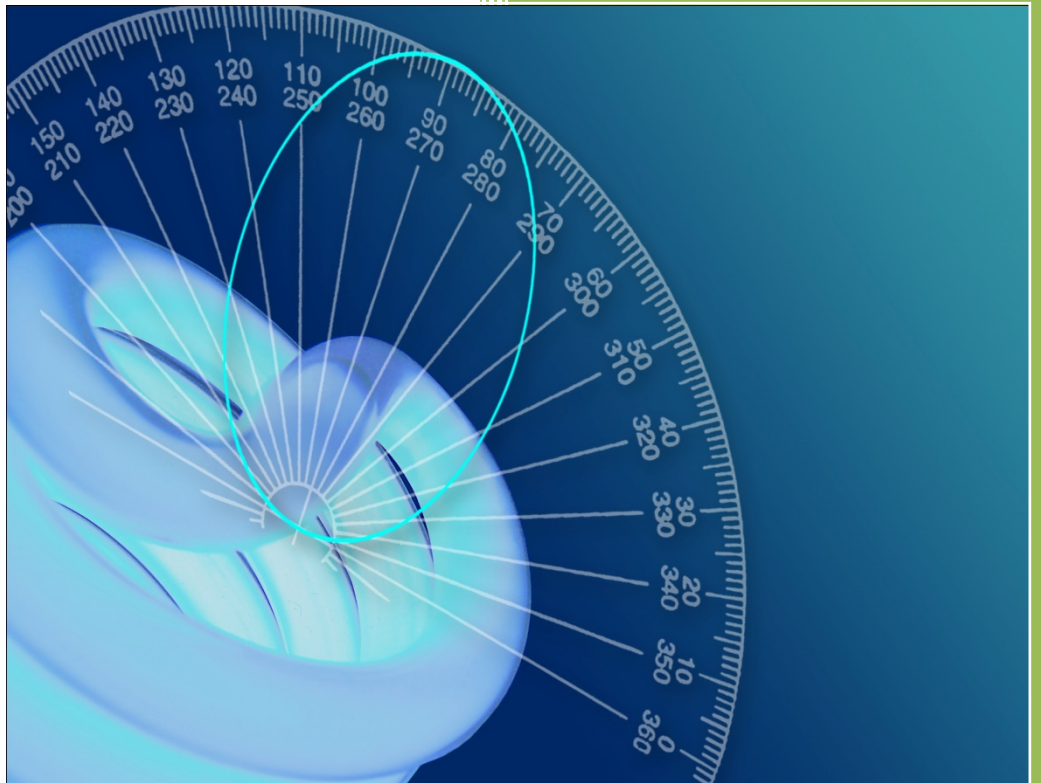


# Photometric Test Report



Photometric and Optical Testing  
Services  
Cheltenham Film and Photographic  
Studios  
Hatherley Lane  
Cheltenham  
Gloucestershire  
GL51 6PN  
UK  
Tel: 01242 701300

## Photometric Test Report

|  |                         |                         |
|--|-------------------------|-------------------------|
| Report Number: POTS/DC18014  | Report Date: 16/01/2018 | Prepared By: D CHAMBERS |
| Test Laboratory: Photometric and Optical Testing Services, Cheltenham Film and Photographic Studios, Hatherley Lane, Cheltenham, Gloucestershire, GL51 6PN |                         |                         |
| Company Registration Number: Registered in England & Wales No. OC352911  |                         |                         |
| Registered Address: Harwood House, Park Road, Melton Mowbray, Leicestershire LE13 1TX  |                         |                         |

### Client Details

|  |                                     |
|--|-------------------------------------|
| Company: Lighting Illumination Technology Experience Limited | Email: davehorsfield@lite-ltd.co.uk |
| Address: Unit 2 Farrington Place, Burnley, BB11 5TY          |                                     |

### Test Method(s) Used

|                                    |                                      |
|------------------------------------|--------------------------------------|
| POTS Standard Operating Procedure: | INTEGRATING SPHERE PROCEDURE POTS016 |
| POTS Standard Operating Procedure: | NFMS OPERATION GUIDE                 |
| Standard:                          | LM79 08                              |

### Details of Product Tested

|  |                           |
|--|---------------------------|
| Manufacturer: Lighting Illumination Technology Experience          | Source Type: LED          |
| Model: WHITE 15 DEG OPTIC  | Luminaire Type: SPOTLIGHT |
| Power Supply Used: Kikusui PCR1000M Voltage Stabiliser S/N SM01191 |                           |

### Integrating Sphere Test

|  |  |
|--|--|
| Date of Test: 12/01/2018   | Ambient Temperature: 25°C                                    |
| Measurement Filename: WHITE 15 DEG OPTIC   |  |
| Instrument Used: Labsphere model CSLMS HALOGEN 4060 integrating sphere spectroradiometer |  |
| Integrating Sphere Size: 1m  | Measurement Geometry ( $2\pi / 4\pi$ ): $2\pi$               |
| Sample Orientation: Facing Downwards   | Auxiliary Correction Applied: YES                            |
| Comments:  |  |
|  |  |
| Date of Last Calibration (Operating Hours): 09-01-2018 (05:32)                           | Spectral Flux Standard Lamp Used: SCL-1400                   |
| Standard Lamp Serial Number: K75   | Traceable: to NIST standards                                 |
| Calibration Certificate Number: DM-02008-001   | Calibration Certificate Date: 19 <sup>th</sup> February 2010 |
| Calibration Lamp Uncertainty: $\pm 0.67\%$ ( $k=2$ )                                     |  |
| <b>Results</b>   |  |
| Flux (lumens): 248   |  |
| CIE 1931 Chromaticity Cx: 0.3799   | CIE 1931 Chromaticity Cy: 0.3748                             |
| CRI (%): 77.50   | CCT (K): 3997  |

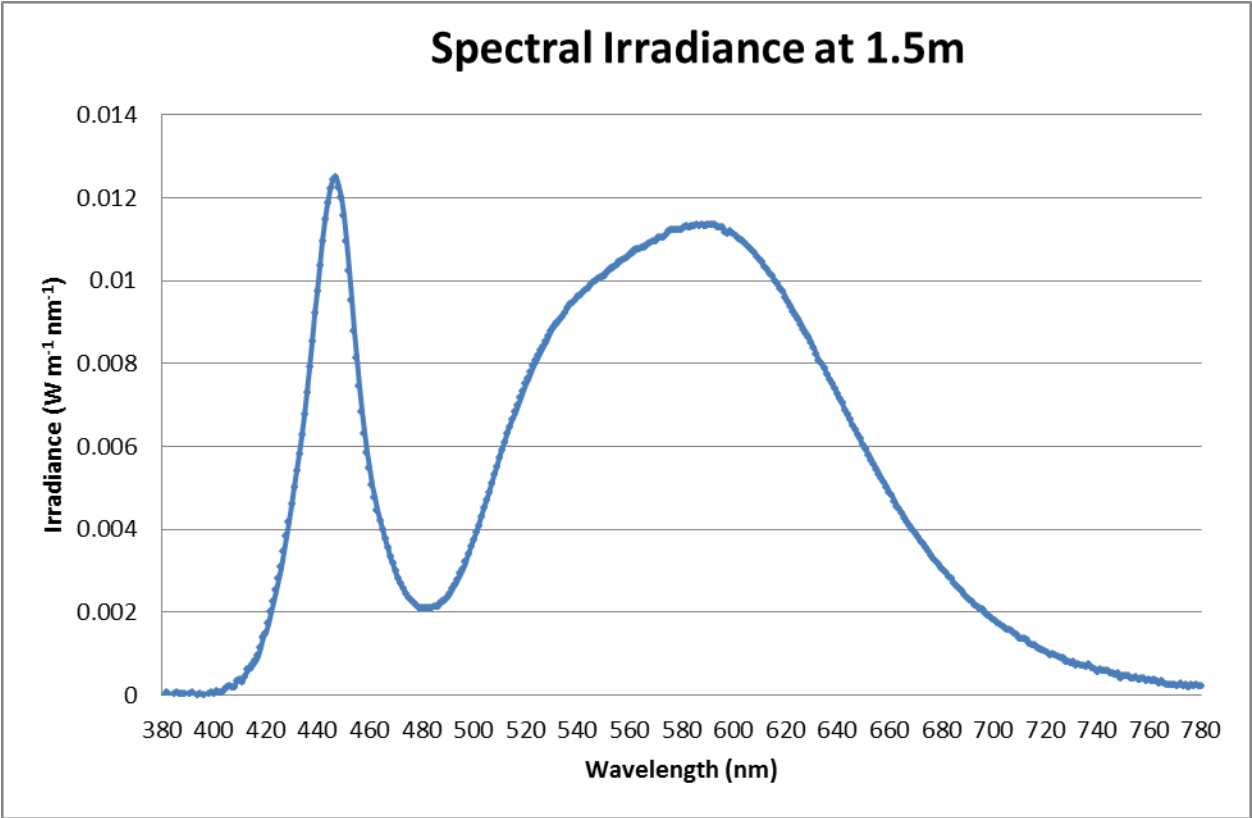


Figure 1: Spectral Irradiance

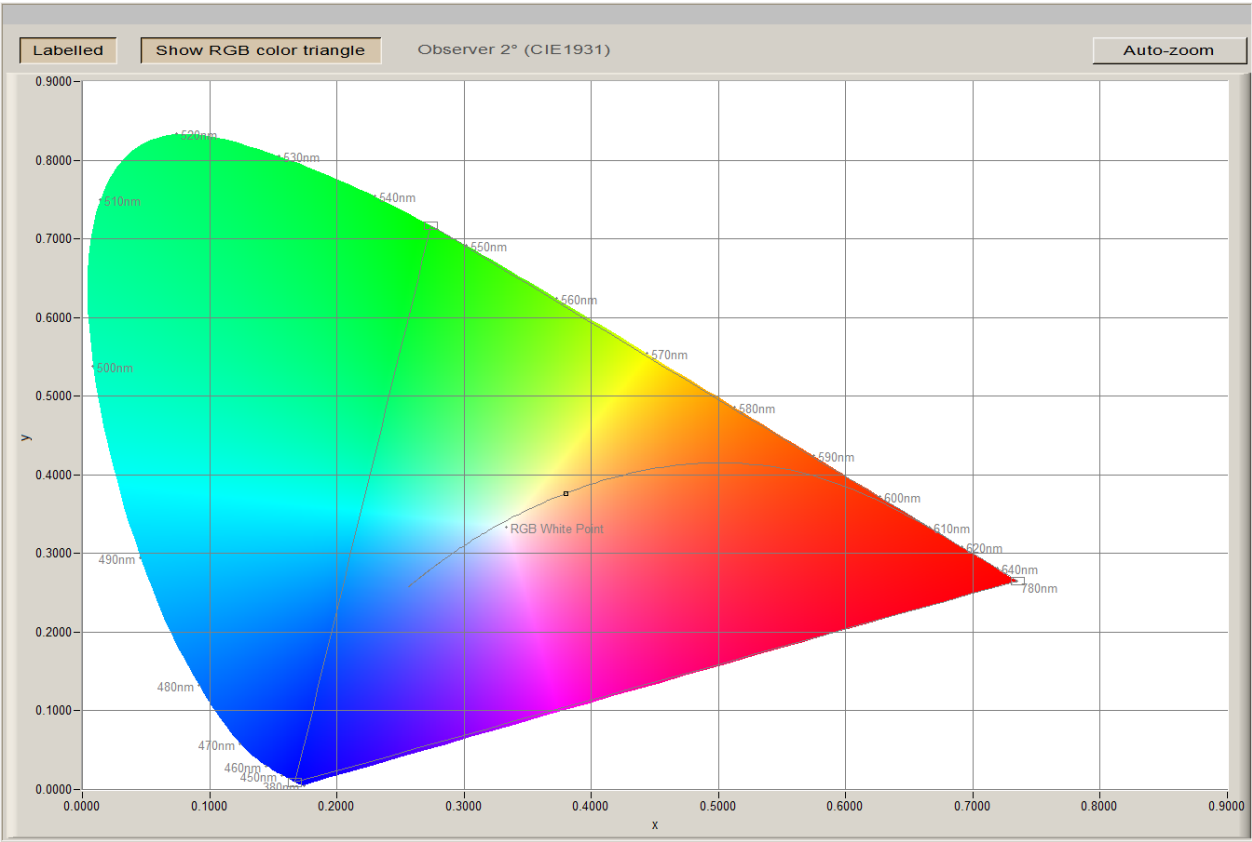


Figure 2: CIE 1931 diagram.

| Goniophotometer Test  |  |   |
|---|--|---|
| Date of Test: 04/01/2018  |  | Ambient Temperature: 25°C                   |
| Measurement Filename: WHITE 15 DEG OPTIC  |  |   |
| Instrument Used: Radiant Imaging NFMS0800 Goniometer with ProMetric PM-1200N-1 Imaging Photometer             |  |   |
| Photometer Working Distance: 1.5m   |  | Measurement Geometry: Near-Field            |
| Comments: Power supply from ballast into LEDs given as 4.7W, and this figure used to calculate lamp efficacy. |  |   |
| Reference Photometer Used: Specbos1211  |  | Reference Photometer Serial Number: 2014754 |
| Traceable: to NIST standards  |  |   |
| Calibration Certificate Date: 02 November 2017  |  | Sample Stabilisation Time (minutes): 45     |
| Reference Photometer Calibration Uncertainty: $\pm 2.4\%$ ( $k=2$ , 20-200 lux, CIE illuminant A source)      |  |   |
| Scan Set Up   |  |   |
| Direction   | Range                                      | Increment                                   |
| Inclination Zone 1  | 0-40°                                      | 2°  |
| Inclination Zone 2  | 45-90°                                     | 5°  |
| Azimuth   | 0-360°                                     | 10°   |
| Results   |  |   |
| Integrated Luminous Flux (lumens):248   | Peak Intensity (3° Spot, candelas): 1583.9 | Efficacy (lumens/Watt): 52.8                |
| Beam Angle (50% of max intensity C0-180, degrees): 19.7   |  |   |
| Photometric Filename (IES LM-63-2002): WHITE 15 DEG OPTIC   |  |   |
| IES File – Absolute or Relative Format? Absolute  |  |   |
| Photometric Filename (EULUMDAT): WHITE 15 DEG OPTIC   |  |   |
| EULUMDAT File – Absolute or Relative Format? Absolute   |  |   |

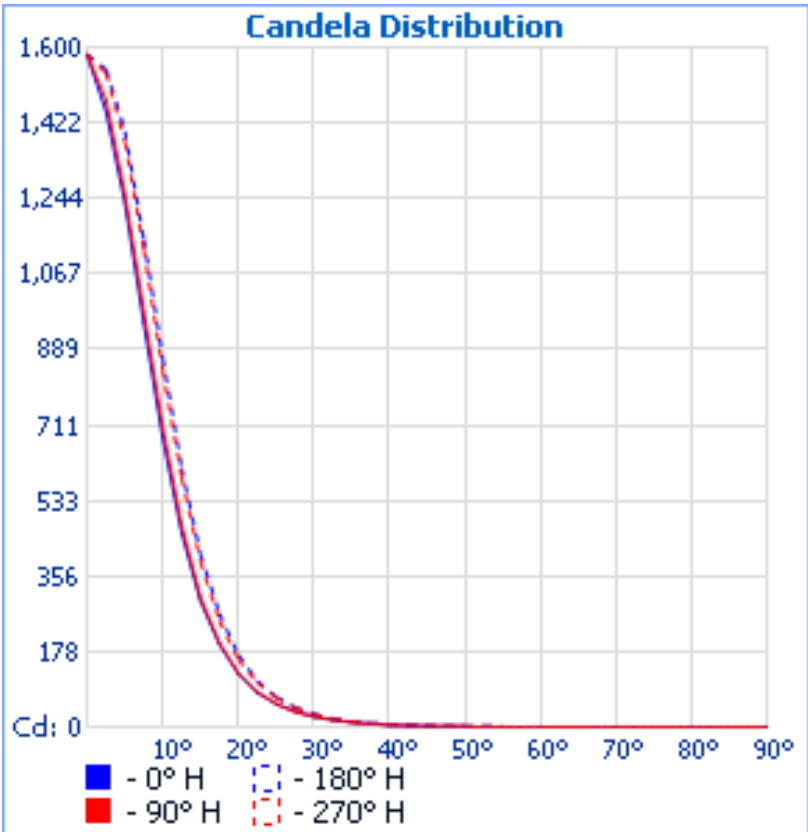


Figure 3: Far-Field Luminous Intensity (C0-180, Cartesian Coordinates)

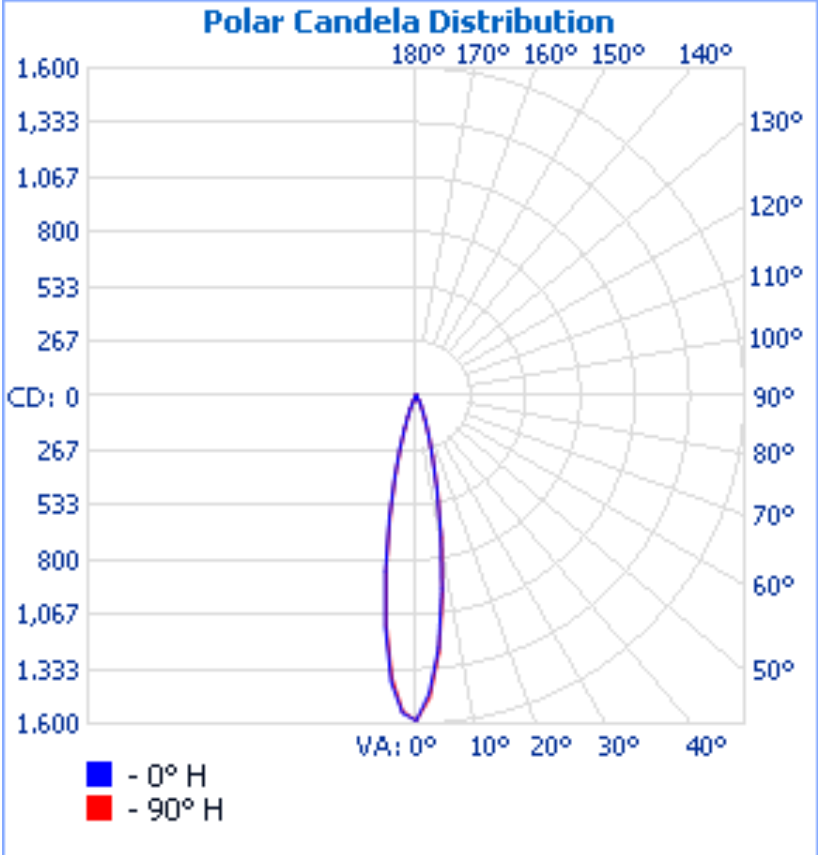


Figure 4: Far-Field Luminous Intensity (C0-180, C90-270, Polar Coordinates)

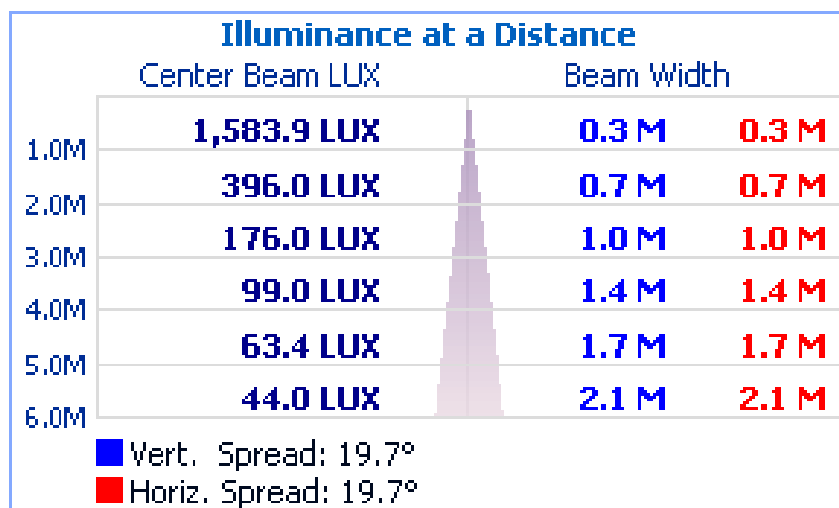


Figure 5. Cone diagram for mounting height of 6 metres.

|                |     |                   |       |       |       |       |                      |       |       |       |       |
|----------------|-----|-------------------|-------|-------|-------|-------|----------------------|-------|-------|-------|-------|
| Reflectance of |     | 0.7               | 0.7   | 0.5   | 0.5   | 0.3   | 0.7                  | 0.7   | 0.5   | 0.5   | 0.3   |
| Ceiling        |     |                   |       |       |       |       |                      |       |       |       |       |
| Wall           |     | 0.5               | 0.3   | 0.5   | 0.3   | 0.3   | 0.5                  | 0.3   | 0.5   | 0.3   | 0.3   |
| Floor Cavity   |     | 0.2               | 0.2   | 0.2   | 0.2   | 0.2   | 0.2                  | 0.2   | 0.2   | 0.2   | 0.2   |
| Room dimension |     | View endwise (C0) |       |       |       |       | View crosswise (C90) |       |       |       |       |
| x              | y   |                   |       |       |       |       |                      |       |       |       |       |
| 2H             | 2H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 3H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 4H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 6H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 8H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 12H | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
| 4H             | 2H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 3H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 4H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 6H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 8H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 12H | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
| 8H             | 4H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 6H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 8H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 12H | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
| 12H            | 4H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 6H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |
|                | 8H  | <10.0             | <10.0 | <10.0 | <10.0 | <10.0 | <10.0                | <10.0 | <10.0 | <10.0 | <10.0 |

Distance between luminaires: 0.25

Due to missing symmetry characteristics the values apply only to the indicated line of sight.

Table 1. UGR values

[illegible]

|             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <b>77.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>80</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>82.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>85</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>87.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>90</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 2a. Luminous intensity values, azimuth 0-180°

|             | <b>190</b> | <b>200</b> | <b>210</b> | <b>220</b> | <b>230</b> | <b>240</b> | <b>250</b> | <b>260</b> | <b>270</b> | <b>280</b> | <b>290</b> | <b>300</b> | <b>310</b> | <b>320</b> | <b>330</b> | <b>340</b> | <b>350</b> |
|-------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>0</b>    | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       | 1584       |
| <b>2.5</b>  | 1563       | 1560       | 1560       | 1561       | 1559       | 1554       | 1550       | 1545       | 1540       | 1531       | 1518       | 1505       | 1497       | 1487       | 1475       | 1467       | 1473       |
| <b>5</b>    | 1415       | 1410       | 1416       | 1413       | 1411       | 1408       | 1400       | 1390       | 1378       | 1359       | 1342       | 1324       | 1302       | 1282       | 1269       | 1250       | 1251       |
| <b>7.5</b>  | 1164       | 1168       | 1182       | 1179       | 1173       | 1165       | 1155       | 1138       | 1125       | 1103       | 1088       | 1063       | 1040       | 1021       | 1005       | 978        | 967        |
| <b>10</b>   | 872        | 892        | 903        | 898        | 892        | 882        | 863        | 852        | 841        | 816        | 794        | 781        | 763        | 747        | 735        | 714        | 688        |
| <b>12.5</b> | 622        | 626        | 619        | 630        | 622        | 617        | 613        | 593        | 588        | 564        | 555        | 535        | 518        | 508        | 485        | 481        | 471        |
| <b>15</b>   | 410        | 419        | 417        | 416        | 415        | 415        | 409        | 391        | 390        | 370        | 366        | 355        | 342        | 331        | 320        | 314        | 302        |
| <b>17.5</b> | 274        | 271        | 274        | 268        | 272        | 268        | 265        | 262        | 251        | 248        | 237        | 228        | 223        | 212        | 210        | 202        | 201        |
| <b>20</b>   | 174        | 172        | 174        | 174        | 172        | 173        | 173        | 167        | 160        | 158        | 155        | 148        | 141        | 138        | 135        | 130        | 130        |
| <b>22.5</b> | 112        | 111        | 111        | 112        | 111        | 111        | 111        | 108        | 106        | 103        | 100        | 96         | 92         | 90         | 87         | 86         | 86         |
| <b>25</b>   | 72         | 73         | 73         | 73         | 73         | 72         | 72         | 71         | 70         | 67         | 65         | 63         | 62         | 60         | 59         | 58         | 57         |
| <b>27.5</b> | 48         | 47         | 49         | 47         | 48         | 48         | 47         | 47         | 46         | 45         | 43         | 42         | 41         | 40         | 40         | 38         | 38         |
| <b>30</b>   | 32         | 32         | 31         | 32         | 32         | 32         | 32         | 31         | 31         | 30         | 29         | 28         | 28         | 27         | 26         | 26         | 26         |
| <b>32.5</b> | 21         | 21         | 22         | 21         | 21         | 21         | 21         | 21         | 21         | 20         | 20         | 19         | 19         | 19         | 18         | 18         | 18         |
| <b>35</b>   | 14         | 14         | 14         | 14         | 15         | 15         | 14         | 14         | 14         | 14         | 13         | 13         | 13         | 13         | 12         | 12         | 12         |
| <b>37.5</b> | 10         | 10         | 10         | 10         | 10         | 10         | 10         | 10         | 10         | 10         | 9          | 9          | 9          | 8          | 8          | 9          | 8          |
| <b>40</b>   | 6          | 7          | 7          | 7          | 7          | 7          | 7          | 7          | 7          | 7          | 6          | 6          | 6          | 6          | 6          | 6          | 6          |
| <b>42.5</b> | 4          | 4          | 5          | 4          | 5          | 5          | 5          | 5          | 5          | 5          | 4          | 4          | 4          | 4          | 4          | 4          | 4          |
| <b>45</b>   | 3          | 3          | 3          | 3          | 3          | 3          | 4          | 4          | 4          | 3          | 3          | 3          | 3          | 3          | 3          | 3          | 3          |
| <b>47.5</b> | 3          | 3          | 2          | 2          | 2          | 3          | 3          | 3          | 3          | 3          | 3          | 2          | 2          | 2          | 3          | 3          | 3          |



|             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <b>50</b>   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| <b>52.5</b> | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| <b>55</b>   | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| <b>57.5</b> | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| <b>60</b>   | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| <b>62.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>65</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>67.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>70</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>72.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>75</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>77.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>80</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>82.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>85</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>87.5</b> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <b>90</b>   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 2b. Luminous intensity values, azimuth 190-350°

| Zone  | Lumens | % Total |
|-------|--------|---------|
| 0-5   | 34.1   | 13.50%  |
| 05-10 | 72.5   | 28.80%  |
| 10-15 | 63     | 25.00%  |
| 15-20 | 38.3   | 15.20%  |
| 20-25 | 20.6   | 8.20%   |
| 25-30 | 10.9   | 4.30%   |
| 30-35 | 5.8    | 2.30%   |
| 35-40 | 3      | 1.20%   |
| 40-45 | 1.6    | 0.60%   |
| 45-50 | 1      | 0.40%   |
| 50-55 | 0.7    | 0.30%   |
| 55-60 | 0.4    | 0.20%   |
| 60-65 | 0.1    | 0.00%   |
| 65-70 | 0      | 0.00%   |
| 70-75 | 0      | 0.00%   |
| 75-80 | 0      | 0.00%   |
| 80-85 | 0      | 0.00%   |
| 85-90 | 0      | 0.00%   |

Table 3. Zonal Flux Table

| Effective Floor Cavity Reflectance: 20% |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| RCC %:                                  | 80   |      |      |      | 70   |      |      |      | 50   |      |      | 30   |      |      | 10   |      |      | 0    |
| RW %:                                   | 70   | 50   | 30   | 0    | 70   | 50   | 30   | 0    | 50   | 30   | 20   | 50   | 30   | 20   | 50   | 30   | 20   | 0    |
| RCR: 0                                  | 1.19 | 1.19 | 1.19 | 1.19 | 1.16 | 1.16 | 1.16 | 1    | 1.11 | 1.11 | 1.11 | 1.06 | 1.06 | 1.06 | 1.02 | 1.02 | 1.02 | 1    |
| 1                                       | 1.15 | 1.13 | 1.11 | 1.1  | 1.13 | 1.11 | 1.09 | 0.97 | 1.07 | 1.06 | 1.05 | 1.03 | 1.02 | 1.02 | 1    | 0.99 | 0.99 | 0.97 |
| 2                                       | 1.12 | 1.08 | 1.05 | 1.03 | 1.1  | 1.07 | 1.04 | 0.95 | 1.03 | 1.01 | 1    | 1.01 | 0.99 | 0.97 | 0.98 | 0.97 | 0.95 | 0.94 |
| 3                                       | 1.08 | 1.04 | 1    | 0.98 | 1.07 | 1.03 | 0.99 | 0.92 | 1    | 0.98 | 0.95 | 0.98 | 0.96 | 0.94 | 0.96 | 0.94 | 0.93 | 0.91 |
| 4                                       | 1.05 | 1    | 0.96 | 0.93 | 1.04 | 0.99 | 0.96 | 0.89 | 0.97 | 0.94 | 0.92 | 0.95 | 0.93 | 0.91 | 0.94 | 0.92 | 0.9  | 0.89 |
| 5                                       | 1.02 | 0.97 | 0.93 | 0.9  | 1.01 | 0.96 | 0.92 | 0.87 | 0.94 | 0.91 | 0.89 | 0.93 | 0.9  | 0.88 | 0.91 | 0.89 | 0.87 | 0.86 |
| 6                                       | 1    | 0.94 | 0.9  | 0.87 | 0.98 | 0.93 | 0.89 | 0.85 | 0.92 | 0.88 | 0.86 | 0.9  | 0.88 | 0.86 | 0.89 | 0.87 | 0.85 | 0.84 |
| 7                                       | 0.97 | 0.91 | 0.87 | 0.84 | 0.96 | 0.9  | 0.87 | 0.83 | 0.89 | 0.86 | 0.84 | 0.88 | 0.85 | 0.83 | 0.87 | 0.85 | 0.83 | 0.82 |
| 8                                       | 0.95 | 0.88 | 0.85 | 0.82 | 0.94 | 0.88 | 0.84 | 0.81 | 0.87 | 0.84 | 0.81 | 0.86 | 0.83 | 0.81 | 0.85 | 0.83 | 0.81 | 0.8  |
| 9                                       | 0.92 | 0.86 | 0.82 | 0.8  | 0.92 | 0.86 | 0.82 | 0.79 | 0.85 | 0.82 | 0.79 | 0.84 | 0.81 | 0.79 | 0.84 | 0.81 | 0.79 | 0.78 |
| 10                                      | 0.9  | 0.84 | 0.8  | 0.78 | 0.9  | 0.84 | 0.8  | 0.77 | 0.83 | 0.8  | 0.77 | 0.82 | 0.79 | 0.77 | 0.82 | 0.79 | 0.77 | 0.76 |

Table 4. Utilisation Factor Table

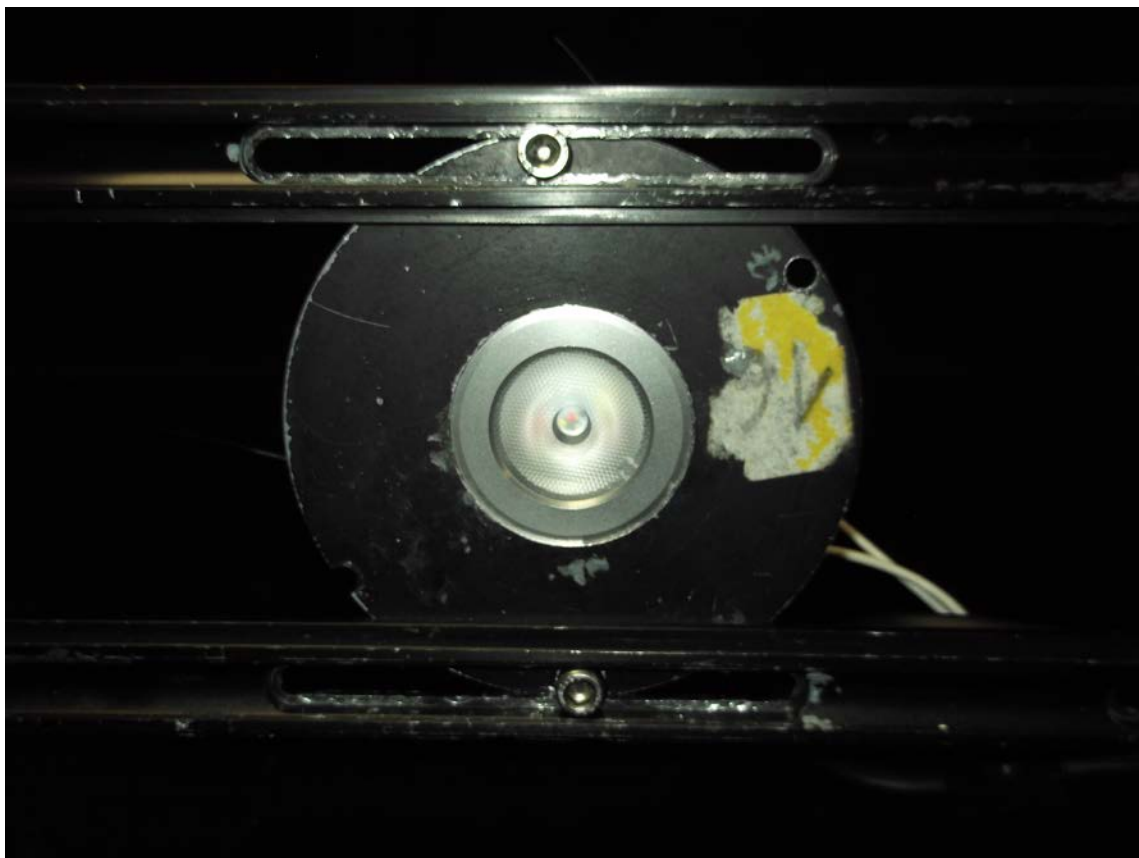


Photo 1: Luminaire on goniometer mount

Signature:

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Print Name:

D CHAMBERS

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Date:

16/01/2018

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Technical Manager

*Duly authorised to sign on behalf of:*

Photometric and Optical Testing Services LLP