

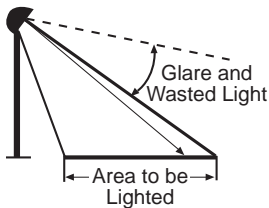
**NEMA CLASSIFICATION**

NEMA Type	Horizontal Field Angle*	Protection Distance	Suggested Maximum Aiming Line Separation (X)
1	10°-18°	240' upward	8°
2	18°-29°	200'-240'	12°
3	29°-46°	175'-200'	24°
4	46°-70°	145'-175'	40°
5	70°-100°	105'-145'	60°
6	100°-130°	80'-105'	90°
7	130+	under 80'	120°

\*Formerly Beam Spread

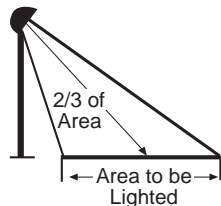
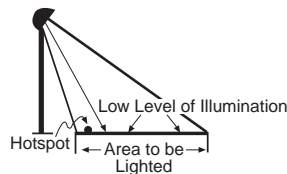
**FLOODLIGHT AIMING**

These examples are guidelines for aiming floodlights in typical lighting applications.



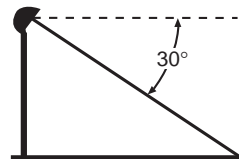
When luminaire is aimed at the far side, light is lost and results in glare.

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

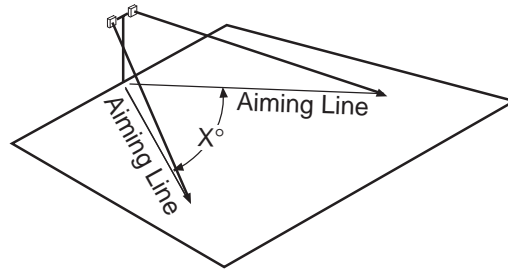
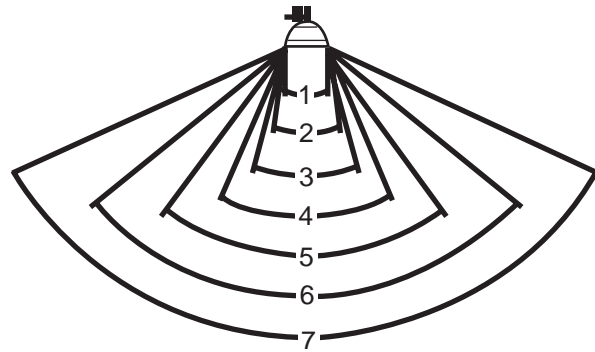


In general practice aim the luminaire two thirds the distance across the area to be luminated, or 2 times the mounting height, whichever is the lower value.

To provide good visual comfort aim luminaire at least 30° below horizontal. Increase mounting height if necessary to get angle 30° below horizontal.



When floodlights are aimed in such a way that the edge of the beam of a given fixture intersects the aiming of the adjacent luminaire, then acceptable uniformity is usually achieved.

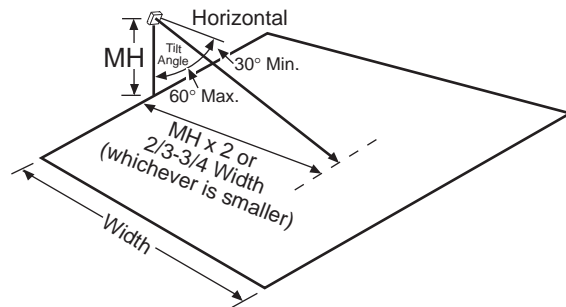


**HORIZONTAL AIMING**

NEMA 6 or 7 horizontal beam floodlights will effectively light an area 45° to either side of the aiming line.

For uniform lighting of narrow beam floodlights reduce the separation degrees between aiming line.

Perimeter poles need at least two floodlights per pole to cover the area

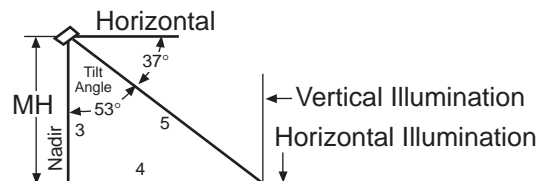


**VERTICAL AIMING**

The aiming point should be approximately 2/3-3/4 the distance across the area (width) or twice the mounting height (MH), whichever is the lower value.

For good visual comfort aim floodlight at least 30° below horizontal (or max. 60° tilt angle from nadir).

Higher aiming angles will not improve uniformity and utilization.



The highest horizontal illumination occurs when the maximum intensity (candlepower) is aimed to form approximately a 3, 4, 5 right triangle.

This is useful when determining area lighting pole height or building lighting setback.

## CALCULATIONS

### Standard Illumination Formula for Floodlights

Illuminance = (Average Maintained Footcandles)

$$\frac{\text{Quantity of Floodlights} \times \text{Beam Lumens} \times \text{Coefficient of Beam Utilization} \times \text{Light Loss Factor}}{\text{Area in Square Feet (length x width)}}$$

Quantity of Floodlights =

Average Maintained Footcandles x Area in Square Feet (Length x Width)

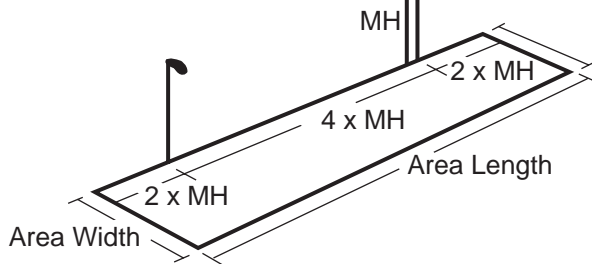
$$\frac{\text{Beam Lumens} \times \text{Coefficient of Beam Utilization} \times \text{Light Loss Factor}}{\text{Coefficient of Beam Utilization} = \frac{\text{Initial Lumens of Floodlight Reaching Specified Area}}{\text{Total Beam Lumens}}}$$

## MAINTENANCE FACTORS

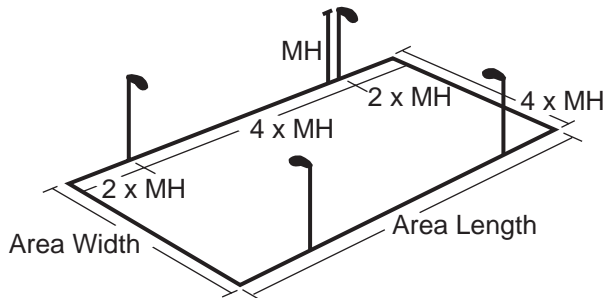
Maintenance factor is determined by multiplying the lamp lumen depreciation (LLD) by the luminaire dirt depreciation factor (LDD). The lamp lumen is usually the mean lumen value of the lamp. The luminaire dirt depreciation factor range is described in the Illuminating Engineering Society Handbook. A .9 dirt factor is commonly used.

### POLE/LUMINAIRE PLACEMENT "2x-4x Rule" (2 by 4 by)

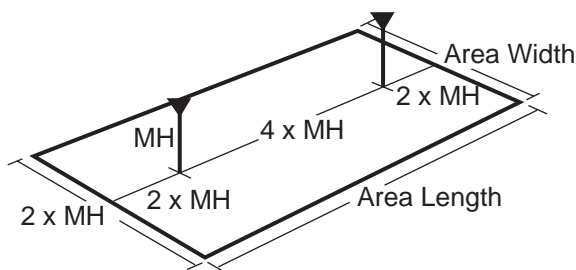
Poles should be spaced not more than 2 times their mounting height from the edge of an area to be lit, and 4 times their mounting height from any adjacent pole location.



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



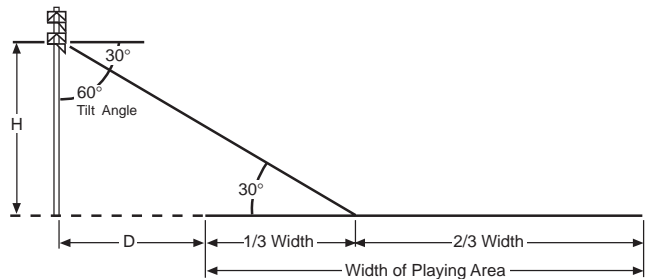
When lighting from two sides, the width of the area should not exceed 4 times the mounting height.



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

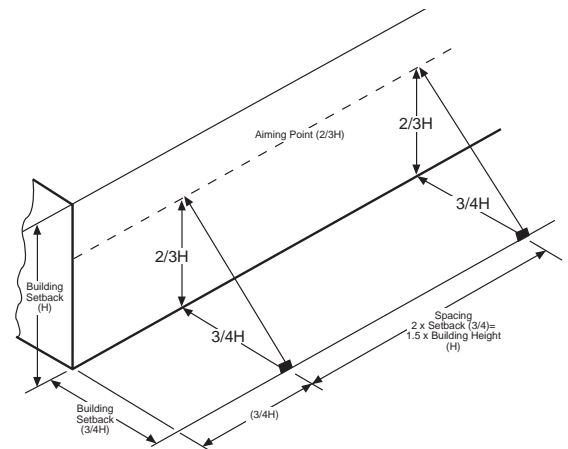
### SPORTS LIGHTING POLE HEIGHTS

$$H = (D + 1/3W) (\tan 30^\circ)$$



For adequate mounting heights, a line drawn from a point one third the distance across the playing field to the lowest mounted floodlight should form an angle with the horizontal of not less than 30° (tilt angle not greater than the 60°). In addition, minimum pole height for ground sports should not be less than 20 feet (6 meters); for aerial sports not less than 30 feet (9 meters).

### BUILDING LIGHTING GENERAL RULES



#### Luminaire setback from building facade:

3/4 the height of the building (or vertical distance). Closer will reduce uniformity, farther away will reduce lighting efficiency.

#### Luminaire Spacing:

For uniform lighting the spacing should not exceed twice the setback ( $2 \times 3/4 H = 1-1/2$  times the building height).

#### Ground Mounted Aiming:

The aiming point should be at least 2/3 up the building height. If the setback is reduced the aiming point must go higher.