | 4160.441 * | 2584.669 * | 926.588 * | 14.388 | 0.541 |
| -9    | 7919.3 *   | 7925.022 * | 7920.398 * | 7907.474 * | 7876.101 * | 7837.871 * | 7779.567 * | 7713.974 * | 7647.844 * | 7570.472 * | 7457.505 * | 7300.654 * | 7126.29 *  | 6903.781 * | 6612.755 * | 6206.734 * | 5693.527 * | 5119.915 * | 4132.062 * | 2573.68 *  | 913.921 * | 14.402 | 0.541 |
| -11   | 7834.49 *  | 7841.982 * | 7835.317 * | 7826.315 * | 7792.822 * | 7747.817 * | 7697.176 * | 7628.405 * | 7559.537 * | 7487.686 * | 7377.003 * | 7215.11 *  | 7046.874 * | 6832.12 *  | 6546.866 * | 6151.659 * | 5639.995 * | 5072.026 * | 4097.611 * | 2557.388 * | 898.225 * | 14.416 | 0.541 |
| -13   | 7710.97 *  | 7719.036 * | 7715.318 * | 7702.133 * | 7671.955 * | 7636.222 * | 7589.363 * | 7518.954 * | 7458.513 * | 7393.342 * | 7286.939 * | 7121.452 * | 6961.867 * | 6754.264 * | 6478.743 * | 6096.178 * | 5587.702 * | 5017.005 * | 4060.655 * | 2535.884 * | 879.488 * | 12.819 | 0.541 |
| -15   | 7617.12 *  | 7620.878 * | 7616.311 * | 7601.631 * | 7572.951 * | 7534.567 * | 7489.895 * | 7425.991 * | 7360.987 * | 7297.536 * | 7197.714 * | 7040.369 * | 6870.462 * | 6670.027 * | 6407.886 * | 6044.968 * | 5523.674 * | 4955.22 *  | 4014.251 * | 2509.262 * | 857.696 * | 12.307 | 0.541 |
| -17   | 7544.66 *  | 7546.177 * | 7539.921 * | 7524.571 * | 7495.565 * | 7454.667 * | 7409.747 * | 7350.719 * | 7280.672 * | 7207.432 * | 7115.931 * | 6976.071 * | 6797.171 * | 6581.776 * | 6336.612 * | 5991.699 * | 5487.704 * | 4886.966 * | 3966.018 * | 2477.864 * | 832.844 * | 11.723 | 0.541 |
| -19.5 | 7472.775 * | 7470.757 * | 7462.699 * | 7448.776 * | 7419.18 *  | 7379.219 * | 7327.999 * | 7276.554 * | 7213.552 * | 7134.204 * | 7032.826 * | 6908.578 * | 6739.557 * | 6494.028 * | 6247.17 *  | 5925.104 * | 5435.481 * | 4842.081 * | 3895.062 * | 2431.514 * | 797.481   | 10.893 | 0.541 |
| -22.5 | 7436.875 * | 7431.411 * | 7419.118 * | 7404.688 * | 7374.938 * | 7330.396 * | 7281.46 *  | 7228.19 *  | 7161.627 * | 7082.098 * | 6975.77 *  | 6843.521 * | 6675.933 * | 6446.813 * | 6160.3 *   | 5839.847 * | 5373.485 * | 4771.391 * | 3794.558 * | 2368.183 * | 751.663   | 9.756  | 0.541 |
| -25.5 | 7392.305 * | 7386.839 * | 7373.472 * | 7356.674 * | 7331.308 * | 7285.079 * | 7233.293 * | 7178.013 * | 7110.498 * | 7030.02 *  | 6921.482 * | 6780.705 * | 6611.176 * | 6380.479 * | 6097.947 * | 5752.635 * | 5277.245 * | 4676.511 * | 3659.479 * | 2283.807 * | 702.101   | 8.468  | 0.541 |
| -29   | 7288.15 *  | 7283.875 * | 7269.834 * | 7251.755 * | 7229.283 * | 7185.31 *  | 7132.29 *  | 7072.476 * | 7009.941 * | 6932.446 * | 6817.541 * | 6669.194 * | 6512.114 * | 6290.937 * | 5960.546 * | 5593.924 * | 5160.449 * | 4523.48 *  | 3457.592 * | 2171.35 *  | 637.091   | 6.781  | 0.541 |
| -33   | 7025.02 *  | 7026.84 *  | 7017.173 * | 6998.77 *  | 6971.684 * | 6939.775 * | 6872.817 * | 6814.127 * | 6752.078 * | 6686.185 * | 6554.518 * | 6381.299 * | 6221.894 * | 6048.271 * | 5670.637 * | 5246.175 * | 4908.971 * | 4269.272 * | 3158.556 * | 2019.715 * | 557.822   | 4.62   | 0.541 |
| -37.5 | 6254.63 *  | 6266.494 * | 6274.365 * | 6262.423 * | 6244.227 * | 6177.008 * | 6135.664 * | 6086.779 * | 6033.66 *  | 5967.364 * | 5859.496 * | 5682.833 * | 5534.022 * | 5390.227 * | 5059.723 * | 4645.31 *  | 4315.112 * | 3831.136 * | 2768.494 * | 1760.887 * | 460.496   | 2.335  | 0.541 |
| -42.5 | 4929.96 *  | 4944.026 * | 4957.343 * | 4949.996 * | 4921.012 * | 4876.575 * | 4840.313 * | 4849.303 * | 4801.225 * | 4745.632 * | 4637.238 * | 4545.378 * | 4454.166 * | 4312.695 * | 4052.977 * | 3789.962 * | 3521.528 * | 3076.031 * | 2283.18 *  | 1381.039 * | 346.422   | 2.097  | 0.541 |
| -47.5 | 3793.48 *  | 3802.652 * | 3810.429 * | 3804.509 * | 3785.407 * | 3750.061 * | 3697.615 * | 3677.865 * | 3650.464 * | 3608.346 * | 3537.536 * | 3434.834 * | 3355.646 * | 3232.906 * | 3056.637 * | 2855.273 * | 2587.804 * | 2248.057 * | 1734.136 * | 1006.287 * | 249.564   | 1.842  | 0.541 |
| -55   | 1801.65 *  | 1818.315 * | 1851.626 * | 1842.721 * | 1834.343 * | 1811.032 * | 1772.36 *  | 1744.524 * | 1748.606 * | 1743.57    |            |            |            |            |            |            |            |            |            |            |           |        |       |

## 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   |        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |        |     |    |    |       |
| 85   | 0      | 0       | 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       | 0.1     | 0.1     | 0      | 0   | 0  | 0  | 0     |
| 65   | 0.2    | 0.4     | 0.4     | 0.4     | 0.4     | 0.4     | 0.4     | 0.4     | 0.4     | 0.4     | 0.5     | 0.7     | 0.6     | 0.7     | 0.8     | 0.9     | 0.8     | 0.8     | 1.1     | 0.9    | 0.4 | 0  | 0  | 0     |
| 55   | 3.05 * | 6.17 *  | 6.20 *  | 6.17 *  | 6.11 *  | 6.01 *  | 5.91 *  | 5.86 *  | 5.84 *  | 7.16 *  | 8.18 *  | 7.66 *  | 8.50 *  | 9.28 *  | 9.4     | 8.7     | 7.2     | 8.1     | 6       | 1.9    | 0.2 | 0  | 0  | 0     |
| 47.5 | 6.00 * | 12.09 * | 12.12 * | 12.06 * | 11.93 * | 11.74 * | 11.53 * | 11.42 * | 11.35 * | 13.95 * | 15.99 * | 15.00 * | 16.59 * | 17.91 * | 18.04 * | 17.07 * | 13.98 * | 15.37 * | 11.20 * | 3.4    | 0.4 | 0  | 0  | 0     |
| 42.5 | 5.80 * | 11.64 * | 11.64 * | 11.58 * | 11.46 * | 11.31 * | 11.17 * | 11.04 * | 10.87 * | 13.29 * | 15.39 * | 14.77 * | 16.39 * | 17.26 * | 17.50 * | 17.13 * | 14.11 * | 15.57 * | 11.60 * | 3.7    | 0.4 | 0  | 0  | 0     |
| 37.5 | 7.47 * | 14.97 * | 14.94 * | 14.86 * | 14.70 * | 14.53 * | 14.36 * | 14.12 * | 13.81 * | 16.82 * | 19.52 * | 18.72 * | 20.74 * | 21.84 * | 21.99 * | 21.57 * | 18.04 * | 19.96 * | 15.00 * | 4.92 * | 0.6 | 0  | 0  | 0     |
| 33   | 8.25 * | 16.52 * | 16.48 * | 16.38 * | 16.22 * | 16.03 * | 15.78 * | 15.48 * | 15.16 * | 18.55 * | 21.53 * | 20.42 * | 22.48 * | 23.96 * | 24.23 * | 23.37 * | 19.46 * | 21.53 * | 16.19 * | 5.44 * | 0.6 | 0  | 0  | 0     |
| 29   | 8.38 * | 16.76 * | 16.70 * | 16.59 * | 16.43 * | 16.20 * | 15.95 * | 15.72 * | 15.40 * | 18.70 * | 21.71 * | 20.86 * | 22.84 * | 24.03 * | 24.66 * | 23.83 * | 19.49 * | 21.57 * | 16.35 * | 5.54 * | 0.7 | 0  | 0  | 0     |
| 25.5 | 7.96 * | 15.90 * | 15.84 * | 15.75 * | 15.59 * | 15.36 * | 15.14 * | 14.93 * | 14.62 * | 17.71 * | 20.53 * | 19.78 * | 21.66 * | 22.67 * | 23.26 * | 22.57 * | 18.42 * | 20.51 * | 15.65 * | 5.30 * | 0.7 | 0  | 0  | 0     |
| 22.5 | 7.02 * | 14.02 * | 13.97 * | 13.90 * | 13.77 * | 13.60 * | 13.41 * | 13.19 * | 12.93 * | 15.76 * | 18.26 * | 17.47 * | 19.23 * | 20.30 * | 20.72 * | 20.11 * | 16.54 * | 18.62 * | 14.28 * | 4.84 * | 0.6 | 0  | 0  | 0     |
| 19.5 | 7.08 * | 14.15 * | 14.11 * | 14.02 * | 13.90 * | 13.74 * | 13.55 * | 13.33 * | 13.07 * | 15.94 * | 18.49 * | 17.68 * | 19.50 * | 20.70 * | 21.10 * | 20.46 * | 17.02 * | 19.32 * | 14.85 * | 5.08 * | 0.7 | 0  | 0  | 0     |
| 17   | 5.93 * | 11.85 * | 11.82 * | 11.75 * | 11.64 * | 11.51 * | 11.35 * | 11.17 * | 10.96 * | 13.36 * | 15.50 * | 14.84 * | 16.38 * | 17.40 * | 17.74 * | 17.22 * | 14.44 * | 16.45 * | 12.66 * | 4.40 * | 0.6 | 0  | 0  | 0     |
| 15   | 4.77 * | 9.52 *  | 9.49 *  | 9.44 *  | 9.36 *  | 9.25 *  | 9.12 *  | 8.97 *  | 8.80 *  | 10.74 * | 12.45 * | 11.93 * | 13.18 * | 14.00 * | 14.27 * | 13.86 * | 11.67 * | 13.33 * | 10.29 * | 3.61 * | 0.5 | 0  | 0  | 0     |
| 13   | 4.78 * | 9.55 *  | 9.53 *  | 9.47 *  | 9.39 *  | 9.28 *  | 9.15 *  | 9.01 *  | 8.84 *  | 10.78 * | 12.50 * | 11.98 * | 13.25 * | 14.07 * | 14.32 * | 13.92 * | 11.75 * | 13.45 * | 10.40 * | 3.68 * | 0.5 | 0  | 0  | 0     |
| 11   | 4.80 * | 9.59 *  | 9.57 *  | 9.51 *  | 9.43 *  | 9.32 *  | 9.19 *  | 9.05 *  | 8.88 *  | 10.82 * | 12.56 * | 12.05 * | 13.33 * | 14.14 * | 14.37 * | 13.99 * | 11.83 * | 13.55 * | 10.49 * | 3.73 * | 0.5 | 0  | 0  | 0     |
| 9    | 4.83 * | 9.66 *  | 9.63 *  | 9.57 *  | 9.49 *  | 9.38 *  | 9.26 *  | 9.11 *  | 8.93 *  | 10.88 * | 12.63 * | 12.12 * | 13.40 * | 14.20 * | 14.44 * | 14.06 * | 11.90 * | 13.62 * | 10.55 * | 3.77 * | 0.5 | 0  | 0  | 0     |
| 7    | 4.87 * | 9.73 *  | 9.70 *  | 9.64 *  | 9.56 *  | 9.45 *  | 9.32 *  | 9.16 *  | 8.98 *  | 10.95 * | 12.71 * | 12.19 * | 13.46 * | 14.27 * | 14.53 * | 14.15 * | 11.96 * | 13.68 * | 10.60 * | 3.81 * | 0.5 | 0  | 0  | 0     |
| 5    | 4.89 * | 9.77 *  | 9.74 *  | 9.68 *  | 9.60 *  | 9.49 *  | 9.36 *  | 9.20 *  | 9.02 *  | 11.00 * | 12.77 * | 12.24 * | 13.52 * | 14.33 * | 14.59 * | 14.21 * | 12.00 * | 13.72 * | 10.63 * | 3.84 * | 0.6 | 0  | 0  | 0     |
| 3    | 4.89 * | 9.79 *  | 9.75 *  | 9.70 *  | 9.61 *  | 9.50 *  | 9.37 *  | 9.22 *  | 9.05 *  | 11.04 * | 12.81 * | 12.27 * | 13.56 * | 14.38 * | 14.64 * | 14.25 * | 12.03 * | 13.74 * | 10.65 * | 3.86 * | 0.6 | 0  | 0  | 0     |
| 1    | 4.90 * | 9.80 *  | 9.77 *  | 9.71 *  | 9.63 *  | 9.52 *  | 9.39 *  | 9.24 *  | 9.07 *  | 11.07 * | 12.83 * | 12.29 * | 13.58 * | 14.41 * | 14.67 * | 14.27 * | 12.04 * | 13.74 * | 10.64 * | 3.87 * | 0.6 | 0  | 0  | 0     |
| 0    | 2.46 * | 4.91 *  | 4.90 *  | 4.87 *  | 4.83 *  | 4.77 *  | 4.70 *  | 4.63 *  | 4.54 *  | 5.54 *  | 6.42 *  | 6.15 *  | 6.79 *  | 7.21 *  | 7.34 *  | 7.14 *  | 6.02 *  | 6.86 *  | 5.31 *  | 1.93 * | 0.3 | 0  | 0  | 0     |
|      | 2.46 * | 4.92 *  | 4.90 *  | 4.87 *  | 4.83 *  | 4.78 *  | 4.71 *  | 4.63 *  | 4.54 *  | 5.54 *  | 6.42 *  | 6.15 *  | 6.79 *  | 7.21 *  | 7.34 *  | 7.14 *  | 6.01 *  | 6.85 *  | 5.30 *  | 1.93 * | 0.3 | 0  | 0  | 0     |

|       |        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |        |      |      |        |
|-------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|------|------|--------|
| -1    | 4.92 * | 9.85 *  | 9.81 *  | 9.75 *  | 9.67 *  | 9.56 *  | 9.42 *  | 9.26 *  | 9.08 *  | 11.07 * | 12.82 * | 12.28 * | 13.56 * | 14.38 * | 14.65 * | 14.24 * | 12.00 * | 13.69 * | 10.62 * | 3.88 * | 0.6  | 0    | 0      |
| -3    | 4.91 * | 9.82 *  | 9.79 *  | 9.73 *  | 9.64 *  | 9.53 *  | 9.39 *  | 9.24 *  | 9.06 *  | 11.04 * | 12.79 * | 12.23 * | 13.51 * | 14.33 * | 14.59 * | 14.17 * | 11.94 * | 13.64 * | 10.61 * | 3.88 * | 0.6  | 0    | 0      |
| -5    | 4.88 * | 9.75 *  | 9.72 *  | 9.66 *  | 9.58 *  | 9.47 *  | 9.34 *  | 9.18 *  | 9.01 *  | 10.99 * | 12.73 * | 12.18 * | 13.44 * | 14.26 * | 14.51 * | 14.09 * | 11.87 * | 13.57 * | 10.57 * | 3.86 * | 0.6  | 0    | 0      |
| -7    | 4.84 * | 9.68 *  | 9.65 *  | 9.59 *  | 9.51 *  | 9.40 *  | 9.26 *  | 9.11 *  | 8.94 *  | 10.90 * | 12.63 * | 12.09 * | 13.35 * | 14.17 * | 14.42 * | 13.99 * | 11.79 * | 13.48 * | 10.52 * | 3.84 * | 0.6  | 0    | 0      |
| -9    | 4.80 * | 9.59 *  | 9.56 *  | 9.50 *  | 9.42 *  | 9.31 *  | 9.18 *  | 9.02 *  | 8.86 *  | 10.80 * | 12.51 * | 11.97 * | 13.23 * | 14.06 * | 14.30 * | 13.87 * | 11.69 * | 13.38 * | 10.46 * | 3.81 * | 0.5  | 0    | 0      |
| -11   | 4.74 * | 9.47 *  | 9.44 *  | 9.38 *  | 9.30 *  | 9.20 *  | 9.06 *  | 8.91 *  | 8.75 *  | 10.68 * | 12.36 * | 11.83 * | 13.09 * | 13.92 * | 14.17 * | 13.75 * | 11.58 * | 13.26 * | 10.38 * | 3.77 * | 0.5  | 0    | 0      |
| -13   | 4.67 * | 9.34 *  | 9.31 *  | 9.25 *  | 9.18 *  | 9.08 *  | 8.95 *  | 8.80 *  | 8.64 *  | 10.55 * | 12.22 * | 11.69 * | 12.94 * | 13.77 * | 14.04 * | 13.62 * | 11.45 * | 13.12 * | 10.28 * | 3.73 * | 0.5  | 0    | 0      |
| -15   | 4.62 * | 9.23 *  | 9.21 *  | 9.15 *  | 9.07 *  | 8.97 *  | 8.85 *  | 8.70 *  | 8.54 *  | 10.43 * | 12.09 * | 11.57 * | 12.79 * | 13.62 * | 13.92 * | 13.51 * | 11.34 * | 12.96 * | 10.17 * | 3.67 * | 0.5  | 0    | 0      |
| -17   | 5.72 * | 11.43 * | 11.39 * | 11.33 * | 11.23 * | 11.10 * | 10.95 * | 10.78 * | 10.57 * | 12.90 * | 14.97 * | 14.34 * | 15.82 * | 16.82 * | 17.22 * | 16.76 * | 14.04 * | 16.00 * | 12.53 * | 4.50 * | 0.6  | 0    | 0      |
| -20   | 6.81 * | 13.61 * | 13.57 * | 13.49 * | 13.37 * | 13.22 * | 13.04 * | 12.83 * | 12.59 * | 15.35 * | 17.81 * | 17.07 * | 18.82 * | 19.96 * | 20.42 * | 19.90 * | 16.68 * | 18.91 * | 14.71 * | 5.25 * | 0.7  | 0    | 0      |
| -23   | 6.77 * | 13.53 * | 13.49 * | 13.42 * | 13.30 * | 13.14 * | 12.96 * | 12.75 * | 12.50 * | 15.24 * | 17.67 * | 16.92 * | 18.66 * | 19.77 * | 20.17 * | 19.63 * | 16.43 * | 18.48 * | 14.28 * | 5.05 * | 0.7  | 0    | 0      |
| -26   | 7.82 * | 15.63 * | 15.58 * | 15.49 * | 15.36 * | 15.18 * | 14.96 * | 14.72 * | 14.44 * | 17.59 * | 20.38 * | 19.50 * | 21.51 * | 22.74 * | 23.10 * | 22.45 * | 18.75 * | 20.83 * | 15.94 * | 5.60 * | 0.7  | 0    | 0      |
| -29   | 8.72 * | 17.42 * | 17.36 * | 17.27 * | 17.13 * | 16.92 * | 16.66 * | 16.39 * | 16.08 * | 19.59 * | 22.63 * | 21.62 * | 23.90 * | 25.19 * | 25.34 * | 24.64 * | 20.58 * | 22.49 * | 17.03 * | 5.96 * | 0.7  | 0    | 0      |
| -33   | 9.11 * | 18.21 * | 18.16 * | 18.06 * | 17.89 * | 17.65 * | 17.39 * | 17.11 * | 16.79 * | 20.44 * | 23.56 * | 22.46 * | 24.85 * | 26.19 * | 26.15 * | 25.34 * | 21.26 * | 23.05 * | 17.25 * | 5.99 * | 0.7  | 0    | 0      |
| -38   | 8.53 * | 17.08 * | 17.05 * | 16.94 * | 16.75 * | 16.52 * | 16.33 * | 16.10 * | 15.79 * | 19.21 * | 22.16 * | 21.18 * | 23.45 * | 24.70 * | 24.75 * | 24.00 * | 20.14 * | 21.90 * | 16.22 * | 5.51 * | 0.6  | 0    | 0      |
| -43   | 6.65 * | 13.33 * | 13.32 * | 13.23 * | 13.08 * | 12.89 * | 12.74 * | 12.58 * | 12.34 * | 15.01 * | 17.33 * | 16.60 * | 18.34 * | 19.31 * | 19.49 * | 18.91 * | 15.71 * | 17.21 * | 12.74 * | 4.2    | 0.5  | 0    | 0      |
| -48   | 6.41 * | 12.89 * | 12.90 * | 12.82 * | 12.67 * | 12.44 * | 12.22 * | 12.05 * | 11.87 * | 14.48 * | 16.71 * | 15.88 * | 17.49 * | 18.53 * | 18.71 * | 17.91 * | 14.86 * | 16.52 * | 12.35 * | 4.1    | 0.5  | 0    | 0      |
| -55   | 3.02 * | 6.12 *  | 6.15 *  | 6.10 *  | 6.03 *  | 5.90 *  | 5.76 *  | 5.68 *  | 5.64 *  | 6.93 *  | 8.02 *  | 7.56 *  | 8.34 *  | 9.02 *  | 9.2     | 8.7     | 7.5     | 8.7     | 6.9     | 2.5    | 0.3  | 0    | 0      |
| -65   | 0.4    | 0.7     | 0.7     | 0.7     | 0.7     | 0.7     | 0.7     | 0.7     | 0.7     | 0.8     | 1       | 0.9     | 1.1     | 1.3     | 1.4     | 1.3     | 1.4     | 1.9     | 1.7     | 0.8    | 0.1  | 0    | 0      |
| -75   | 0.1    | 0.2     | 0.2     | 0.2     | 0.2     | 0.2     | 0.2     | 0.2     | 0.2     | 0.3     | 0.3     | 0.3     | 0.3     | 0.4     | 0.4     | 0.4     | 0.4     | 0.5     | 0.4     | 0.2    | 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    | 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      |
| Total | 219    | 439     | 438     | 435     | 431     | 426     | 420     | 413     | 405     | 494     | 573     | 547     | 604     | 641     | 651     | 631     | 528     | 594     | 455     | 159    | 20.5 | 0.06 | 9524.2 |

## 4.0 LM-79 Measurement and Test Results

### 4.3 THD and PF Test

|                  |                       |                |      |
|------------------|-----------------------|----------------|------|
| Model No.        | FFLEDL @ 120W / 5000K | Sample ID.     | L1   |
| Temperature (°C) | 25.4                  | Humidity (%RH) | 54.0 |

#### 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

| Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD    |
|---------------|----------------|-------------|-----------|--------------|--------|
| 119.96        | 60             | 0.992       | 118.3     | 0.994        | 5.97%  |
| 276.96        | 60             | 0.484       | 116.6     | 0.869        | 16.15% |



## 5.0 Equipment Information

| Test Equipment |   |                       |                      |
|----------------|---|-----------------------|----------------------|
| Equipment ID   | Equipment Name  | Last Calibration Date | Calibration Due Date |
| DLF107         | Integrating Sphere System   | 2020/12/26            | 2021/12/25           |
| DLF108         | Auxiliary Lamp  | 2020/12/26            | 2021/12/25           |
| DLF122         | Measurement Standard Lamp<br>Standard Lamp Type: 220 V, 0.4720 A,<br>Tungsten, Omni-derectional | 2020/12/26            | 2021/12/25           |
| DLF116         | AC Power Source   | 2020/12/26            | 2021/12/25           |
| DLF113         | Power Meter   | 2020/12/26            | 2021/12/25           |
| DLF112         | Temperature Recorder  | 2020/12/26            | 2021/12/25           |
| DLF114         | Temperature & Humidity Datalogger   | 2020/12/26            | 2021/12/25           |
| DLF101         | Goniophotometer   | 2020/12/26            | 2021/12/25           |
| DLF125         | Standard Lamp<br>Standard Lamp Type: 76.58 V, 6.7875 A,<br>Tungsten, Omni-derectional           | 2020/12/26            | 2021/12/25           |
| DLF104         | AC Power Source   | 2020/12/26            | 2021/12/25           |
| DLF507         | DC Power Source   | 2020/12/26            | 2021/12/25           |
| DLF102         | Power Meter   | 2020/12/26            | 2021/12/25           |
| DLF111         | Temperature & Humidity Datalogger   | 2020/12/26            | 2021/12/25           |
| DLF119         | Power Meter   | 2020/12/26            | 2021/12/25           |
| DLF031         | Temperature data logger   | 2020/12/26            | 2021/12/25           |
| DLF022         | Digital power meter   | 2020/12/26            | 2021/12/25           |
| DLF003         | Temperature & Humidity Datalogger   | 2020/12/26            | 2021/12/25           |

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