

HID INDUSTRIAL LIGHTING GUIDELINES

COEFFICIENT OF UTILIZATION (CU) TABLES

Coefficient of Utilization refers to the amount of light (lumens) available to perform useful work. It is expressed as a percentage of the total light produced by the lamp.

Each Coefficient of Utilization (CU) table is specific to a fixture, lamp type and wattage. Values found in Coefficient of Utilization (CU) tables are needed to perform interior lighting calculations such as determining fixture quantity of maintained footcandle levels.

Coefficient of Utilization (CU) tables are set up as a matrix. The values change with wall reflectance, ceiling reflectance and room cavity ratio. Typical reflectances are shown in Table 1. The room cavity ratio (RCR) is calculated as follows:

$$RCR = \frac{5 \times \left(\frac{ROOM\ CAVITY\ HEIGHT}{ROOM\ LENGTH + ROOM\ WIDTH} \right) \times \left(\frac{ROOM\ LENGTH + ROOM\ WIDTH}{ROOM\ LENGTH + ROOM\ WIDTH} \right)}{\left(\frac{ROOM\ LENGTH}{ROOM\ LENGTH + ROOM\ WIDTH} \right) + \left(\frac{ROOM\ WIDTH}{ROOM\ LENGTH + ROOM\ WIDTH} \right)}$$

NOTE: Room cavity height is the distance between luminaries and the work plane.

The RCR and reflectance values are used to select the appropriate values from the CU table. This value is used to calculate fixture quantity or maintained footcandle levels, as shown below.

Percentage of ceiling reflectance: RC 80

Percentage of wall reflectance: RW 70 50 30 10

Room Cavity Ratio (RCR): 1 to 10

CU Values

1	88	85	82	80
2	82	76	72	68
3	75	68	63	58
4	70	61	55	50
5	64	55	48	43
6	59	49	42	37
7	53	43	36	32
8	49	39	32	27
9	45	35	28	24
10	42	31	25	21

Typical CU Table

TABLE 1

REFLECTANCE GUIDE			
Class	Surface Finish	Color	% Light Reflected
Light	Paint	White	.81
	Paint	Ivory	.79
	Paint	Cream	.74
	Stone	Cream	.69
	Plaster	White	.90
Medium	Paint	Buff	.63
	Paint	Lt. Green	.63
	Paint	Lt. Gray	.58
	Stone	Gray	.56
Dark	Paint	Tan	.48
	Concrete Block	Med Gray	.38
	Paint	Dark Gray	.26
	Paint	Olive Green	.17
	Paint	Dark Oak	.13
	Cement	Natural	.25
	Brick	Red	.13

QUICK FIXTURE ESTIMATOR

FIXTURES REQUIRED –

To maintain a given footcandle level.

$$\text{FIXTURE QUANTITY} = \frac{\text{REQUIRED FOOTCANDLES} \times \text{LENGTH} \times \text{WIDTH}}{\text{LAMPS PER FIXTURE} \times \text{INITIAL LUMENS PER LAMP} \times \text{LLD} \times \text{LDD} \times \text{CU}}$$

- INITIAL LUMENS PER LAMP** – See lamp and fixture data. Check burning position.
- LLD** – "Lamp Lumen Depreciation". See manufacturers lamp data.
- LDD** – "Luminaire Dirt Depreciation". See Table 2.
- CU** – "Coefficient of Utilization". Select from photometric data.

MAINTAINED FOOTCANDLES –

From a given number of fixtures.

$$\text{MAINTAINED FOOTCANDLES} = \frac{\text{FIXTURE QUANTITY} \times \text{LAMPS PER FIXTURE} \times \text{INITIAL LUMENS PER LAMP} \times \text{LLD} \times \text{LDD} \times \text{CU}}{\text{LENGTH} \times \text{WIDTH}}$$

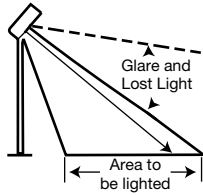
TABLE 2

Industrial Fixture Types	HID LUMINAIRE DIRT DEPRECIATION GUIDE		
	Cleaning Every Year		
	Clean	Medium	Dirty
Open Reflector	.90	.87	.83
Enclosed Reflector	.88	.83	.77

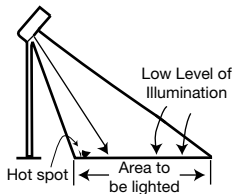
FLOODLIGHTING GUIDELINES

AIMING

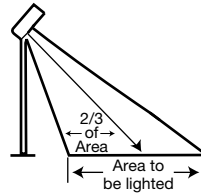
These drawings illustrate floodlight aiming in typical applications.



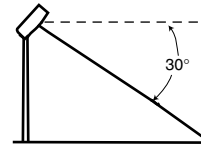
When luminaire is aimed at the far side, light loss is substantial.



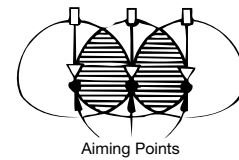
When luminaire is aimed at the near side, the far side will not receive adequate illumination.



A good "rule of thumb" is to aim the luminaire two thirds the distance across the area to be illuminated.



To provide visual comfort aim luminaire at least 30 degrees below the horizontal.



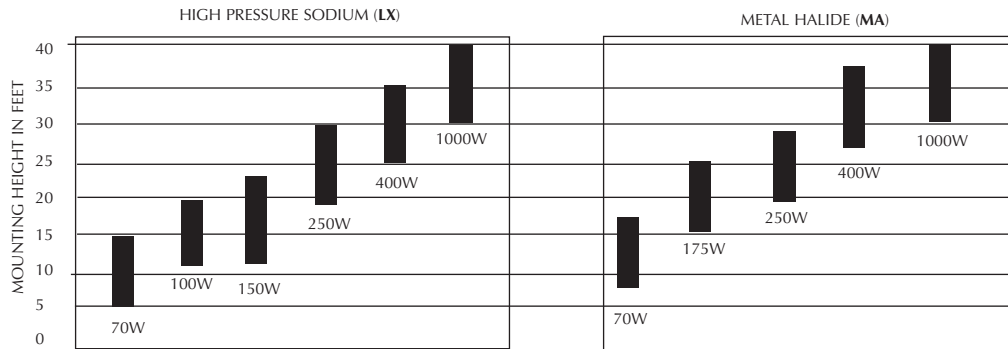
When floodlights are aimed in such a way that the illumination patterns of adjacent luminaires overlap, then acceptable uniformity is usually achieved.

MOUNTING HEIGHT

Mounting height can greatly affect the light levels produced by a fixture. The type of lamp and its wattage are major factors in determining pole height. The two graphs

presented here give height ranges for different wattages of two types of HID lamps: High Pressure Sodium (LX), and Metal Halide (MA). Choosing mounting heights within these ranges

will produce more uniform light as well as better utilization of light from the chosen fixture. The first step in any lighting job is to decide the type of fixture and its mounting height.



QUICK FIXTURE ESTIMATOR

AVERAGE MAINTAINED FOOTCANDLES =

$$\frac{\text{FIXTURE QUANTITY} \times \text{BEAM LUMENS} \times \text{"CBU"} \times \text{"LLD"} \times \text{"LDD"}}{\text{AREA LENGTH} \times \text{AREA WIDTH}}$$

1

2

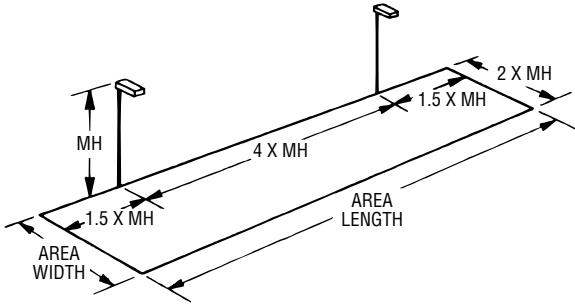
DEFINITIONS
BEAM LUMENS — Lumens produced by fixture (see page 130).
CBU — Coefficient of beam utilization. This is the ratio of lumens striking the area to be illuminated to the beam lumens generated by the floodlight. Both horizontal and vertical beam spread must be considered. See "estimating" factor at right.
LLD — Lamp lumen depreciation factor.
LDD — Luminaire dirt depreciation factor.

CBU "ESTIMATING" FACTOR RULE OF THUMB

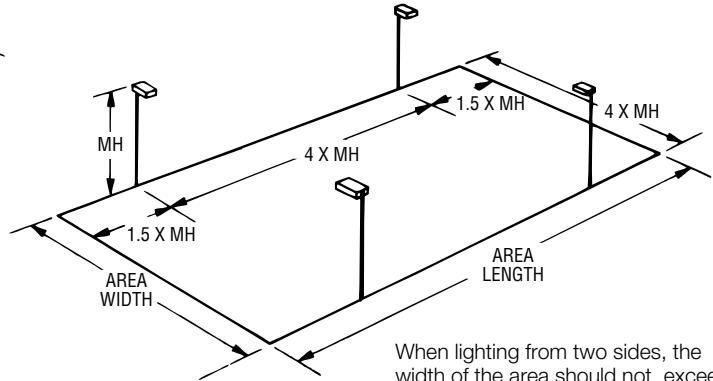
- For floodlights monitored inside a given area to be lighted use a CBU factor of .80.
- For floodlights mounted on the perimeter of an area to be lighted use a CBU factor of .60.

AREA LIGHT GUIDELINES

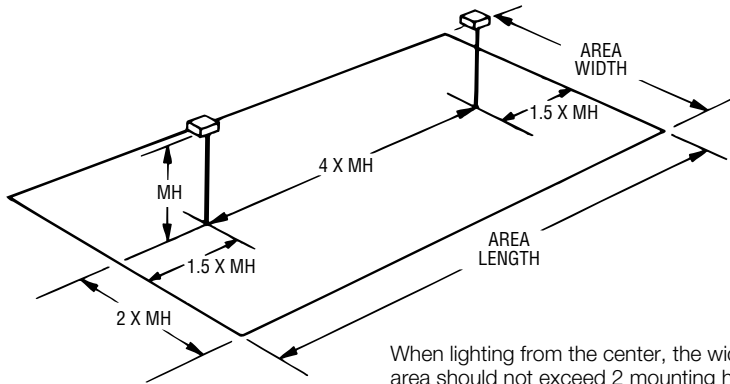
POLE/FIXTURE PLACEMENT



When lighting from one side, the width of the area should not exceed 2 mounting heights.



When lighting from two sides, the width of the area should not exceed 4 mounting heights.



When lighting from the center, the width of the area should not exceed 2 mounting heights on either side of the pole.

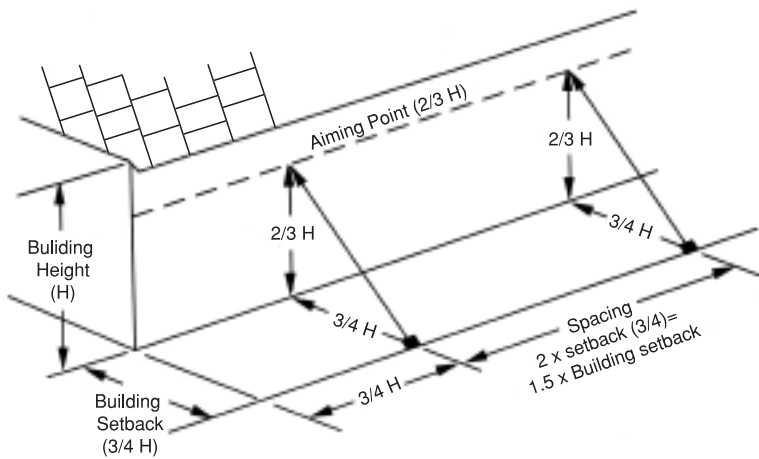
QUICK FIXTURE ESTIMATOR

AVERAGE MAINTAINED FOOTCANDLES	FIXTURE QUANTITY	BEAM LUMENS	"CU"	"LLD"	"LDD"
[]	[]	[]	[]	[]	[]
=					
<div style="display: flex; justify-content: center; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> X <div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> X <div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> X <div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> X <div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> </div>					
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<div style="display: flex; justify-content: center; align-items: center; gap: 20px;"> <div style="text-align: center;">AREA LENGTH</div> <div style="text-align: center;">AREA WIDTH</div> </div>					
<p>DEFINITIONS BEAM LUMENS — Lumens produced by fixture (see page 130). CU — Coefficient of utilization. This is the ratio of lumens striking the area to be illuminated to the beam lumens generated by the luminaire. LLD — Lamp lumen depreciation factor. LDD — Luminaire dirt depreciation factor.</p>					

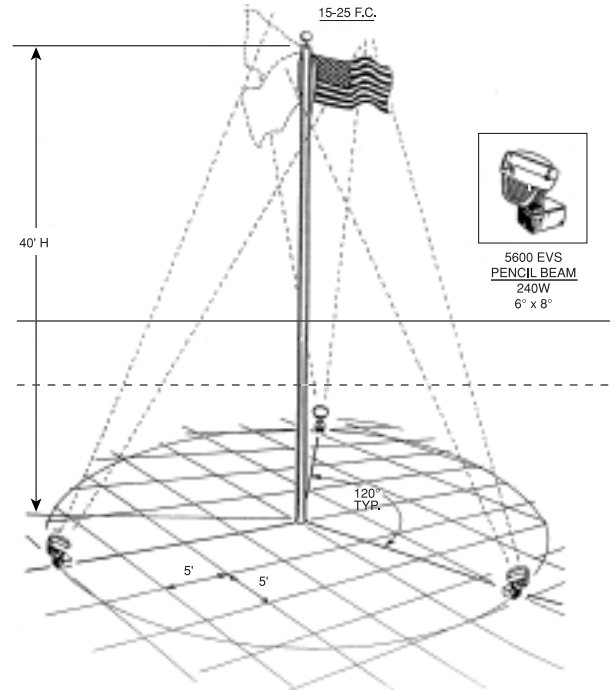
FACADE & SIGN LIGHTING

FIXTURE PLACEMENT

Floodlights should be aimed approximately 2/3 the height of the vertical surface.



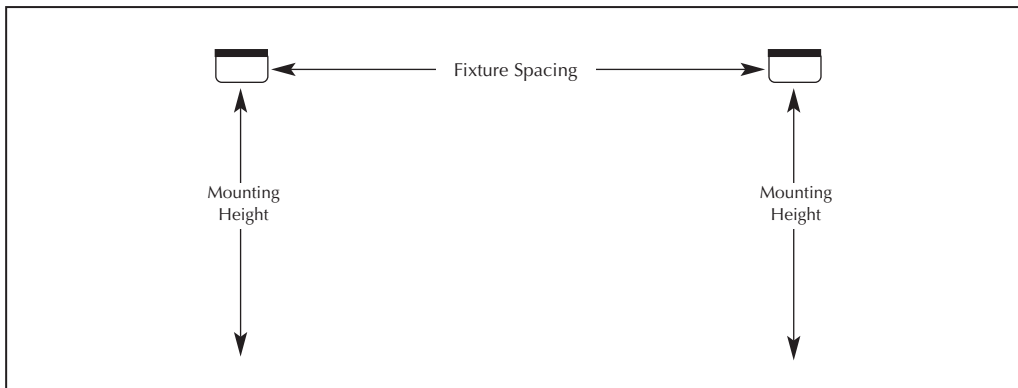
FLAG POLE



Fixture placement = 1/2 Height

WALLPRISM LIGHTING GUIDELINES

FIXTURE PLACEMENT



SPACING RULES:
STANDARD SERIES
3 x the mounting height for uniform lighting.
5 x the mounting height for security lighting.

SPACING RULES:
LYTEPRO SERIES
UNIFORM LIGHTING
6 x mounting height — Type II.
4 x mounting height — Type III.
3 x mounting height — Type IV.

RECOMMENDED FLOODLIGHT BEAM LUMENS

To find effective Beam Lumens, multiply initial Lamp Lumens X Floodlight Beam Lumen Factors below:

Example:

PHA Series 400 watt HPS — (50,000 x .65 = 32,500 Beam Lumens)

Floodlight Beam Lumen Factors

PARA Series—70%	Q Series—69%
PHA Series—65%	CPH Series—64%
SLM Series—58%	MLQ Series—30%
SLA Series—60%	

BALLAST SOURCE CODES

Source	Code	Ballast Type	Power Factor	Wattage	Available Voltages
High Pressure Sodium	NLX	Reactor	Normal	35 thru 150	120
High Pressure Sodium	HLX	Reactor	High	35 thru 150	120
High Pressure Sodium	LX	HX	High	70 thru 150	120-480
High Pressure Sodium	LX	CWA	High	250 thru 1000	120-480
Metal Halide	MA	HX	High	70,100	120/277
Metal Halide	MA	CWA	High	150-1500	120-480
Metal Halide	NMA	HX	Normal	50	120 or 277
Metal Halide	HMA	CWA	High	50-100	120 or 277
Mercury Vapor	NMM	Reactor	Normal	75	120
Mercury Vapor	MM	CWA	High	100-1000	120-480
Compact Fluorescent	NFL	Fluorescent	Normal	7-28	120
Compact Fluorescent	HF	Fluorescent	High	7-28	120
Pulse Start	PMA	HX	High	50-100	120-277V*
Pulse Start	PMA	CWA	High	150-450	120-277V*
Pulse Start	LR	Linear Reactor	High	70-450	277V

* For 480V Pulse Start Consult Factory.

VOLTAGE CODES

Footcandle multiplying factor:
Mounting height conversion:

$$= \frac{\text{old mounting height}^2}{\text{actual mounting height}^2}$$

*Footcandle multiplying factor:
Wattage conversion:

$$= \frac{\text{existing lamp lumens}}{\text{proposed lamp lumens}}$$

*This formula is for use within the same lamp source. Not for converting from one light source to another.

CATALOG NUMBER SUFFIX

Code	Voltage
-1	120
-2	208
-3	240
-4	277
-5	480
-6	120/277 (Dual Tap)
-8	120-277 (Multi-Tap)