

Test Report

Report Number: L16009

Date: Feb 12, 2016

Issued by:

Dialight Optics Laboratory
1501 Route 34 South, Farmingdale, NJ 07727

Test of one Vigilant 18K With Glass Lens
Unit manufacturer: Dialight Corporation
Unit model number: HEGMC4Kx-xxx

Issued to:

Dialight Corporation
1501 Route 34 South, Farmingdale, NJ 07727

Tests performed: Photometric characterization and temperature measurement per the described standards.

Dates of test: February 1, 2016 through February 11, 2016

Standards used: All tests are performed in accordance with procedures and guidelines prescribed by the American National Standards Institute (ANSI) or Illuminating Engineering Society of North America (IES):

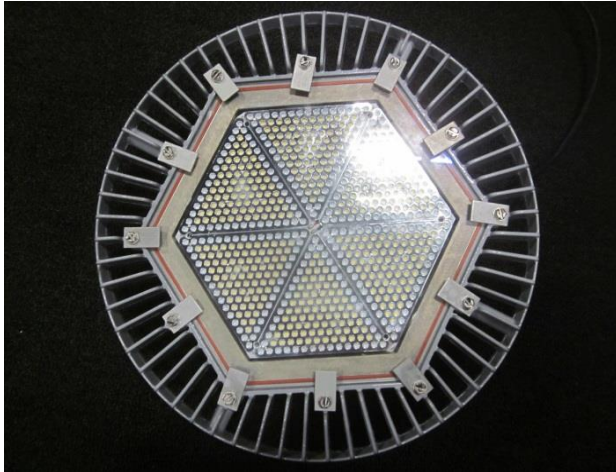
- IES LM-79:2008: Electrical and Photometric Measurements of Solid-State Lighting Products
- ANSI/UL 1598:2008: Underwriters Laboratories Inc. Standard for Safety: Luminaires
- ENERGY STAR Manufacturer's Guide for Qualifying Solid State Lighting Luminaires Version 2.1

Description of sample:

Sample Number: L16009
Manufacturer: Dialight Corporation
Product Name: Vigilant 18K With Glass Lens
Description: Vigilant 18K With Glass Lens
Model Number: HEGMC4Kx-xxx

Report Summary
Sample number L16009
Dialight unit model number HEGMC4Kx-xxx

Photograph(s) of sample:



*Photographs not to scale. For reference only.

Summary of Results:

| | <u>Integrating Sphere</u> | <u>Goniophotometer</u> |
|--------------------|---------------------------|------------------------|
| Luminous Flux: | 18780 (lumens) | 18525 (lumens) |
| Electrical Power: | 144.9 (W) | 144.7 (W) |
| Luminous Efficacy: | 129.6 (lumens/W) | 128 (lumens/W) |

Electrical Measurements:

- Input Power (120VACVAC): 144.9 (W)
- Power Factor (120VACVAC): 0.994
- Current ATHD % (120VACVAC): 8.299
- Input Power (277VACVAC): 142.2 (W)
- Power Factor (277VACVAC): 0.957
- Current ATHD % (277VACVAC): 14.55

Color Measurements:

- Correlated Color Temperature (CCT): 4966
- Color Rendering Index (CRI): 78.4
- Chromaticity Coordinate (x): 0.346
- Chromaticity Coordinate (y): 0.354
- Chromaticity Coordinate (u'): 0.211
- Chromaticity Coordinate (v'): 0.324
- DUV: 0.00057

Temperature Measurements:

- In Situ LED Source Temperature: 51.3 (°C)

Test Results: Integrating Sphere

Results include unit color, flux, efficacy and electrical power for sample number L16009.
Dialight unit model number HEGMC4Kx-xxx

Test Conditions:

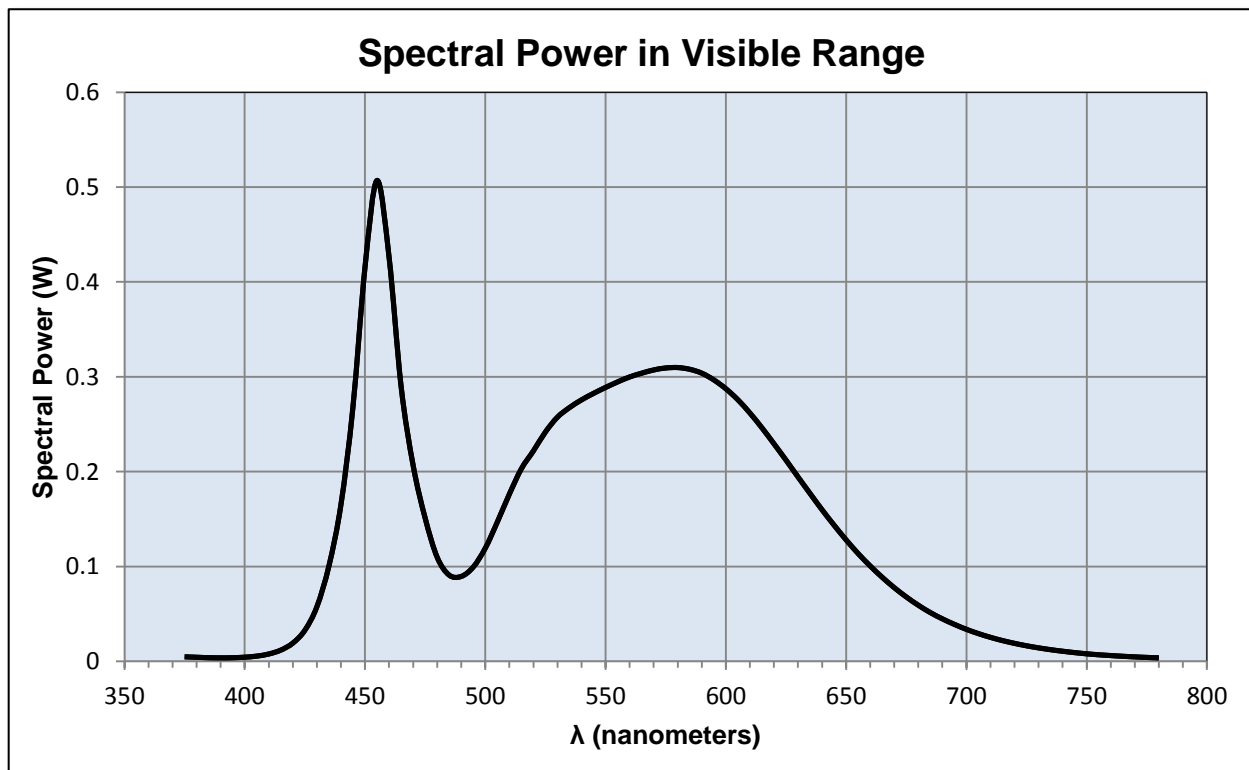
Ambient Temperature: 25 ± 1 (°C)

Electrical Measurements:

Input Voltage: 120 (VAC)
Input Current: 1.213 (A)
Input Power: 144.9 (W)
Input Power Factor: 0.994
Current ATHD: 8.299 (%)

Photometric measurements:

Luminous Flux: 18780 (lumens)
Luminous Efficacy: 129.6 (lumens/W)
Correlated Color Temperature (CCT): 4966 (K)
CRI -Ra: 78.4
CRI -R9: -7.8
DUV: 0.00057
CIE Coordinate (x): 0.346
CIE Coordinate (y): 0.354
CIE Coordinate (u'): 0.211
CIE Coordinate (v'): 0.324



Test Results: Integrating Sphere

Results continued from previous page.

Tabulated Spectral Power in Visible Range:

| $\lambda(\text{nm})$ | (W/nm) | $\lambda(\text{nm})$ | (W/nm) | $\lambda(\text{nm})$ | (W/nm) |
|----------------------|--------|----------------------|--------|----------------------|--------|
| 375 | 0.005 | 515 | 0.203 | 655 | 0.114 |
| 380 | 0.004 | 520 | 0.222 | 660 | 0.101 |
| 385 | 0.004 | 525 | 0.242 | 665 | 0.089 |
| 390 | 0.004 | 530 | 0.257 | 670 | 0.078 |
| 395 | 0.004 | 535 | 0.267 | 675 | 0.068 |
| 400 | 0.004 | 540 | 0.276 | 680 | 0.059 |
| 405 | 0.006 | 545 | 0.282 | 685 | 0.051 |
| 410 | 0.008 | 550 | 0.289 | 690 | 0.045 |
| 415 | 0.012 | 555 | 0.295 | 695 | 0.039 |
| 420 | 0.019 | 560 | 0.3 | 700 | 0.034 |
| 425 | 0.033 | 565 | 0.304 | 705 | 0.029 |
| 430 | 0.058 | 570 | 0.307 | 710 | 0.025 |
| 435 | 0.101 | 575 | 0.309 | 715 | 0.022 |
| 440 | 0.165 | 580 | 0.31 | 720 | 0.019 |
| 445 | 0.268 | 585 | 0.308 | 725 | 0.016 |
| 450 | 0.415 | 590 | 0.304 | 730 | 0.014 |
| 455 | 0.507 | 595 | 0.297 | 735 | 0.012 |
| 460 | 0.426 | 600 | 0.287 | 740 | 0.011 |
| 465 | 0.29 | 605 | 0.276 | 745 | 0.009 |
| 470 | 0.207 | 610 | 0.262 | 750 | 0.008 |
| 475 | 0.151 | 615 | 0.246 | 755 | 0.007 |
| 480 | 0.11 | 620 | 0.229 | 760 | 0.006 |
| 485 | 0.091 | 625 | 0.212 | 765 | 0.005 |
| 490 | 0.09 | 630 | 0.194 | 770 | 0.005 |
| 495 | 0.099 | 635 | 0.177 | 775 | 0.004 |
| 500 | 0.119 | 640 | 0.16 | 780 | 0.004 |
| 505 | 0.147 | 645 | 0.144 | | |
| 510 | 0.176 | 650 | 0.128 | | |

Test Results: Goniometer

Results include unit flux, distribution, efficacy, and electrical power for sample number L16009.
Dialight unit model number HEGMC4Kx-xxx

Electrical Measurements:

Input Voltage: 120 (VAC)
Input current: 1.209 (A)
Input Power: 144.7 (W)
Power Factor: 0.995

Photometric measurements:

Absolute Luminous Flux: 18525 (lumens)
Luminous Efficacy: 128.0 (lumens/W)

Intensity Summary:

| INTENSITY (CANDLEPOWER) SUMMARY | | | | | | |
|--|-------|------|------|------|--------|---------------|
| ANGLE | ALONG | 23 | 45 | 68 | ACROSS | OUTPUT LUMENS |
| 0 | 6981 | 6981 | 6981 | 6981 | 6981 | |
| 5 | 7019 | 7019 | 7019 | 7019 | 7019 | 262 |
| 15 | 7395 | 7395 | 7395 | 7395 | 7395 | 1548 |
| 25 | 8142 | 8142 | 8142 | 8142 | 8142 | 3135 |
| 35 | 7854 | 7854 | 7854 | 7854 | 7854 | 4593 |
| 45 | 5750 | 5750 | 5750 | 5750 | 5750 | 4784 |
| 55 | 2336 | 2336 | 2336 | 2336 | 2336 | 3068 |
| 65 | 543 | 543 | 543 | 543 | 543 | 985 |
| 75 | 21 | 21 | 21 | 21 | 21 | 141 |
| 85 | 3 | 3 | 3 | 3 | 3 | 9 |
| 95 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105 | 0 | 0 | 0 | 0 | 0 | 0 |
| 115 | 0 | 0 | 0 | 0 | 0 | 0 |
| 125 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135 | 0 | 0 | 0 | 0 | 0 | 0 |
| 145 | 0 | 0 | 0 | 0 | 0 | 0 |
| 155 | 0 | 0 | 0 | 0 | 0 | 0 |
| 165 | 0 | 0 | 0 | 0 | 0 | 0 |
| 175 | 0 | 0 | 0 | 0 | 0 | 0 |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 |

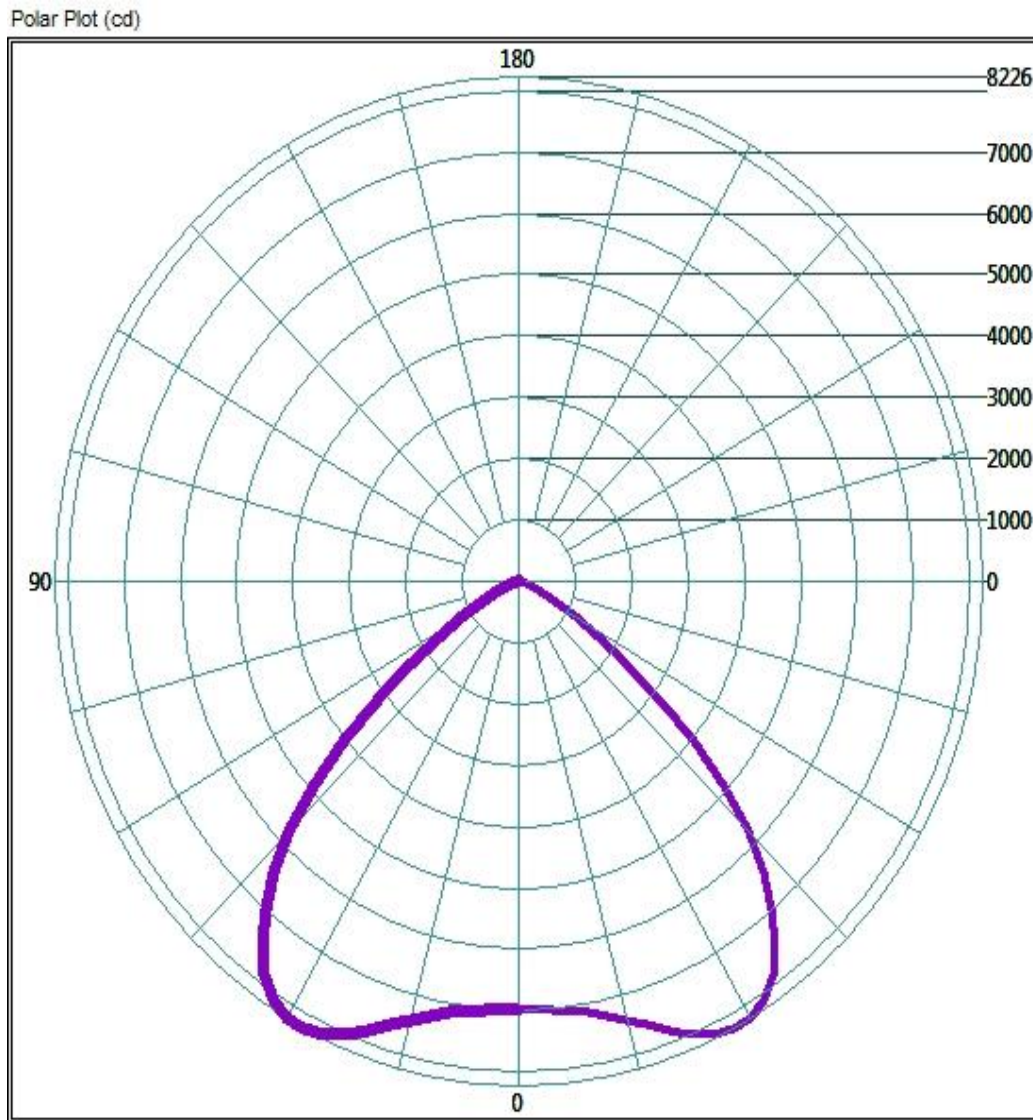
ZONAL LUMEN AND PERCENTAGES

| ZONE | LUMENS | % LUMINAIRE |
|--------|----------|-------------|
| 0-30 | 7110.88 | 38.4% |
| 0-40 | 12015.52 | 64.9% |
| 0-60 | 18050.24 | 97.4% |
| 60-90 | 750.56 | 4.1% |
| 0-90 | 18525.44 | 100.0% |
| 90-180 | 0 | 0.0% |
| 0-180 | 18525.44 | 100.0% |

Test Results: Goniometer

Results continued from previous page.

Polar Plot:

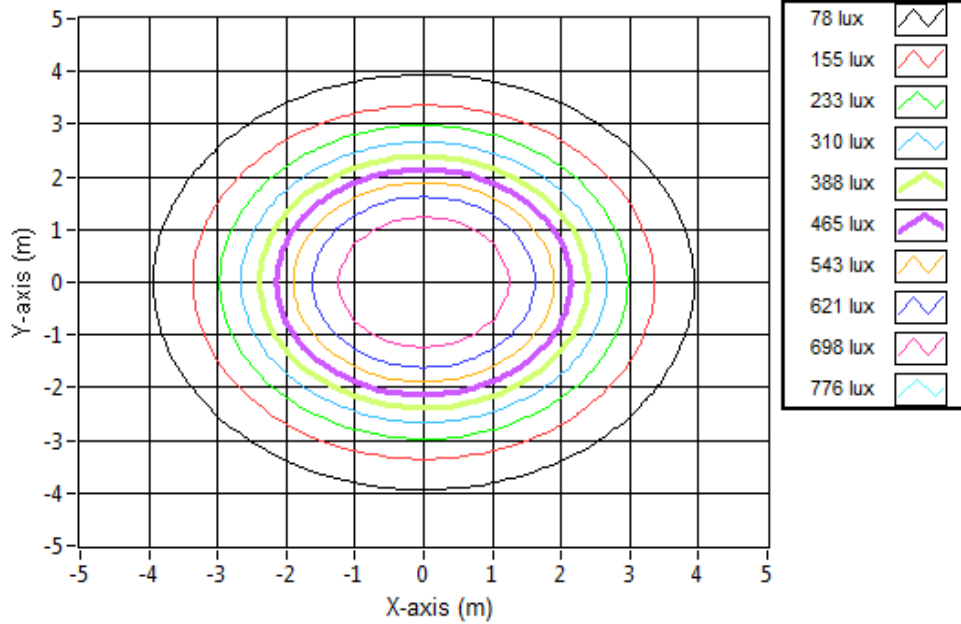


Test Results: Goniometer

Results continued from previous page.

Illuminance Plot:

Illuminance Contour Graph



Illuminance-Cone of Light:

| Mounting Height (m) | Beam Cone Width (m) | Orthogonal Beam Cone Width (m) | Projected Illuminance (lux) |
|---------------------|---------------------|--------------------------------|-----------------------------|
| 3.048 | 7.69 | 7.69 | 751.4 |
| 6.096 | 15.38 | 15.38 | 187.9 |
| 9.144 | 23.07 | 23.07 | 83.5 |
| 12.192 | 30.77 | 30.77 | 47.0 |
| 15.24 | 38.46 | 38.46 | 30.1 |
| 18.288 | 46.15 | 46.15 | 20.9 |
| 21.336 | 53.84 | 53.84 | 15.3 |
| 24.384 | 61.53 | 61.53 | 11.7 |
| 27.432 | 69.22 | 69.22 | 9.3 |
| 30.48 | 76.91 | 76.91 | 7.5 |

Test Results: In Situ Temperature Measurement Test

Results include maximum LED chip temperature for sample number L16009.
Dialight unit model number HEGMC4Kx-xxx

LED identified as Nichia part number NT2W757DT.

LED drive current (as indicated by customer): 100 (mA)

LED Specifications:

LED specifications are taken from LED manufacturer datasheet:

Maximum Forward Current (If): 300 (mA)
Maximum Rated Power Dissipation: 1.05 (W)
Maximum Junction Temp. (Tj): 120 (°C)
Thermal Resistance (Rth): 18 (°C/W)

Derived Specifications:

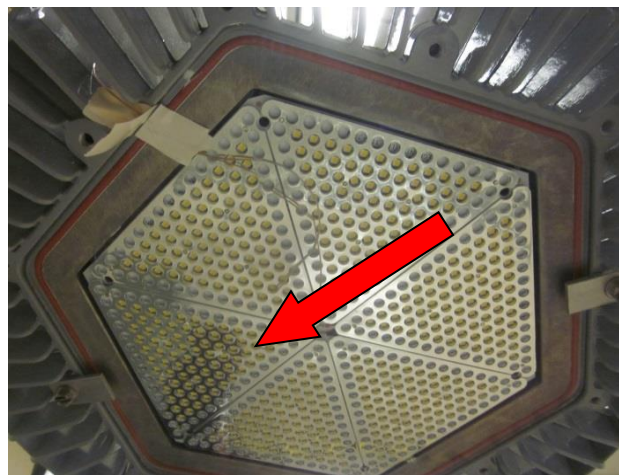
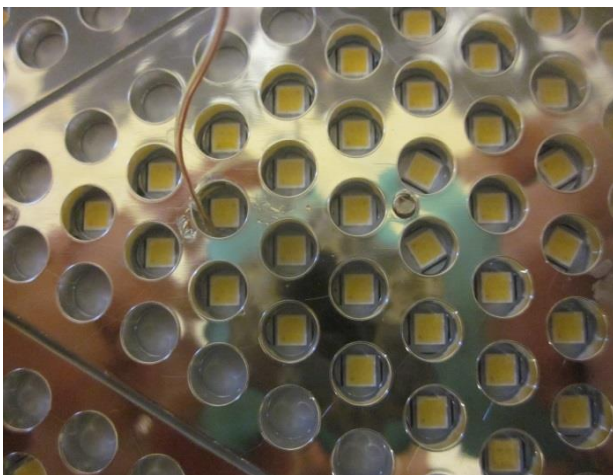
Maximum Power at Indicated Current: 0.35 (W)
Maximum Source Temperature: 113.7 (°C)

Test Conditions:

Temperature Measurement Location: See Photographs Below
Ambient Temperature: $25^{\circ} \pm 1^{\circ}$ (°C)
Ambient temperature at time of measurement: 25.6 (°C)
Relative humidity at time of measurement: 16%

Results:

Measured LED source temperature: 51.3 (°C)



Equipment Used:

| Equipment Name | Model Number |
|--|------------------|
| Omega TC | Dpi8 |
| Fluke 8808A Digit Multimeter | 8808A |
| YOKOGAWA Digital Power Meter | 11/26/3981 |
| LSI High Speed Mirror Goniometer | 6240T |
| Instrument System Spectrometer | CAS140B-151 |
| Instrument System 1.5 Meter Sphere | ISP1500 |
| Volttech Power Analyzer | PM1000+ |
| Delta Elektronika DC Power Supply | SM.300-5 |
| Elgar AC Power Supply | CW1251P |
| Instek AC Power Supply | APS-9501 |
| Sorensen DC Power Supply | XHR150-7 |
| Extech Hygro-Thermometer | 4/16/3120 |
| Extech Hygro-Thermometer | 4/16/3120 |
| Fluke 52II Thermometer | 52II Thermometer |
| Volttech Power Analyzer | PM1000+ |
| BK Precision | 1715A |
| TDK-Lambda | GEN1500W |
| Fluke 8808A Digit Multimeter | 8808A |
| TPI Digital Thermometer 343 | TPI 343 |
| TPI Digital Thermometer 343 | TPI 343 |
| Step-Up Transformer | |
| Omega TC | Dpi8-C24 |
| Agilent True RMS OLED Multimeter | U1273A |
| Adaptive Power Systems AC Power Supply | FC-210 |
| Xitron Power Analyzer | XT2640 |

Additional Notes:

Samples are received and tested in new and undamaged condition, unless otherwise noted. The results shown in this report are representative only of the test samples submitted. This data has been issued to the assignee for further evaluation. This report shall not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. This report shall not be reproduced, except in full, without the express written permission of Dialight Optics Laboratory.

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Optical Engineer
Approved Signatory