



Moving Mirror Goniophotometer Test Report

Standard(s): IES LM-63, IES LM-79, ANSI C82.77

Customer ANDlight, 1951 Franklin St., Vancouver, British Columbia , Canada, V5L 0C7

| General Information | | Lamp Details: CY4417 | | Driver Details: CY2018 | |
|---------------------|------------------|-------------------------|---------------------|----------------------------|------------------|
| DUT Lab ID | SRIS 3021-5 | Seasoning | NA | Type | LED Power Supply |
| Lamp Type | LED/SSL | Test Product | VAL-P-27 | Manufacturer | Meanwell |
| Current Mode | AC | Manufacturer | EPISTAR | Catalog No. | IDLV-45-24 |
| Test Report | S2008246-R1 | Lamp Catalog No. | 2700K | Maximum Power | 45 W |
| Test Date | 24 August 2020 | Drive Current | 18 mA | Input Voltage | 120.00 V |
| Report Date | 23 November 2020 | Nominal Color | 2700 K | Operating Frequency | 60 Hz |
| Ambient | 24.8 °C | Burning Position | Junction Horizontal | Input Power | 22.82 W |

Luminaire Data

| General Information | | Optics | | Aperture (feet) | |
|---------------------|----------|------------------|--------------------------------------|-----------------|--------|
| Manufacturer | AndLight | Reflector | None | X | 0.6875 |
| Name | VALE | Housing | Aluminum Frame | Y | 3.3333 |
| Catalog No. | VAL-P-27 | Lens | Up & Down Prismatic Acrylic Diffuser | Z | 0.5000 |

Stabilization Time: 1 hour

Approved Signatory: Chrisnel Blot

Signature:



Luminaire Test Method

Precise installation and alignment of the luminaire to the rotation axis of the photometer is governed by a servomotor controlled via a microcontroller. A laser is used to validate the luminaire positioning. Before photometric measurements are taken, luminaire is operated long enough to reach stabilization and temperature equilibrium.

All movement commands issued to the photometer axes are mediated by the software to ensure the motion is within the limits of operation. The photometric detector used is a silicon detector corrected to closely match the spectral luminous efficiency photopic curve with a quality index less than 1.5%. Proper shielding is incorporated to the photometric test bench such that only the light from the unit under test is measured.

Luminous intensity measurements are performed at a distance great enough so that the inverse-square law applies. During each measurement the computer records the luminous intensity associated to the corresponding angles of radiation, as well as input electrical operational parameters and temperature measurements. Candela values are reported in IES format as per LM-63.

Equipment, reference standards are traceable to National Institute of Standards and Technology (NIST) and National Research Council of Canada (NRC).





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Electrical Equipment

| Equipment | Manufacturer | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------------|--------------|-----------|---------------|------------------|----------------------|
| Power Supply | iRDC | CIF-3000A | 974998 | N.P.C.R. | N.P.C.R. |
| Input Power Meter | Yokogawa | WT210 | 27E116584 | 2020/07/22 | 2021/09/22 |
| Output Power Meter | N/A | N/A | N/A | N.P.C.R. | N.P.C.R. |

Photometric Equipment

| Equipment | Manufacturer | Model | Serial Number | Calibration Date | Calibration Due Date |
|---------------|--------------|-------------|---------------|------------------|----------------------|
| Photometer | N/A | N/A | N/A | N.P.C.R. | N.P.C.R. |
| Photodetector | INPHORA | IPR-PDET 19 | 110802 | 2019/09/05 | 2020/09/05 |

Environment Equipment

| Equipment | Manufacturer | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------------------|--------------|-------|---------------|------------------|----------------------|
| Temperature Humidity Sensor | Omega | HH311 | 120504176 | 2020/07/16 | 2021/07/16 |

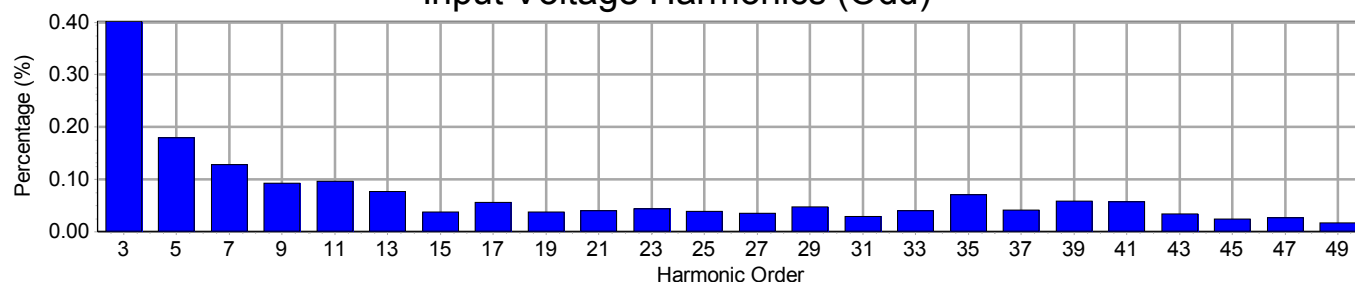


Electrical Measurements

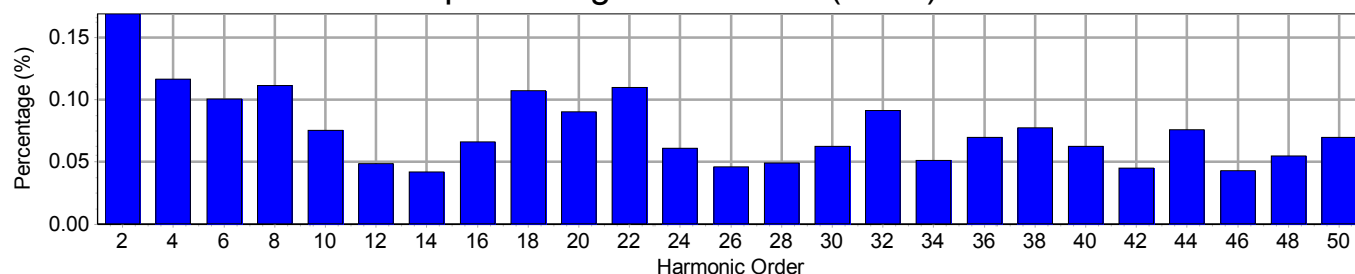
Input

| | | | | | |
|-----------|---------------|----------------|----------|------------------|-----------|
| Frequency | 60 Hz | Active Power | 22.82 W | THDV [ANSI] | 0.64 % |
| Voltage | 120.1 V(rms) | Apparent Power | 23.67 VA | THDA [ANSI] | 8.96 % |
| Current | 0.1971 A(rms) | Power Factor | 0.964 | Max. Harmonic At | 3rd order |

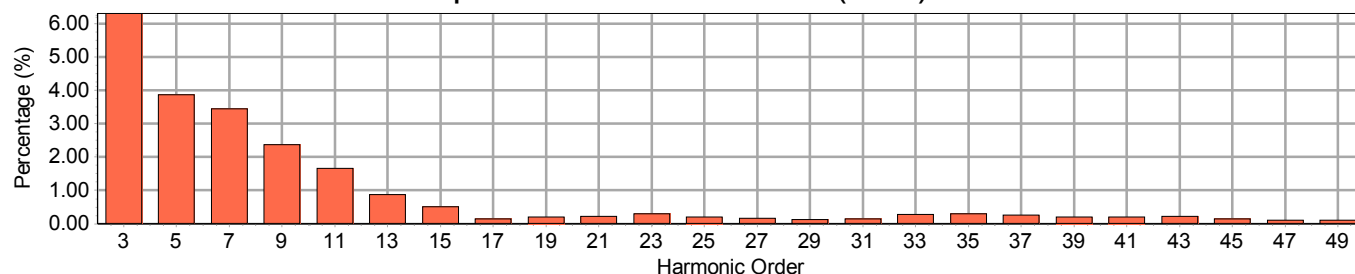
Input Voltage Harmonics (Odd)



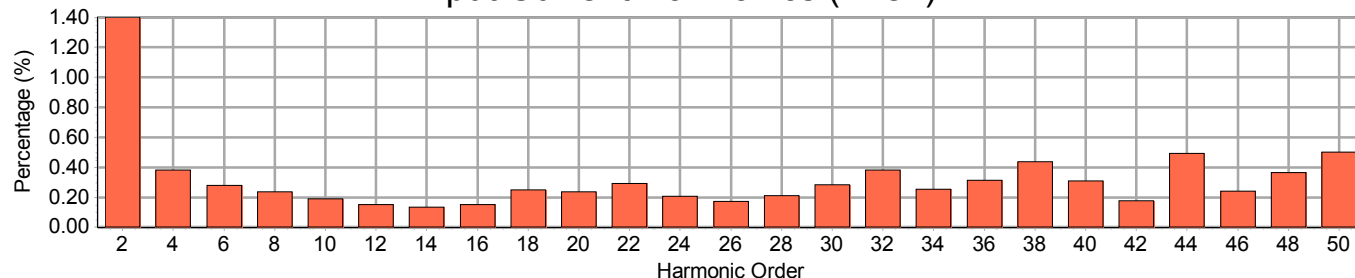
Input Voltage Harmonics (Even)



Input Current Harmonics (Odd)



Input Current Harmonics (Even)





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Lab Code: 200899-0

Harmonic Measurements

| Odd Harmonics | | | | Even Harmonics | | | |
|----------------|----------------|-----------------------|-----------------------|----------------|----------------|-----------------------|-----------------------|
| Harmonic Order | Frequency (HZ) | Voltage Harmonics (%) | Current Harmonics (%) | Harmonic Order | Frequency (HZ) | Voltage Harmonics (%) | Current Harmonics (%) |
| 1 | 60 | 100.000 | 100.000 | 2 | 120 | 0.169 | 1.405 |
| 3 | 180 | 0.403 | 6.324 | 4 | 240 | 0.116 | 0.384 |
| 5 | 300 | 0.179 | 3.868 | 6 | 360 | 0.100 | 0.278 |
| 7 | 420 | 0.127 | 3.446 | 8 | 480 | 0.111 | 0.237 |
| 9 | 540 | 0.092 | 2.367 | 10 | 600 | 0.075 | 0.191 |
| 11 | 660 | 0.096 | 1.669 | 12 | 720 | 0.048 | 0.151 |
| 13 | 780 | 0.076 | 0.882 | 14 | 840 | 0.042 | 0.134 |
| 15 | 900 | 0.037 | 0.518 | 16 | 960 | 0.066 | 0.150 |
| 17 | 1020 | 0.055 | 0.135 | 18 | 1080 | 0.107 | 0.251 |
| 19 | 1140 | 0.038 | 0.210 | 20 | 1200 | 0.090 | 0.238 |
| 21 | 1260 | 0.039 | 0.223 | 22 | 1320 | 0.110 | 0.294 |
| 23 | 1380 | 0.044 | 0.295 | 24 | 1440 | 0.061 | 0.208 |
| 25 | 1500 | 0.039 | 0.208 | 26 | 1560 | 0.046 | 0.173 |
| 27 | 1620 | 0.035 | 0.160 | 28 | 1680 | 0.049 | 0.212 |
| 29 | 1740 | 0.048 | 0.128 | 30 | 1800 | 0.062 | 0.283 |
| 31 | 1860 | 0.029 | 0.145 | 32 | 1920 | 0.091 | 0.383 |
| 33 | 1980 | 0.039 | 0.273 | 34 | 2040 | 0.051 | 0.253 |
| 35 | 2100 | 0.071 | 0.299 | 36 | 2160 | 0.070 | 0.313 |
| 37 | 2220 | 0.042 | 0.256 | 38 | 2280 | 0.078 | 0.439 |
| 39 | 2340 | 0.058 | 0.208 | 40 | 2400 | 0.062 | 0.309 |
| 41 | 2460 | 0.057 | 0.201 | 42 | 2520 | 0.045 | 0.176 |
| 43 | 2580 | 0.034 | 0.214 | 44 | 2640 | 0.076 | 0.493 |
| 45 | 2700 | 0.024 | 0.148 | 46 | 2760 | 0.043 | 0.241 |
| 47 | 2820 | 0.027 | 0.111 | 48 | 2880 | 0.055 | 0.367 |
| 49 | 2940 | 0.016 | 0.100 | 50 | 3000 | 0.069 | 0.501 |



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Photometric Report: S2008246-R1

Prepared for: ANDlight · Test Date: 24 August 2020

Luminaire: VALE · Lumcat: VAL-P-27

Coefficients of Utilization - Zonal Cavity Method

| RCR | RC | 0.9 | | | | 0.8 | | | | 0.7 | | | | 0.5 | | | 0.1 | | | 0 |
|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| | RW | 0.7 | 0.5 | 0.3 | 0.1 | 0.7 | 0.5 | 0.3 | 0.1 | 0.7 | 0.5 | 0.3 | 0.1 | 0.5 | 0.3 | 0.1 | 0.5 | 0.3 | 0.1 | 0 |
| 0 | | 116 | 116 | 116 | 116 | 107 | 107 | 107 | 107 | 99 | 99 | 99 | 99 | 83 | 83 | 83 | 56 | 56 | 56 | 50 |
| 1 | | 105 | 99 | 94 | 90 | 97 | 92 | 87 | 83 | 89 | 85 | 81 | 77 | 71 | 68 | 66 | 48 | 46 | 45 | 40 |
| 2 | | 95 | 86 | 78 | 72 | 87 | 79 | 73 | 67 | 80 | 73 | 68 | 63 | 62 | 57 | 54 | 41 | 39 | 37 | 32 |
| 3 | | 87 | 75 | 66 | 59 | 80 | 69 | 62 | 55 | 73 | 64 | 57 | 52 | 54 | 49 | 45 | 36 | 33 | 31 | 27 |
| 4 | | 79 | 66 | 57 | 50 | 73 | 61 | 53 | 47 | 66 | 57 | 49 | 44 | 48 | 42 | 38 | 32 | 29 | 26 | 23 |
| 5 | | 72 | 59 | 49 | 42 | 66 | 54 | 46 | 40 | 61 | 50 | 43 | 37 | 43 | 37 | 32 | 29 | 25 | 23 | 19 |
| 6 | | 67 | 52 | 43 | 36 | 61 | 49 | 40 | 34 | 56 | 45 | 38 | 32 | 38 | 32 | 28 | 26 | 23 | 20 | 17 |
| 7 | | 61 | 47 | 38 | 32 | 56 | 44 | 36 | 30 | 52 | 41 | 33 | 28 | 35 | 29 | 25 | 24 | 20 | 18 | 15 |
| 8 | | 57 | 43 | 34 | 28 | 52 | 40 | 32 | 26 | 48 | 37 | 30 | 25 | 32 | 26 | 22 | 22 | 18 | 16 | 13 |
| 9 | | 53 | 39 | 30 | 25 | 49 | 36 | 29 | 23 | 45 | 34 | 27 | 22 | 29 | 23 | 19 | 20 | 17 | 14 | 12 |
| 10 | | 49 | 35 | 27 | 22 | 45 | 33 | 26 | 21 | 42 | 31 | 24 | 20 | 27 | 21 | 17 | 19 | 15 | 13 | 11 |

Zonal Lumen Summary

| Zone | Lumens | % Lamp | % Luminaire |
|----------|--------|--------|-------------|
| 0 - 10 | 16 | 1.50 | 1.50 |
| 10 - 20 | 46 | 4.23 | 4.23 |
| 20 - 30 | 70 | 6.37 | 6.37 |
| 30 - 40 | 85 | 7.74 | 7.74 |
| 40 - 50 | 90 | 8.21 | 8.21 |
| 50 - 60 | 85 | 7.82 | 7.82 |
| 60 - 70 | 70 | 6.40 | 6.40 |
| 70 - 80 | 50 | 4.55 | 4.55 |
| 80 - 90 | 35 | 3.19 | 3.19 |
| 90 - 120 | 154 | 14.14 | 14.14 |
| 90 - 130 | 240 | 21.95 | 21.95 |
| 90 - 150 | 414 | 37.90 | 37.90 |
| 90 - 180 | 546 | 50.00 | 50.00 |
| 0 - 180 | 1093 | 100.00 | 100.00 |

Average Luminance (Cd/m²)

| Angle | 0 Degree | 45 Degree | 90 Degree |
|-------|----------|-----------|-----------|
| 45.0 | 212 | 200 | 205 |
| 55.0 | 229 | 193 | 210 |
| 65.0 | 265 | 190 | 197 |
| 75.0 | 281 | 204 | 225 |
| 85.0 | 237 | 459 | 522 |

Luminaire Luminous Flux: 1093

Measured Input Power: 22.82 W

Total Luminaire Efficiency: N/A

Luminaire Luminous Efficacy: 47.9 lm/W

Luminaire Spacing Criterion (0 Degree): 1.2299

Luminaire Spacing Criterion (90 Degree): 1.2601

Category: Up and Down

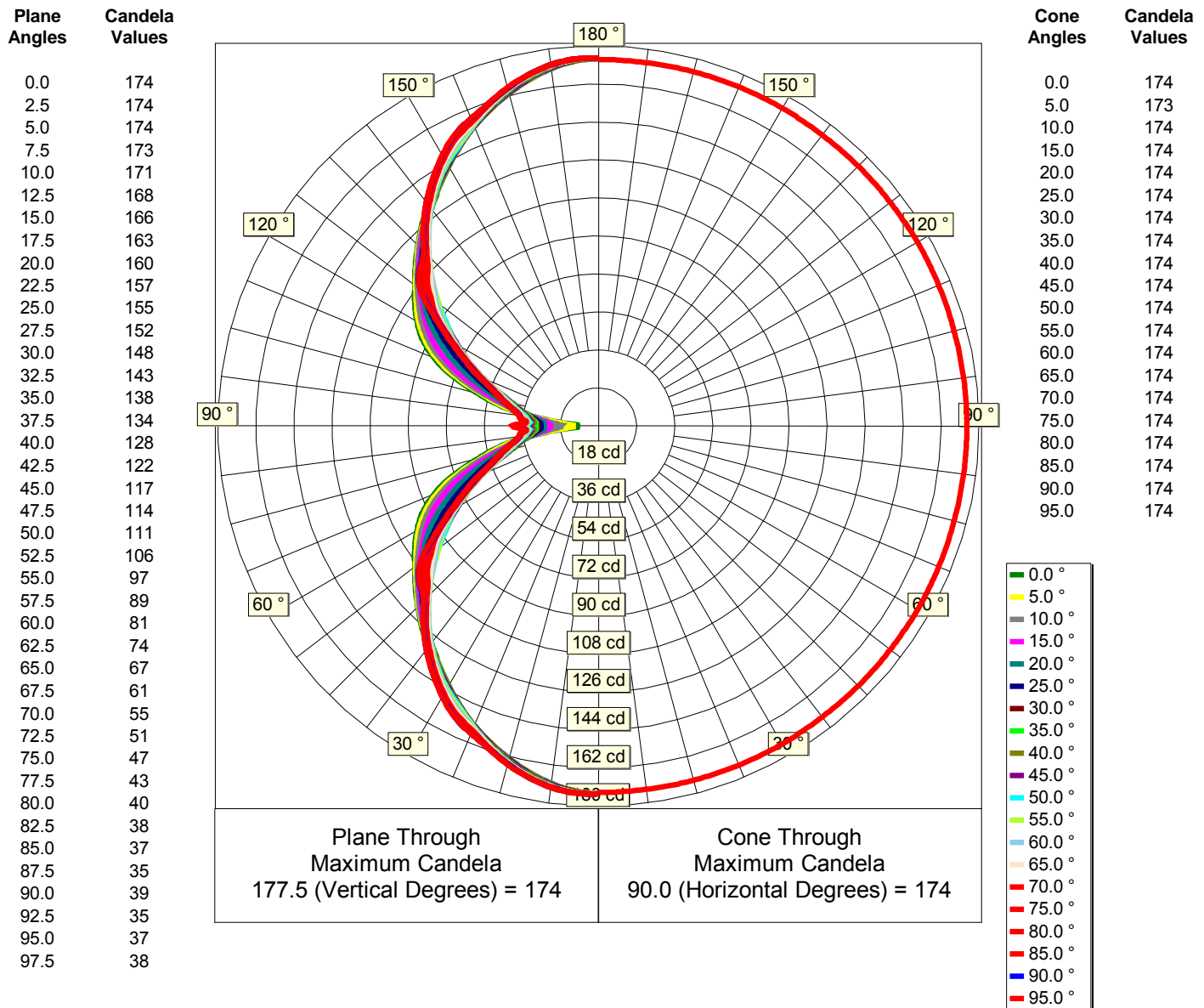


Photometric Report: S2008246-R1

Prepared for: ANDlight · Test Date: 24 August 2020

Luminaire: VALE · Lumcat: VAL-P-27

Luminous Intensity - Polar Curve for each Plane(1)



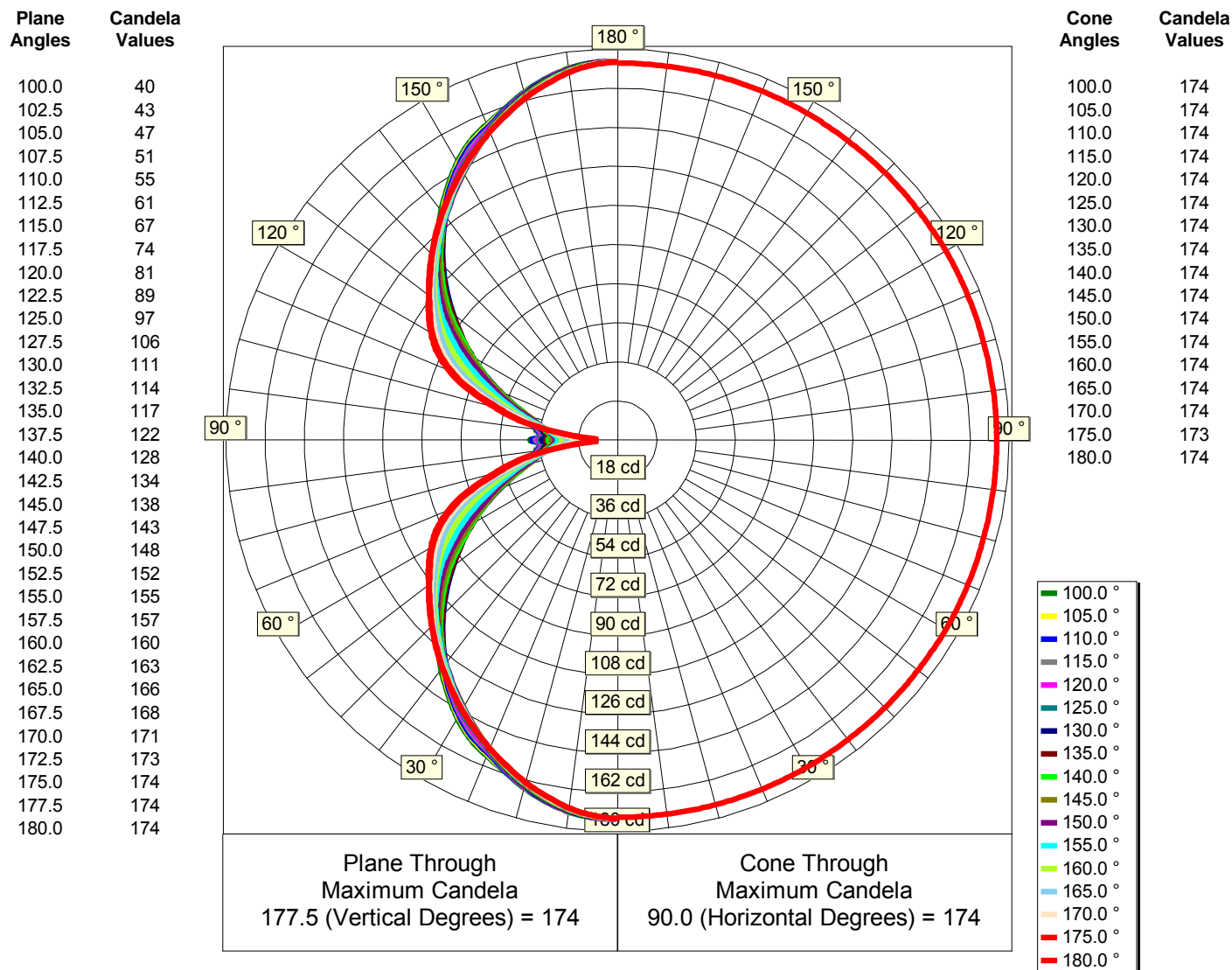


Photometric Report: S2008246-R1

Prepared for: ANDlight · Test Date: 24 August 2020

Luminaire: VALE · Lumcat: VAL-P-27

Luminous Intensity - Polar Curve for each Plane(2)





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IES File Headers

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IESNA:LM-63
[ISSUEDATE]      24 August 2020
[TESTLAB]        Spectra Lux
[TEST]           S2008246-R1
[MANUFAC]        AndLight
[LUMCAT]          VAL-P-27
[LUMINAIRE]       VALE
[LAMP]            Clusters of EPISTAR 2700K LEDs c/w Meanwell Driver IDLV-45-24 @ 120.00V
[_BURNING]        Horizontal (1,093 Luminaire Lumens)
[_REFLECTOR]      None
[_LENS]           Up & Down Prismatic Acrylic Diffuser
[_HOUSING]        Aluminum Frame
[_NOMINAL COLOR]  2700 K
[_DRIVE CURRENT] 18 mA
```

Candela Table

Lateral Angles

| | 0.0 | 5.0 | 10.0 | 15.0 | 20.0 | 25.0 | 30.0 | 35.0 | 40.0 | 45.0 |
|----------|-------------|-----|------|------|------|------|------|------|------|------|
| V | 0.0 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 2.5 | 174 | 173 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 5.0 | 172 | 172 | 173 | 173 | 173 | 173 | 173 | 173 | 173 |
| | 7.5 | 171 | 171 | 171 | 171 | 171 | 171 | 171 | 172 | 172 |
| | 10.0 | 168 | 168 | 168 | 169 | 169 | 169 | 169 | 170 | 170 |
| | 12.5 | 166 | 166 | 166 | 166 | 166 | 167 | 167 | 167 | 167 |
| | 15.0 | 163 | 163 | 163 | 163 | 164 | 164 | 164 | 164 | 164 |
| | 17.5 | 160 | 160 | 160 | 160 | 161 | 161 | 161 | 161 | 161 |
| | 20.0 | 157 | 157 | 157 | 157 | 157 | 157 | 157 | 158 | 158 |
| | 22.5 | 153 | 154 | 154 | 153 | 154 | 154 | 154 | 154 | 154 |
| e | 25.0 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| | 27.5 | 147 | 147 | 146 | 146 | 146 | 146 | 146 | 146 | 146 |
| | 30.0 | 143 | 143 | 143 | 143 | 142 | 142 | 142 | 142 | 142 |
| | 32.5 | 140 | 139 | 139 | 139 | 138 | 138 | 138 | 138 | 139 |
| | 35.0 | 136 | 136 | 135 | 135 | 134 | 134 | 134 | 134 | 135 |
| | 37.5 | 132 | 132 | 132 | 131 | 131 | 130 | 130 | 130 | 130 |
| | 40.0 | 129 | 128 | 128 | 127 | 126 | 126 | 126 | 125 | 125 |
| | 42.5 | 125 | 124 | 124 | 123 | 122 | 121 | 121 | 120 | 120 |
| | 45.0 | 121 | 121 | 120 | 119 | 118 | 117 | 116 | 115 | 114 |
| | 47.5 | 117 | 116 | 116 | 115 | 114 | 112 | 111 | 109 | 108 |
| r | 50.0 | 113 | 113 | 112 | 111 | 110 | 109 | 107 | 105 | 103 |
| | 52.5 | 109 | 109 | 108 | 106 | 105 | 104 | 101 | 99 | 97 |
| | 55.0 | 106 | 105 | 104 | 102 | 101 | 98 | 95 | 93 | 91 |
| | 57.5 | 103 | 102 | 100 | 98 | 96 | 92 | 89 | 86 | 84 |
| | 60.0 | 99 | 98 | 96 | 93 | 90 | 86 | 82 | 79 | 77 |
| | 62.5 | 95 | 94 | 92 | 88 | 84 | 79 | 74 | 72 | 71 |
| | 65.0 | 90 | 89 | 86 | 83 | 77 | 72 | 67 | 66 | 65 |
| | 67.5 | 84 | 82 | 80 | 76 | 70 | 65 | 61 | 60 | 59 |
| | 70.0 | 77 | 75 | 72 | 68 | 63 | 58 | 55 | 54 | 53 |
| | 72.5 | 68 | 66 | 63 | 60 | 55 | 52 | 49 | 48 | 47 |
| t | 75.0 | 59 | 56 | 54 | 51 | 49 | 46 | 44 | 42 | 42 |
| | 77.5 | 50 | 48 | 45 | 43 | 42 | 40 | 39 | 38 | 39 |
| | 80.0 | 40 | 39 | 38 | 36 | 36 | 35 | 35 | 35 | 35 |
| | 82.5 | 28 | 29 | 30 | 30 | 31 | 32 | 32 | 32 | 33 |
| | 85.0 | 17 | 19 | 23 | 26 | 27 | 29 | 30 | 31 | 31 |
| | 87.5 | 9 | 13 | 19 | 23 | 26 | 27 | 29 | 29 | 30 |
| | 90.0 | 13 | 12 | 18 | 23 | 26 | 28 | 29 | 30 | 32 |
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Lab Code: 200899-0

Lateral Angles

| | 0.0 | 5.0 | 10.0 | 15.0 | 20.0 | 25.0 | 30.0 | 35.0 | 40.0 | 45.0 | |
|--------------------------------------|-------|-----|------|------|------|------|------|------|------|------|-----|
| V e r t i c a l | 92.5 | 9 | 13 | 19 | 23 | 26 | 27 | 29 | 29 | 30 | 32 |
| | 95.0 | 17 | 19 | 23 | 26 | 27 | 29 | 30 | 31 | 31 | 32 |
| | 97.5 | 28 | 29 | 30 | 30 | 31 | 32 | 32 | 32 | 33 | 34 |
| | 100.0 | 40 | 39 | 38 | 36 | 36 | 35 | 35 | 35 | 35 | 36 |
| | 102.5 | 50 | 48 | 45 | 43 | 42 | 40 | 39 | 38 | 39 | 39 |
| | 105.0 | 59 | 56 | 54 | 51 | 49 | 46 | 44 | 42 | 42 | 43 |
| | 107.5 | 68 | 66 | 63 | 60 | 55 | 52 | 49 | 48 | 47 | 47 |
| | 110.0 | 77 | 75 | 72 | 68 | 63 | 58 | 55 | 54 | 53 | 53 |
| | 112.5 | 84 | 82 | 80 | 76 | 70 | 65 | 61 | 60 | 59 | 59 |
| | 115.0 | 90 | 89 | 86 | 83 | 77 | 72 | 67 | 66 | 65 | 65 |
| | 117.5 | 95 | 94 | 92 | 88 | 84 | 79 | 74 | 72 | 71 | 71 |
| | 120.0 | 99 | 98 | 96 | 93 | 90 | 86 | 82 | 79 | 77 | 77 |
| | 122.5 | 103 | 102 | 100 | 98 | 96 | 92 | 89 | 86 | 84 | 83 |
| | 125.0 | 106 | 105 | 104 | 102 | 101 | 98 | 95 | 93 | 91 | 89 |
| | 127.5 | 109 | 109 | 108 | 106 | 105 | 104 | 101 | 99 | 97 | 96 |
| | 130.0 | 113 | 113 | 112 | 111 | 110 | 109 | 107 | 105 | 103 | 102 |
| | 132.5 | 117 | 116 | 116 | 115 | 114 | 113 | 112 | 111 | 109 | 108 |
| | 135.0 | 121 | 121 | 120 | 119 | 118 | 118 | 117 | 116 | 115 | 114 |
| | 137.5 | 125 | 124 | 124 | 123 | 122 | 122 | 121 | 121 | 120 | 120 |
| | 140.0 | 129 | 128 | 128 | 127 | 127 | 126 | 126 | 126 | 125 | 125 |
| A n g l e s | 142.5 | 132 | 132 | 132 | 131 | 131 | 130 | 130 | 130 | 130 | 130 |
| | 145.0 | 136 | 136 | 135 | 135 | 135 | 134 | 134 | 134 | 134 | 135 |
| | 147.5 | 140 | 139 | 139 | 139 | 139 | 138 | 138 | 138 | 138 | 139 |
| | 150.0 | 143 | 143 | 143 | 143 | 142 | 142 | 142 | 142 | 142 | 142 |
| | 152.5 | 147 | 147 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 |
| | 155.0 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| | 157.5 | 153 | 154 | 154 | 153 | 154 | 154 | 154 | 154 | 154 | 154 |
| | 160.0 | 157 | 157 | 157 | 157 | 157 | 157 | 157 | 157 | 158 | 158 |
| | 162.5 | 160 | 160 | 160 | 160 | 160 | 161 | 161 | 161 | 161 | 161 |
| | 165.0 | 163 | 163 | 163 | 163 | 163 | 164 | 164 | 164 | 164 | 164 |
| | 167.5 | 166 | 166 | 166 | 166 | 166 | 166 | 167 | 167 | 167 | 167 |
| | 170.0 | 168 | 168 | 168 | 169 | 169 | 169 | 169 | 169 | 170 | 170 |
| | 172.5 | 171 | 171 | 171 | 171 | 171 | 171 | 171 | 171 | 172 | 172 |
| | 175.0 | 172 | 172 | 173 | 173 | 173 | 173 | 173 | 173 | 173 | 173 |
| | 177.5 | 174 | 173 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 180.0 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |



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Lab Code: 200899-0

Lateral Angles

| | 50.0 | 55.0 | 60.0 | 65.0 | 70.0 | 75.0 | 80.0 | 85.0 | 90.0 | 95.0 |
|--------------------------------------|-------|------|------|------|------|------|------|------|------|------|
| V e r t i c a l | 0.0 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 2.5 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 5.0 | 173 | 173 | 173 | 173 | 174 | 174 | 174 | 174 | 174 |
| | 7.5 | 172 | 172 | 172 | 172 | 172 | 173 | 173 | 173 | 173 |
| | 10.0 | 170 | 170 | 170 | 170 | 171 | 170 | 171 | 171 | 171 |
| | 12.5 | 168 | 168 | 168 | 168 | 168 | 168 | 169 | 168 | 169 |
| | 15.0 | 165 | 165 | 165 | 165 | 165 | 166 | 166 | 166 | 166 |
| | 17.5 | 161 | 162 | 162 | 162 | 162 | 163 | 163 | 163 | 163 |
| | 20.0 | 158 | 158 | 158 | 158 | 159 | 160 | 160 | 160 | 160 |
| | 22.5 | 154 | 154 | 155 | 155 | 156 | 157 | 158 | 157 | 158 |
| | 25.0 | 150 | 151 | 151 | 152 | 153 | 154 | 155 | 155 | 155 |
| | 27.5 | 147 | 147 | 148 | 149 | 150 | 151 | 152 | 152 | 152 |
| | 30.0 | 143 | 144 | 145 | 145 | 146 | 147 | 148 | 148 | 148 |
| | 32.5 | 139 | 140 | 140 | 141 | 142 | 143 | 143 | 143 | 143 |
| | 35.0 | 135 | 135 | 135 | 136 | 137 | 138 | 139 | 138 | 139 |
| | 37.5 | 130 | 130 | 130 | 131 | 131 | 132 | 133 | 134 | 134 |
| | 40.0 | 124 | 124 | 125 | 125 | 126 | 127 | 128 | 128 | 128 |
| | 42.5 | 119 | 119 | 119 | 120 | 121 | 121 | 122 | 123 | 123 |
| | 45.0 | 114 | 113 | 113 | 114 | 115 | 115 | 116 | 117 | 117 |
| | 47.5 | 107 | 107 | 108 | 108 | 109 | 111 | 113 | 114 | 114 |
| A n g l e s | 50.0 | 102 | 101 | 101 | 103 | 106 | 107 | 109 | 111 | 111 |
| | 52.5 | 95 | 95 | 97 | 98 | 100 | 102 | 105 | 106 | 106 |
| | 55.0 | 89 | 90 | 91 | 93 | 95 | 96 | 97 | 98 | 97 |
| | 57.5 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 89 | 89 |
| | 60.0 | 78 | 78 | 78 | 79 | 80 | 80 | 81 | 81 | 81 |
| | 62.5 | 71 | 71 | 72 | 72 | 72 | 73 | 74 | 74 | 74 |
| | 65.0 | 65 | 65 | 65 | 65 | 66 | 66 | 67 | 68 | 67 |
| | 67.5 | 59 | 59 | 59 | 59 | 60 | 60 | 61 | 61 | 61 |
| | 70.0 | 53 | 53 | 53 | 53 | 54 | 54 | 55 | 55 | 55 |
| | 72.5 | 47 | 48 | 48 | 49 | 50 | 50 | 51 | 51 | 51 |
| | 75.0 | 43 | 44 | 45 | 45 | 46 | 46 | 47 | 47 | 47 |
| | 77.5 | 40 | 41 | 41 | 42 | 43 | 43 | 43 | 43 | 43 |
| | 80.0 | 37 | 38 | 38 | 39 | 39 | 40 | 40 | 40 | 40 |
| | 82.5 | 35 | 36 | 36 | 37 | 37 | 37 | 38 | 38 | 38 |
| | 85.0 | 33 | 34 | 35 | 35 | 36 | 36 | 36 | 37 | 36 |
| | 87.5 | 33 | 33 | 34 | 34 | 34 | 35 | 35 | 35 | 35 |
| | 90.0 | 35 | 36 | 37 | 38 | 40 | 39 | 40 | 41 | 39 |
| | 92.5 | 33 | 33 | 34 | 34 | 34 | 35 | 35 | 35 | 35 |
| | 95.0 | 33 | 34 | 35 | 35 | 36 | 36 | 36 | 37 | 36 |
| | 97.5 | 35 | 36 | 36 | 37 | 37 | 37 | 38 | 38 | 38 |
| | 100.0 | 37 | 38 | 38 | 39 | 39 | 40 | 40 | 40 | 40 |
| | 102.5 | 40 | 41 | 41 | 42 | 43 | 43 | 43 | 43 | 43 |
| | 105.0 | 43 | 44 | 45 | 45 | 46 | 46 | 47 | 47 | 47 |
| | 107.5 | 47 | 48 | 48 | 49 | 50 | 50 | 51 | 51 | 51 |
| | 110.0 | 53 | 53 | 53 | 53 | 54 | 54 | 55 | 55 | 55 |
| | 112.5 | 59 | 59 | 59 | 59 | 60 | 60 | 61 | 61 | 61 |
| | 115.0 | 65 | 65 | 65 | 65 | 66 | 66 | 67 | 68 | 67 |
| | 117.5 | 71 | 71 | 72 | 72 | 72 | 73 | 74 | 74 | 74 |
| | 120.0 | 78 | 78 | 78 | 79 | 80 | 80 | 81 | 81 | 81 |
| | 122.5 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 89 | 89 |
| | 125.0 | 89 | 90 | 91 | 93 | 95 | 96 | 97 | 98 | 97 |
| | 127.5 | 95 | 95 | 97 | 98 | 100 | 102 | 105 | 106 | 106 |
| | 130.0 | 102 | 101 | 101 | 103 | 106 | 107 | 109 | 111 | 111 |
| | 132.5 | 107 | 107 | 108 | 108 | 109 | 111 | 113 | 114 | 114 |



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Lateral Angles

| | 50.0 | 55.0 | 60.0 | 65.0 | 70.0 | 75.0 | 80.0 | 85.0 | 90.0 | 95.0 |
|--------------------------------------|-------|------|------|------|------|------|------|------|------|------|
| V e r t i c a l | 135.0 | 114 | 113 | 113 | 114 | 115 | 115 | 116 | 117 | 117 |
| | 137.5 | 119 | 119 | 119 | 120 | 121 | 121 | 122 | 123 | 122 |
| | 140.0 | 124 | 124 | 125 | 125 | 126 | 127 | 128 | 128 | 128 |
| | 142.5 | 130 | 130 | 130 | 131 | 131 | 132 | 133 | 134 | 134 |
| | 145.0 | 135 | 135 | 135 | 136 | 137 | 137 | 138 | 139 | 138 |
| | 147.5 | 139 | 140 | 140 | 141 | 142 | 142 | 143 | 143 | 143 |
| | 150.0 | 143 | 144 | 145 | 145 | 146 | 147 | 147 | 148 | 148 |
| | 152.5 | 147 | 147 | 148 | 149 | 150 | 151 | 151 | 152 | 152 |
| | 155.0 | 150 | 151 | 151 | 152 | 153 | 154 | 155 | 155 | 155 |
| | 157.5 | 154 | 154 | 155 | 155 | 156 | 156 | 157 | 158 | 157 |
| | 160.0 | 158 | 158 | 158 | 158 | 159 | 159 | 160 | 160 | 160 |
| | 162.5 | 161 | 162 | 162 | 162 | 162 | 163 | 163 | 163 | 163 |
| | 165.0 | 165 | 165 | 165 | 165 | 165 | 166 | 166 | 166 | 166 |
| | 167.5 | 168 | 168 | 168 | 168 | 168 | 168 | 169 | 168 | 169 |
| | 170.0 | 170 | 170 | 170 | 170 | 171 | 171 | 171 | 171 | 171 |
| | 172.5 | 172 | 172 | 172 | 172 | 172 | 173 | 173 | 173 | 173 |
| | 175.0 | 173 | 173 | 173 | 173 | 174 | 174 | 174 | 174 | 174 |
| | 177.5 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 180.0 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| A n g l e s | | | | | | | | | | |



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Lateral Angles

| | 100.0 | 105.0 | 110.0 | 115.0 | 120.0 | 125.0 | 130.0 | 135.0 | 140.0 | 145.0 |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| V e r t i c a l | 0.0 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 2.5 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 5.0 | 174 | 174 | 174 | 173 | 173 | 173 | 173 | 173 | 173 |
| | 7.5 | 173 | 172 | 172 | 172 | 172 | 172 | 172 | 172 | 171 |
| | 10.0 | 171 | 170 | 171 | 170 | 170 | 170 | 170 | 170 | 169 |
| | 12.5 | 168 | 168 | 168 | 168 | 168 | 168 | 167 | 167 | 167 |
| | 15.0 | 166 | 165 | 165 | 165 | 165 | 165 | 164 | 164 | 164 |
| | 17.5 | 163 | 162 | 162 | 162 | 162 | 161 | 161 | 161 | 161 |
| | 20.0 | 160 | 159 | 159 | 158 | 158 | 158 | 158 | 158 | 157 |
| | 22.5 | 157 | 156 | 156 | 155 | 155 | 154 | 154 | 154 | 154 |
| | 25.0 | 155 | 154 | 153 | 152 | 151 | 151 | 150 | 150 | 150 |
| | 27.5 | 151 | 151 | 150 | 149 | 148 | 147 | 146 | 146 | 146 |
| | 30.0 | 147 | 147 | 146 | 145 | 144 | 143 | 142 | 142 | 142 |
| | 32.5 | 143 | 142 | 142 | 141 | 140 | 139 | 139 | 138 | 138 |
| | 35.0 | 138 | 137 | 137 | 136 | 135 | 135 | 135 | 134 | 134 |
| | 37.5 | 133 | 132 | 131 | 131 | 130 | 130 | 130 | 130 | 130 |
| | 40.0 | 128 | 127 | 126 | 125 | 125 | 124 | 124 | 125 | 126 |
| | 42.5 | 122 | 121 | 121 | 120 | 119 | 119 | 120 | 120 | 121 |
| | 45.0 | 116 | 115 | 115 | 114 | 113 | 113 | 114 | 114 | 116 |
| | 47.5 | 113 | 111 | 109 | 108 | 108 | 107 | 108 | 109 | 111 |
| A n g l e s | 50.0 | 109 | 107 | 106 | 103 | 101 | 102 | 102 | 103 | 105 |
| | 52.5 | 105 | 102 | 100 | 98 | 97 | 95 | 96 | 97 | 99 |
| | 55.0 | 97 | 96 | 95 | 93 | 91 | 89 | 89 | 91 | 93 |
| | 57.5 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 84 | 86 |
| | 60.0 | 81 | 80 | 80 | 79 | 78 | 78 | 77 | 77 | 79 |
| | 62.5 | 74 | 73 | 72 | 72 | 71 | 71 | 71 | 71 | 72 |
| | 65.0 | 67 | 66 | 66 | 65 | 65 | 65 | 65 | 65 | 66 |
| | 67.5 | 61 | 60 | 60 | 59 | 59 | 59 | 59 | 59 | 60 |
| | 70.0 | 55 | 54 | 54 | 53 | 53 | 53 | 53 | 53 | 54 |
| | 72.5 | 51 | 50 | 50 | 49 | 48 | 47 | 47 | 47 | 48 |
| | 75.0 | 47 | 46 | 46 | 45 | 45 | 44 | 43 | 43 | 42 |
| | 77.5 | 43 | 43 | 43 | 42 | 41 | 41 | 40 | 39 | 38 |
| | 80.0 | 40 | 40 | 39 | 39 | 38 | 38 | 37 | 36 | 35 |
| | 82.5 | 38 | 37 | 37 | 37 | 36 | 36 | 35 | 34 | 33 |
| | 85.0 | 36 | 36 | 36 | 35 | 35 | 34 | 33 | 32 | 31 |
| | 87.5 | 35 | 35 | 34 | 34 | 34 | 33 | 32 | 32 | 30 |
| | 90.0 | 40 | 39 | 40 | 38 | 37 | 36 | 35 | 33 | 32 |
| | 92.5 | 35 | 35 | 34 | 34 | 34 | 33 | 32 | 32 | 30 |
| | 95.0 | 36 | 36 | 36 | 35 | 35 | 34 | 33 | 32 | 31 |
| | 97.5 | 38 | 37 | 37 | 37 | 36 | 36 | 35 | 34 | 33 |
| | 100.0 | 40 | 40 | 39 | 39 | 38 | 37 | 36 | 35 | 35 |
| | 102.5 | 43 | 43 | 43 | 42 | 41 | 41 | 40 | 39 | 38 |
| | 105.0 | 47 | 46 | 46 | 45 | 45 | 44 | 43 | 43 | 42 |
| | 107.5 | 51 | 50 | 50 | 49 | 48 | 47 | 47 | 47 | 48 |
| | 110.0 | 55 | 54 | 54 | 53 | 53 | 53 | 53 | 53 | 54 |
| | 112.5 | 61 | 60 | 60 | 59 | 59 | 59 | 59 | 59 | 60 |
| | 115.0 | 67 | 66 | 66 | 65 | 65 | 65 | 65 | 65 | 66 |
| | 117.5 | 74 | 73 | 72 | 72 | 71 | 71 | 71 | 71 | 72 |
| | 120.0 | 81 | 80 | 80 | 79 | 78 | 78 | 77 | 77 | 79 |
| | 122.5 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 83 | 84 |
| | 125.0 | 97 | 96 | 95 | 93 | 91 | 90 | 89 | 89 | 91 |
| | 127.5 | 105 | 102 | 100 | 98 | 97 | 95 | 96 | 97 | 99 |
| | 130.0 | 109 | 107 | 106 | 103 | 101 | 101 | 102 | 102 | 103 |
| | 132.5 | 113 | 111 | 109 | 108 | 108 | 107 | 108 | 109 | 111 |



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Lateral Angles

| | 100.0 | 105.0 | 110.0 | 115.0 | 120.0 | 125.0 | 130.0 | 135.0 | 140.0 | 145.0 | |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| V e r t i c a l | 135.0 | 116 | 115 | 115 | 114 | 113 | 113 | 114 | 114 | 115 | 116 |
| | 137.5 | 122 | 121 | 121 | 120 | 119 | 119 | 119 | 120 | 120 | 121 |
| | 140.0 | 128 | 127 | 126 | 125 | 125 | 124 | 124 | 125 | 125 | 126 |
| | 142.5 | 133 | 132 | 131 | 131 | 130 | 130 | 130 | 130 | 130 | 130 |
| | 145.0 | 138 | 137 | 137 | 136 | 135 | 135 | 135 | 135 | 134 | 134 |
| | 147.5 | 143 | 142 | 142 | 141 | 140 | 140 | 139 | 139 | 138 | 138 |
| | 150.0 | 147 | 147 | 146 | 145 | 145 | 144 | 143 | 142 | 142 | 142 |
| | 152.5 | 151 | 151 | 150 | 149 | 148 | 147 | 147 | 146 | 146 | 146 |
| | 155.0 | 155 | 154 | 153 | 152 | 151 | 151 | 150 | 150 | 150 | 150 |
| | 157.5 | 157 | 156 | 156 | 155 | 155 | 154 | 154 | 154 | 154 | 154 |
| | 160.0 | 160 | 159 | 159 | 158 | 158 | 158 | 158 | 158 | 158 | 157 |
| | 162.5 | 163 | 162 | 162 | 162 | 162 | 162 | 161 | 161 | 161 | 161 |
| | 165.0 | 166 | 165 | 165 | 165 | 165 | 165 | 165 | 164 | 164 | 164 |
| | 167.5 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 167 | 167 | 167 |
| | 170.0 | 171 | 170 | 171 | 170 | 170 | 170 | 170 | 170 | 170 | 169 |
| | 172.5 | 173 | 172 | 172 | 172 | 172 | 172 | 172 | 172 | 172 | 171 |
| | 175.0 | 174 | 174 | 174 | 173 | 173 | 173 | 173 | 173 | 173 | 173 |
| | 177.5 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 180.0 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 | 174 |
| A n g l e s | | | | | | | | | | | |



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Lateral Angles

| | 150.0 | 155.0 | 160.0 | 165.0 | 170.0 | 175.0 | 180.0 |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| V e r t i c a l | 0.0 | 174 | 174 | 174 | 174 | 174 | 174 |
| | 2.5 | 174 | 174 | 174 | 174 | 173 | 174 |
| | 5.0 | 173 | 173 | 173 | 173 | 172 | 172 |
| | 7.5 | 171 | 171 | 171 | 171 | 171 | 171 |
| | 10.0 | 169 | 169 | 169 | 169 | 168 | 168 |
| | 12.5 | 167 | 166 | 166 | 166 | 166 | 166 |
| | 15.0 | 164 | 164 | 163 | 163 | 163 | 163 |
| | 17.5 | 161 | 161 | 160 | 160 | 160 | 160 |
| | 20.0 | 157 | 157 | 157 | 157 | 157 | 157 |
| | 22.5 | 154 | 154 | 154 | 153 | 154 | 153 |
| | 25.0 | 150 | 150 | 150 | 150 | 150 | 150 |
| | 27.5 | 146 | 146 | 146 | 146 | 147 | 147 |
| | 30.0 | 142 | 142 | 142 | 143 | 143 | 143 |
| | 32.5 | 138 | 138 | 139 | 139 | 139 | 140 |
| | 35.0 | 134 | 134 | 135 | 135 | 136 | 136 |
| | 37.5 | 130 | 130 | 131 | 131 | 132 | 132 |
| | 40.0 | 126 | 126 | 127 | 127 | 128 | 129 |
| | 42.5 | 121 | 122 | 122 | 123 | 124 | 125 |
| | 45.0 | 117 | 118 | 118 | 119 | 120 | 121 |
| | 47.5 | 112 | 113 | 114 | 115 | 116 | 117 |
| A n g l e s | 50.0 | 107 | 109 | 110 | 111 | 112 | 113 |
| | 52.5 | 101 | 104 | 105 | 106 | 108 | 109 |
| | 55.0 | 95 | 98 | 101 | 102 | 104 | 106 |
| | 57.5 | 89 | 92 | 96 | 98 | 100 | 103 |
| | 60.0 | 82 | 86 | 90 | 93 | 96 | 99 |
| | 62.5 | 74 | 79 | 84 | 88 | 92 | 95 |
| | 65.0 | 67 | 72 | 77 | 83 | 86 | 89 |
| | 67.5 | 61 | 65 | 70 | 76 | 80 | 84 |
| | 70.0 | 55 | 58 | 63 | 68 | 72 | 77 |
| | 72.5 | 49 | 52 | 55 | 60 | 63 | 68 |
| | 75.0 | 44 | 46 | 49 | 51 | 54 | 59 |
| | 77.5 | 39 | 40 | 42 | 43 | 45 | 50 |
| | 80.0 | 35 | 35 | 36 | 36 | 38 | 40 |
| | 82.5 | 32 | 32 | 31 | 30 | 30 | 28 |
| | 85.0 | 30 | 29 | 27 | 26 | 23 | 19 |
| | 87.5 | 29 | 27 | 26 | 23 | 19 | 13 |
| | 90.0 | 29 | 28 | 26 | 23 | 18 | 12 |
| | 92.5 | 29 | 27 | 26 | 23 | 19 | 13 |
| | 95.0 | 30 | 29 | 27 | 26 | 23 | 19 |
| | 97.5 | 32 | 32 | 31 | 30 | 30 | 29 |
| | 100.0 | 35 | 35 | 36 | 36 | 38 | 39 |
| | 102.5 | 39 | 40 | 42 | 43 | 45 | 48 |
| | 105.0 | 44 | 46 | 49 | 51 | 54 | 56 |
| | 107.5 | 49 | 52 | 55 | 60 | 63 | 66 |
| | 110.0 | 55 | 58 | 63 | 68 | 72 | 75 |
| | 112.5 | 61 | 65 | 70 | 76 | 80 | 82 |
| | 115.0 | 67 | 72 | 77 | 83 | 86 | 89 |
| | 117.5 | 74 | 79 | 84 | 88 | 92 | 94 |
| | 120.0 | 82 | 86 | 90 | 93 | 96 | 98 |
| | 122.5 | 89 | 92 | 96 | 98 | 100 | 102 |
| | 125.0 | 95 | 98 | 101 | 102 | 104 | 105 |
| | 127.5 | 101 | 104 | 105 | 106 | 108 | 109 |
| | 130.0 | 107 | 109 | 110 | 111 | 112 | 113 |
| | 132.5 | 112 | 113 | 114 | 115 | 116 | 117 |



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Lateral Angles

| | 150.0 | 155.0 | 160.0 | 165.0 | 170.0 | 175.0 | 180.0 |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| V e r t i c a l | 135.0 | 117 | 118 | 118 | 119 | 120 | 121 |
| | 137.5 | 121 | 122 | 122 | 123 | 124 | 124 |
| | 140.0 | 126 | 126 | 127 | 127 | 128 | 128 |
| | 142.5 | 130 | 130 | 131 | 131 | 132 | 132 |
| | 145.0 | 134 | 134 | 135 | 135 | 135 | 136 |
| | 147.5 | 138 | 138 | 139 | 139 | 139 | 140 |
| | 150.0 | 142 | 142 | 142 | 143 | 143 | 143 |
| | 152.5 | 146 | 146 | 146 | 146 | 147 | 147 |
| | 155.0 | 150 | 150 | 150 | 150 | 150 | 150 |
| | 157.5 | 154 | 154 | 154 | 153 | 154 | 154 |
| | 160.0 | 157 | 157 | 157 | 157 | 157 | 157 |
| | 162.5 | 161 | 161 | 160 | 160 | 160 | 160 |
| | 165.0 | 164 | 164 | 163 | 163 | 163 | 163 |
| | 167.5 | 167 | 166 | 166 | 166 | 166 | 166 |
| | 170.0 | 169 | 169 | 169 | 168 | 168 | 168 |
| | 172.5 | 171 | 171 | 171 | 171 | 171 | 171 |
| | 175.0 | 173 | 173 | 173 | 173 | 172 | 172 |
| | 177.5 | 174 | 174 | 174 | 174 | 173 | 174 |
| | 180.0 | 174 | 174 | 174 | 174 | 174 | 174 |
| A n g l e s | | | | | | | |