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This section discusses **photometric distribution** and how to read manufacturer's literature with photometric information on it.



DESIGN LIGHTING DISTRIBUTION

PHOTOMETRIC DISTRIBUTION

Polar Luminous Intensity Graph: The diagram illustrates the distribution of luminous intensity, in candelas, for the transverse (solid line) and axial (dashed line) planes of the luminaire. The curve shown **provides a visual guide to the type of distribution expected from the luminaire** e.g. wide, narrow, direct, indirect etc. in addition to intensity [1].

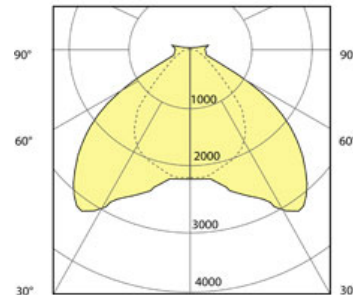


Figure L-LD1: Polar Luminous Intensity Graph [2]

Cartesian Luminous Intensity Graph: The diagram indicates the distribution of luminous intensity, in candelas of the luminaire. The curve shown provides a **visual guide to the type of distribution expected from the luminaire** e.g. narrow or wide beam etc, in addition to intensity [3]. This diagram is useful when light intensity changes rapidly within a small angular area [4].

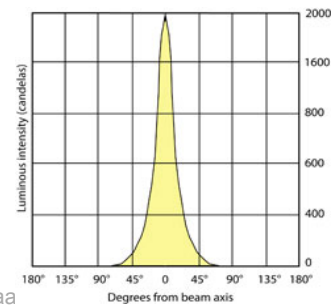


Figure L-LD2: Cartesian Luminous Intensity Graph [5]

Illuminance Cone Diagram: Usually used for spotlights or lamps with reflectors, the **diagram indicates the maximum illuminance at different distances** away from the lamp [6].

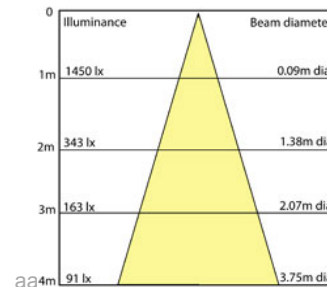


Figure L-LD3: Illuminance Cone Diagram [7]

EXAMPLES OF PHOTOMETRIC DISTRIBUTION IN MANUFACTURER'S LITERATURE:



The **cut sheet** below shows the suspended Quartet luminaire with direct/ indirect 2 T5 High Output Fluorescent lamps. The **voltage, finish and wiring options** are included in the “order guide”.

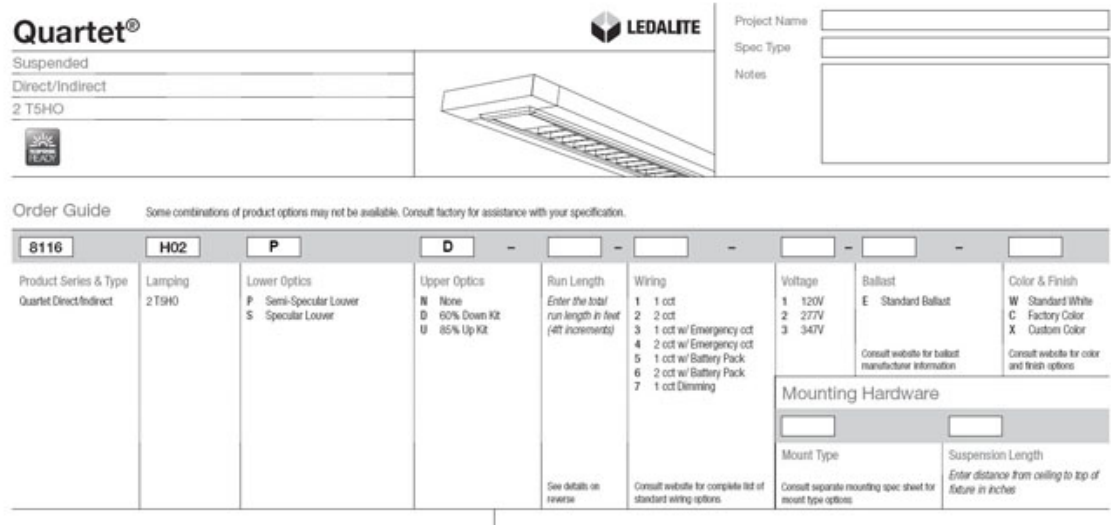


Figure L-LD4. Photometric data cutsheet of a typical direct/ indirect luminaire by Quartet [8].

In the figure below, the curve shown in the polar graph represents the **candlepower distribution of the 1T5HO Quartet luminaire** which indicates the luminous intensity (cd) in all directions from the center of the lamp. The lamp is located at the center; the lines radiating out from the center depict the angles and the concentric lines depict the decreasing luminous intensity.

Candela Distribution

Vertical Angle	Horizontal Angle					Zonal Lumens
	0	22.5	45	67.5	90	
0	2589	2589	2589	2589	2589	
5	2581	2599	2637	2669	2673	257
15	2376	2509	2667	2788	2820	743
25	1932	2172	2442	2538	2559	1070
35	1564	1721	1713	1686	1694	1039
45	832	891	816	659	693	603
55	126	131	170	148	113	149
65	38	35	31	40	33	38
75	13	15	18	17	15	18
85	0	0	0	0	0	5
90	0	0	0	0	0	
95	38	149	139	154	170	155
105	153	332	441	567	565	431
115	280	399	568	602	664	505
125	363	455	613	786	816	545
135	421	556	598	790	922	506
145	475	573	696	793	831	426
155	532	603	747	807	776	323
165	567	612	663	707	706	186
175	548	557	571	584	587	58
180	542	542	542	542	542	

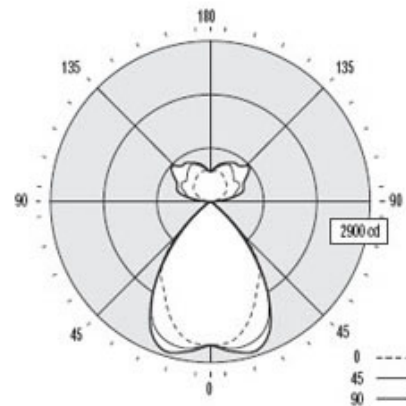


Figure L-LD5. Candela distribution of the Quartet luminaire [9].

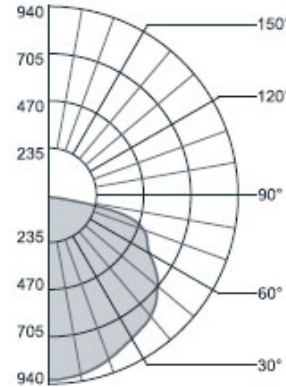
- The table next to the polar graph in Figure L-LD5 shows the **values of the luminous intensity or candela distribution against the vertical and horizontal angles of the luminaire**. For example, the luminous intensity at 0° horizontal angle and 45° vertical angle is 832cd.
- For luminaires with symmetrical light distributions, a single curve fully describes the luminaire’s distribution. Often only one side of the polar graph is shown, since the other side is an identical, mirror image. A luminaire with an asymmetrical distribution, such as a linear fluorescent downlight, requires curves in a number of planes to adequately represent its distribution. Typically, one curve is parallel to the luminaire and another is perpendicular to the luminaire; sometime either a third plane at 45° to three planes at 22 ½ ° intervals are added [10].

Some photometric distribution charts also have the **spacing criteria** mentioned on the cut sheet; see Figure L-LD6 below.

photometric data

CUP-2-22-2BX40W-TMW-P

Report # LSI157 D=10.0% I=0.0%
 Spacing Criteria: Along 1.2; Across 1.4
 Lamp Lumens: 6300 Input Watts: 66



Candlepower Summary

Vertical Angle	Horizontal Angle					Output Lumens
	0°	22.5°	45°	67.5°	90°	
0	924	924	924	924	924	
5	920	918	915	918	921	89
10	906	906	904	908	912	
15	883	884	887	894	899	250
20	850	853	862	873	879	
25	809	816	831	848	856	383
30	761	771	794	822	836	
35	706	720	752	797	818	474
40	645	664	710	776	802	
45	577	604	668	747	772	518
50	505	540	623	704	725	
55	431	474	573	655	674	503
60	358	409	516	590	605	
65	288	344	452	530	558	434
70	227	280	383	488	527	
75	168	209	306	415	455	315
80	102	123	188	236	243	
85	37	43	52	54	55	69
90	0	0	0	0	0	

Zonal Lumen Summary

Zone	% Lamp	% Luminaire
0-90	48.19	100.00
90-180	0.00	0.00

Efficiency = 48.2%

Luminance Summary (cd/m²)

Angle	0°	45°	90°
45	2391	2778	3210
55	2201	2937	3457
65	1998	3144	3881
75	1902	3471	5169
85	1252	1759	1839

Coefficients of Utilization (%)

	Floor effective floor cavity reflectance = .20				
	80	70	50	30	10
Ceiling	80	70	50	30	10
Wall	70	50	30	10	50
RCR 0	57	57	57	56	56
1	52	50	48	46	45
2	47	44	40	37	37
3	43	38	34	31	31
4	40	34	30	26	26
5	36	30	26	22	22
6	33	27	22	19	19
7	31	24	20	17	16
8	28	22	17	15	14
9	26	20	15	13	13
10	24	18	14	11	11

Figure L-LD6. Photometric cut sheet of a typical direct luminaire by Cupola [11].

- The chart in Figure L-LD6 shows the **spacing criteria along (parallel) and across (perpendicular)** the length of the luminaire under the photometric data. The spacing criteria is used to estimate the distance between luminaires in a space as follows:
- **Distance between luminaires= SC (spacing criteria) x MH (mounting height)**
MH (mounting height) refers to the distance between the workplane and the bottom of the luminaire. Thus, if the bottom of the Cupola luminaire from the above example is mounted at a height of 8' above the workplane in an interior space, the recommended spacing is 9.6' based on the spacing criteria along or parallel to the luminaire being 1.2; and the recommended spacing across or perpendicular to the luminaires is 11.2' based on a spacing criteria of 1.4. The **spacing criteria** indicates luminaire locations for spaces based on uniform illumination requirements [12].
- The **zonal lumens summary table** in Figure L-LD6 provides a quick overview of lumens in two zones. The table also indicates the overall efficiency of the luminaire and lamp combination [13].

References

1. Cooper Lighting Design Guide, http://www.cooper-ls.com/dg_itgdesguide.html (accessed July 29, 2009).
2. Ibid.
3. Ibid.
4. Gary Gordon, *Interior Lighting for Designers, 4th ed.* (New Jersey: John Wiley & Sons, Inc.: 2003), 124.
5. Cooper Lighting Design Guide, http://www.cooper-ls.com/dg_itgdesguide.html (accessed July 29, 2009).
6. Ibid.
7. Ibid.
8. Ledalite. *Quartet Product*, <http://www.ledalite.com/products/quartet> (accessed July 29, 2009).
9. Ibid.
10. Gordon, *Interior Lighting for Designers, 4th ed.*, 123-124.
11. Prulite. *Cupola Product*, http://www.prulite.com/downloads/Cupola-2_Jan_08.pdf (accessed July 29, 2009).
12. Susan M. Winchip, *Designing a Quality Lighting Environment.* (New York: Fairchild Publications, Inc., 2005), 158.
13. Ibid., p. 159.

