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**Design Guide**  
Landscape and  
Architectural  
Feature Lighting

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# Masters of Illumination

## Imagination is the only limitation.

For nearly two decades Greenlee products have been an integral part of LSI's product offering; however, the capabilities that make us *Masters of Illumination* go back 40 years. Each of our products is designed to yield energy efficiency, high performance and low total cost of ownership through the life of your project. They will allow you to design a lighting system that will add beauty, safety, and security to your projects, while creating the desired image.

As an integral part of LSI Lighting Solutions *Plus*, we are dedicated to providing you with innovative, high quality lighting solutions utilizing the latest in lighting technology. We are actively developing solid-state LED lighting products and are committed to making them a significant part of our offering. While you won't see those products in this design guide, be sure and check with us for your future projects.

Our credentials, which include experience as lighting designers, installing contractors, and manufacturers, let us bring a wealth of expertise to your project. We'll make sure your lighting solution is the most innovative and energy efficient it can be. This guide is intended to give you tips and techniques to help you create dynamic, energy-efficient lighting systems to meet your criteria and goals. With LSI's products, *your imagination is the only limitation.*



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Opposite Page  
RDB luminaires with PAR  
38 halogen lamps bring  
out the primary color of  
Calder's "Flamingo."



Illuminating landscape and architectural features enhances the beauty of any setting and extends viewing hours. Safety is improved and security is enhanced with functional light levels that facilitate pedestrian traffic. Creating focal points or accenting key features creates an incredible image and lasting impression.

Above  
Bullet downlights with MV lamps “moonlight” the drive, while low voltage fixtures accent the sculpture.

Right  
101 Series well lights with 175-watt MV lamps uplight pine trees.



# Design Considerations: Lighting is an Art

Lighting is an art. Opinions regarding a lighting design are as subjective as those of art critics. A lighting design is not successful unless it meets the needs and expectations of your client, and fits the community in which it's located. Information gathering is the first and most essential step in every successful project.

- **Determine who is paying the bill and how you make them happy.**
  - » What is the primary objective—Beauty? Image? Security?
  - » Who is the audience? How and from where will they view the space?
  - » How will the space be used? How will people interact within it?
  - » What is the most important feature or critical focus?
- **Visit the space at night to determine ambient light levels.**
  - » Study the light sources currently used in the space.
- **What types of objects are being illuminated?**
  - » Study their color, texture, and reflectance.
- **What plant materials are being used?**
  - » Study their size, texture, density, shape, and color.
- **Determine if there are areas or features that shouldn't be illuminated.**
- **Visit the community and study neighboring projects and property.**
  - » What lighting ordinances or energy codes apply?

Since lighting is an art, understanding how the human eye and brain work will help you predict how the finished product will be perceived.

- **It doesn't take much light to make a big difference outdoors at night.**
- **Moonlight from a full moon on a clear night is only 0.01 foot-candle.**
- **Vision and visibility change as light levels diminish.**
  - » Warm (red/yellow) colors disappear at lower levels.
  - » Eyes are more sensitive to cool colors at extremely low levels.
- **Contrast and Uniformity Ratios are critical.**
  - » Eyes are attracted to the brightest object in the field of view.
  - » Eyes adapt more slowly from high to low levels than vice versa.
  - » Dark colors absorb light and require higher illuminance to be as visible as light colors.
  - » Light colors reflect more light and are brighter than dark colors receiving equal illuminance.
- **The effect should be seen, not the source. Eliminate obtrusive light.**
  - » Glare can be distracting or painful, ruining desired effects.
  - » Don't cause light trespass. No light should leave the property.

Below Left

ALV fixtures with MR16 lamps and 30° shields accent a carved wooden sculpture.

Below

Roof mounted bullet downlights with MH lamps highlight the sculpture, while ground mounted bullets accent the trees.





## Lighting is a Science

Lamp and luminaire performances are predictable. Using templates, IESNA photometric reports and formulas—*plus the tools in this guide and on our website ([www.lsi-industries.com](http://www.lsi-industries.com))*—you can determine light levels in advance, and create exactly the image you want.

### Top Left

RDB Series inground uplights, plus CBM and CBS bullets (all using metal halide lamps) illuminate landscape and architectural features.

### Top Right

MDB uplights with 70-watt metal halide lamps illuminate trees and pedestrian walkway.

### Right

MDB Series inground uplights with 70-watt metal halide lamps light sculpture and walkway.



## Lamps

Lamps combine art and science. They are the paints designers use to create their works of art yet lamp performance is based on physics and optics. Different lamp types produce different colors and quantities of light in varying beam spreads. Lamps vary in efficacy and expected life, too. Understanding the benefits (or drawbacks) of each source will help you create desired effects. For example, the spectral distribution of metal halide does a great job of rendering the color of flowers. However, due to its rich blue green color, mercury vapor is preferred for illuminating leaves on trees and creating "Moonlight." In the near future, lighting designers will use LED sources that provide unlimited color selection as well as extraordinary energy efficiency and long life. LSI's products will reflect the solid-state technology as it becomes available.



Lamp Type	Color Temp <sup>1</sup>	CRI <sup>2</sup>	Enhances	Applications	Life (Hours)	Efficacy Lumens/Watt	Initial Cost	Operating Cost
<b>Incandescent</b> 120V Incandescent 120V Quartz/Halogen 12V Quartz/Halogen	Warm 2700K	100	Red-Yellow and Orange	Flowers Shrubs Pathways	750	17	Low	High
	2800K				2,000	14-18		
	3000K				2,000-10,000	18		
<b>Fluorescent</b> Compact Fluorescent Linear Fluorescent	Warm to Cool 2700K-6500K	80+	Yellow-Blue	Hedges Signs Walls	6,500-10,000	70+	Medium	Medium
	3000K-4100K	62-80+	Red-Yellow		16,000-20,000	80-90+		
<b>HID</b> Mercury Vapor-MV <sup>3</sup> Metal Halide-MH High Pressure Sodium	Warm to Cool 3000K-5700K	15	Green-Blue	Leaves-Lawns	24000	45	Med-High	Low
	3000K - 4000K	65-80+	Blue-Green	Flowers-Flags-Signs	8,000-15,000	60+		
	1900K-2100K	22	Yellow	Warm Brick&Stone	24,000	90+		
<b>Specialty</b> LED Sources <sup>4</sup> Low Pressure Sodium	Warm to Cool White & Primary	Varies	Varies	Step Lights Inground, Bullets	50,000+	30+	High	Low
	1800K	< 2	Yellow	Turtle Zones	16000	140	Med-High	Low

## LSI Architectural Outdoor Luminaires

If lamps are the paints, then luminaires (fixtures) are the brushes used to apply them. LSI offers many different luminaire types, sizes, and styles with specific design features for their use.

### Luminaire Types

**Bullets**—Named for their tapered shape, bullets can be mounted at grade, in trees, or on structures. They utilize internal reflectors or self reflectorized lamps to project light down from trees, creating a Moonlighting effect, or upward as accent lights. Adjustable shields and other options provide precise control and cutoff.



**Accent Lights**—Typically cylindrical in shape, like our ALV Series, accent lights perform many of the same functions as bullet fixtures. They are often used for sign lighting and wall washing.



### Direct Burial

**Inground Uplights**—These are totally sealed fixtures with the housing/lens flush with grade. Reflector adjustability (beam spread, tilt, and rotation) and lamp choices ensure great design flexibility. Inground uplights can be installed in concrete or soil, making them workhorses on commercial projects. Composite housings provide corrosion resistance in harsh environments. Accessories enhance their performance.



<sup>1</sup> Correlated Color Temperature - Kelvin

<sup>2</sup> Color Rendering Index (Sunlight = 100)

<sup>3</sup> MV ballasts can't be manufactured or imported after January 1, 2008

<sup>4</sup> LED capabilities are changing rapidly, along with applications and costs.

Above

Inground uplights with 90-watt PAR38 halogen lamps accent statues.



ALV upright wall cylinders mounted on palm tree rings create dramatic lighting on palm fronds.

**Well Lights**—A sealed recessed housing is suspended inside an open cylinder or well sleeve, giving these fixtures their name. The lens is below grade and shielded by an external louver, providing glare control that is perfect for areas where lens brightness and glare are a concern.



**Floodlights**—These luminaires may be used to accent objects, provide area light, or illuminate signs and walls. They can be mounted at grade on stanchions, or on poles and structures. Available beam spreads include horizontal and vertical floods as well as various spot distributions. Flood reflectors provide broad, uniform illumination.



**Path Lights**—Designed to establish borders and outline walkways, these luminaires are usually small in size and low in wattage and mounting height to provide low-level illumination. They can also be used to accent flowers, ground cover, and shrubs in planting beds.



**Wall Mounted Sconces and Cylinders**—New codes requiring illumination of “Means of Egress” can easily be met through the use of wall mounted sconces and cylinders. Architecturally pleasing shapes and sizes allow you to design the day and seize the night. In addition to providing walkway and transitional zone lighting, wall mounted luminaires can eliminate the need for a row of pole-mounted fixtures in part of the parking lot.



**Bollards**—These columnar luminaires are typically 3 to 4 feet tall and 6 to 8 inches in diameter. They are used for area lighting along walkways where pole mounted fixtures are unacceptable. Round or square versions plus a wide variety of louvers/distributions/architectural styles are available. Vandal-resistant models are preferable for commercial or school projects.



**Area Lights**—Mounted on pedestrian scale poles in appropriate sizes these luminaires provide transition zone and walkway lighting. Larger sized luminaires with higher wattage lamps are mounted on higher poles to illuminate roadways and parking areas. Full cutoff performance and flat lenses allow them to be used in areas with stringent outdoor lighting ordinances.



# Art + Science = an LSI Lighting Solution

Transforming a sign, textured wall or other vertical object into a focal point requires the proper lighting fixture paired with the correct lamp. How the fixtures are placed directly influences the resulting appearance, dramatically affecting the vertical image enhancement. Downlighting, grazing, shadowing and silhouetting are all techniques used to achieve *Vertical Image Enhancement*.

**Downlighting/Moonlighting**—Downlighting is achieved by illuminating an area or object from above. High mounting heights and wide beam spreads provide broad, uniform illumination. Lower mounting heights or narrow beam spreads can be used for accent lighting. Bullets and floodlights are the appropriate choice for downlighting outdoors since they can be mounted on structures or poles. Downlighting becomes “Moonlighting” when easily adjustable, fully shielded bullet fixtures are placed high in trees, and aimed down through leaves and branches to produce soft, subtle shadow patterns on the ground in imitation of true moonlight.

**Uplighting**—This technique uses direct burial fixtures, well lights, and grade-mounted bullet fixtures which are aimed upward to illuminate trees, sculptures, walls, and flags. Uplights provide very dramatic effects because they generate light and shadows in the opposite direction of the sun and moon.

**Accent Lighting**—Using higher light levels, uplights or downlights can be used to accent key features and create focal points, by separating them from objects or areas of lesser importance.

**Backlighting**—When light is aimed from behind and passes through or around the object to the observer’s eye it creates depth.

**Floodlighting**—The technique provides broad, uniform illumination over large areas through the use of fixtures with wide beam spreads, typically at long setbacks. It is often used for walls and signage.

**Grazing**—Light is aimed parallel to a surface to bring out its texture.

**Shadowing**—Projecting light onto an object and casting shadows onto the vertical surface behind that object will create a shadow effect, similar to moonlighting.

**Silhouetting**—Lighting a vertical surface behind an object makes that object appear as a dark shape (in silhouette) against the lighter reflective surface.



Inground uplights with 175-watt MV lamps light an F-15.



ALV uplight/downlight wall cylinders highlight brick texture while lighting the sidewalk.



## Downlighting Tips & Techniques

### Creating Spectacular “Moonlight” Effects with Greenlee Bullets & Low Voltage Accent Lights

Fully adjustable bullet fixtures and well-shielded low voltage accent lights are the preferred luminaires for downlighting.

- **Place fixtures as high as possible in the tree.**
  - » Generally 10' higher than anyone is willing to climb.
- **Light levels decrease exponentially with distance.**
  - » High fixture placement results in lower light levels on the ground, but provides broad coverage because the beam has time to spread.
  - » Luminaires placed lower in the canopy cover smaller areas, but produce higher light levels on the ground.
- **Regardless of mounting height.**
  - » Aiming down through leaves and branches produces more shadow patterns and lowers light levels.
  - » Aiming through openings in leaves and branches increases light levels and produces fewer shadows.
  - » Luminaires placed near the center of the canopy produce softer shadows and lower light levels (light passes through more foliage).
  - » Luminaires placed near the edge of the tree's canopy create higher light levels and fewer shadows (light passes through less foliage).

**Top Left**  
Shielded bullet downlights create shadows and soft illumination on a deck and steps, enhancing both beauty and safety.

**Top Right**  
Bullet uplights and downlights with MV lamps define the entrance.

**Opposite Page**  
High CRI metal halide lamps in shielded downlights enhance food, clothing, and faces, while MV uplights accent foliage.



**Three MV downlights** add depth and texture with shadows.



## Downlighting Design Tips



Fixtures placed at the top center of a tree and aimed straight down illuminate the core of the tree, accent the trunk, and create a circle of light and shadow at the base of the tree.



Multiple fixtures can be placed in a tree, but not too closely together. Separation is required to prevent the creation of a bright spot. Locating them high in the tree near its center and aimed down at a low angle will illuminate more foliage, decrease light levels on the ground, and produce more shadows.



Placing single or multiple fixtures lower in the tree (or towards the outside) will result in fewer shadows and higher light levels. Aiming through openings in foliage will have the same result. Higher aiming angles (never above 45°) provide broader coverage on the ground.



In large trees, fixtures can be cross aimed through the canopy to bring out structure, depth, and texture. Fixtures can also be mounted on low scaffold branches and aimed up through the full height of the canopy.



Aiming fixtures behind the tree, toward the edge of the viewing area, will pull observer's eyes past the tree, into the space, making it appear larger.



Fixtures mounted on tall trees or structures (chimneys, gables), and aimed down onto shorter trees, shrubs, and planting beds create a true "Moonlight" effect, as soft, filtered light passes through foliage to illuminate the understory.



## Downlighting Lamp/Wattage Recommendations

Bullet Height	Quartz/Halogen	Mercury Vapor	Metal Halide
18' - 22'	90W PAR38	50W R20	35W - 50W
23' - 28'	150W PAR38	100W R40	70W
28' - 35'	250W PAR38	175W R40	100W
35'+		175W R40	175W

Tree mounted bullet fixtures with 175R40MV lamps provide lighting for pedestrian traffic.



## Installation Tips

- **Downlight shields** are designed to control obtrusive light.
  - » Use their length to shield the lamp from observer's eyes.
  - » Rotate them to prevent light from straying into unwanted areas.
  - » Avoid glare and light trespass by aiming fixtures below 45°.
- **To save time and money, adjust fixtures during daylight.**
  - » If you can see the lamp in the day, you'll see it at night.
  - » Check shielding at the edge of the property; prevent light trespass.
- **To achieve optimum results, fine-tune aiming and shielding at night.**



Above  
Tree mounted bullet downlights with 175-watt MV lamps illuminate pool area.



Above  
Trunk mounted floodlight define the canopy and shielded bullets illuminate the lawn.



# Uplighting Tips & Techniques

Bullets, Direct Burial Lights, Well Lights, and Floodlights can all be used as uplights. To help you choose the right one for your project, the advantages of each are shown below.

### Bullets

- Most aiming flexibility—able to aim up and over ground cover and flowers
- More susceptible to damage by mowers or vandals
- More noticeable during the day
- Least expensive uplight tool

### Direct Burial

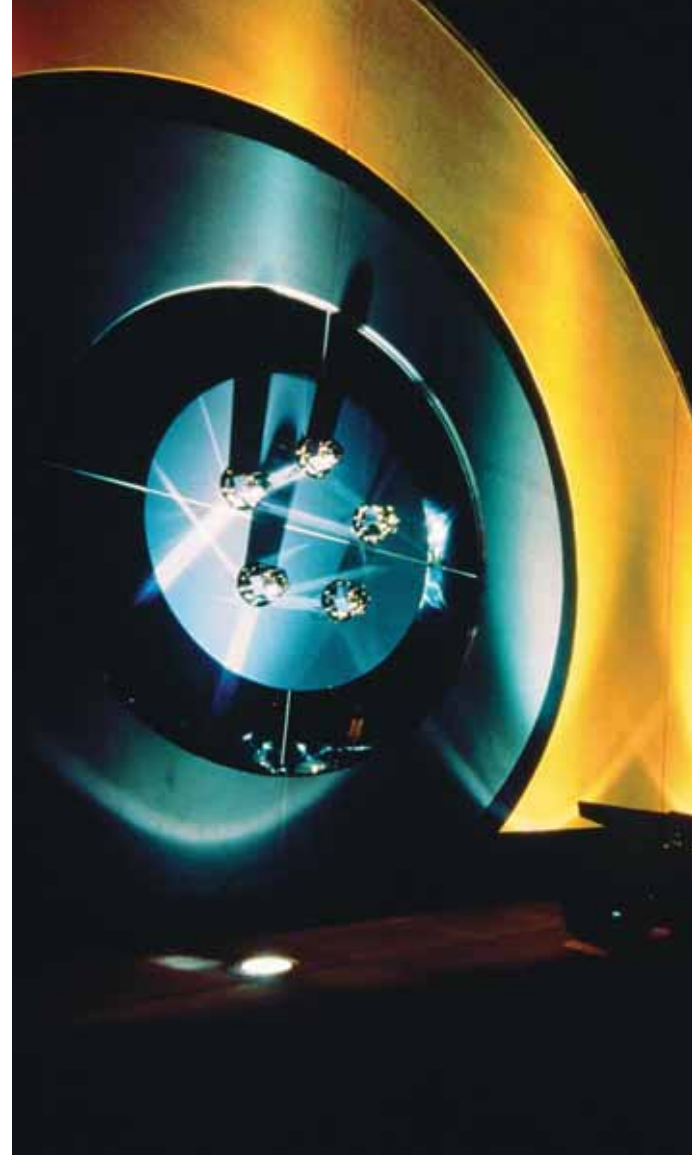
- Reflectors can be tilted and rotated
- Offers a wide variety of optics and lamp choices
- Most durable inground uplight
- Requires less maintenance than well lights

### Well Lights

- Most unobtrusive and glare-free uplight
- Lamp is shielded from view
- Great for residential settings
- Frequent maintenance is required

### Floodlights

- Offer a variety of optics and lamp choices—available with high wattage for large trees
- Large size makes them obvious
- Wide beams and large lenses can cause glare



## Uplighting Design Tips



Luminaires placed behind a tree or structure to illuminate a wall (or other reflective surface) will cause the tree to appear as a silhouette. Light colored stucco walls in western communities are great for creating dramatic silhouettes of cacti, yucca, and other desert plants.



Striking backlight effects can be created by placing luminaires behind a tree or shrub, and then aiming the light through them toward the observer's eyes. If the tree can be seen from two directions, one observer will enjoy the backlight effect, while the other will see an accent light effect.



To fully accent a tree, define its structure and highlight its texture, and turn it into a focal point, two or more uplights should be used. Crossing paths of light and shadow make a very aesthetically pleasing and dramatic scene.



To maximize the project's appearance, and stretch the budget, place lights at either end of a row of trees, with one in between each of the others. If the trees are properly spaced, this will have the impact of using two fixtures per tree, and only requires one extra fixture. Ten trees need eleven fixtures, not twenty.

## Uplighting Lamp/Wattage Recommendations

Tree Height	Low Voltage	Quartz	Mercury Vapor	Metal Halide
5' - 15'	20W MR16	36W PAR20	50W R20	35W-PAR20
23' - 28'		150W PAR38	100W R40	70W
28' - 35'		250W PAR38	175W R40	100W
35'+			175W R40	175W

## Locating Uplights to Illuminate Trees

- Enhance the effect of uplights by:
  - » Using two or more fixtures to bring out texture.
  - » Placing luminaires behind trees to add depth to the space.
  - » Using uplights in combination with downlights on large trees.
- Avoid unattractive hot spots on trunks and branches by:
  - » Locating luminaires one-third to one-half the distance between the trunk and canopy edge.
  - » Never placing luminaires directly under large branches.
  - » Aiming uplights toward the top of the tree, not at the trunk.

**Caution:** Never cut or disturb the root ball of a newly planted tree.



Left  
RDB-175-MH-SPF luminaires produce vibrant patterns that evoke feelings of excitement and motion.

Right  
101 Series well lights with 175-watt MV lamps illuminate pine trees.

Below  
Metal halide uplights are used to accent the trunks of mature trees and enhance their foliage.



# Illuminating Signs and Walls with Greenlee Uplights



Above  
Concealed floodlights at each level enhance the texture of the columns and arches.

Inground uplights are unobtrusive so they are frequently used to enhance vertical images by illuminating signs, walls, and vertical architectural features. Light levels and uniformity are based on setback distance (measured from the surface to the lens center) and spacing, so precisely calculated luminaire locations are critical. Although optics in inground luminaires can be tilted, luminaires should be placed within their aiming range. Unfortunately structures and obstacles (above and below ground) often dictate luminaire locations that disrupt the lighting plan.

## Setback

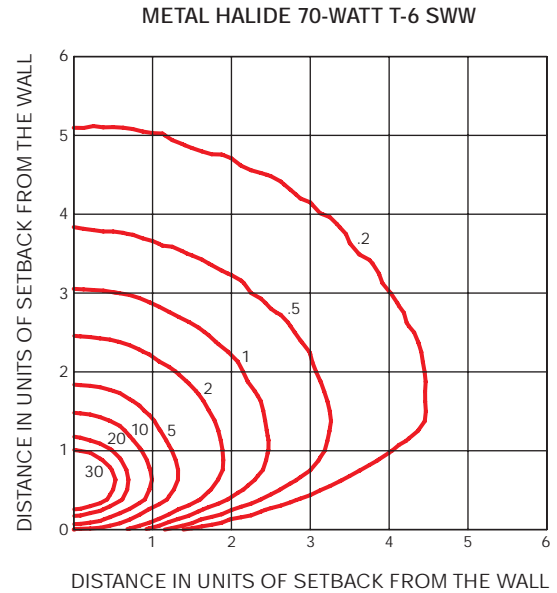
- **Placing luminaires too close to a vertical surface results in hotspots at its base.**
  - » A setback of 3' to 4' works well for many applications.
  - » Light from luminaires at extremely short setbacks grazes the surface and enhances its texture.
  - » Longer setbacks may be required for taller surfaces.
- **Luminaires too far from a vertical surface cause shadows at low levels.**
  - » Scallops between fixtures become more noticeable as setback increases.
  - » Light levels and uniformity decrease as setback (or spacing) distance increases.

## Spacing

- **Placing luminaires too far apart creates scallops at the base of the surface.**
  - » Spacing distances that are equal to 3 to 4 times the setback work well for many applications.
  - » Placing luminaires closer together eliminates scallops.
  - » Uniformity and light levels increase as spacing (or setback) distances decrease.

## Design Tools

Designers can use templates, with isolux curves, to determine optimum setback and spacing. Grid increments on the template are based on units of setback distance. Using correction factors, the same grid can be used for multiple setbacks. On templates created by LSI, the luminaire is at the (0,0) point. Only one-half of a symmetrical beam pattern is shown.



The template above shows an RDB with an SWW wall wash reflector, which delivers light at very low elevations on vertical surfaces yet provides a very wide distribution. The grid is shown in units of setback. Assuming a setback of four feet, point (0, 3) represents a spot that is twelve feet up the wall (4' x 3 = 12'), which shows an illuminance level of just over 1 foot-candle.

The correction factor table, at right, allows you to use this chart for other setbacks.

Setback	Correction Factor
2.5'	2.56
3.0'	1.77
3.5'	1.30
4.0'	1
4.5'	.79
5.0'	.64

Right  
RDB-175-MH-SPF luminaires attract attention and highlight the entrance.





## Illuminating Walls and Signs with LSI Floodlights

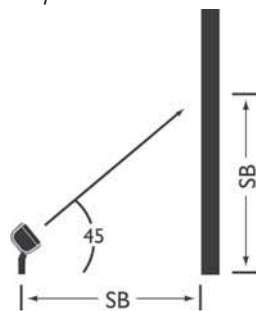
Properly located floodlights provide uniform, scallop-free illumination for signs and walls. Fortunately appropriate spacing and setback are easy to calculate, as is the recommended aiming point, just use the formula shown below. It combines the Inverse Square Law and Cosine Law, which are the basis of most lighting calculations.

$$FC = \cos \alpha \times \frac{I}{D^2}$$

Thanks to LSI's years of design experience, you don't have to calculate light levels by hand. Simply rely on the following rules of thumb. Horizontal flood reflectors are used for many applications, so these recommendations are based on their performance. Different techniques are required for other reflector types. High performance optics allow wider spacing. **Note:** *These techniques can be used when illuminating horizontal areas (parking lots, etc.) with floodlights mounted on poles.*

### Aiming Point

- Aim floodlights  $\frac{2}{3}$  of the distance up (or across) the surface.
  - » For an 18' tall wall, aim floodlights at a point 12' up the wall.
  - » Due to the cosine law, aiming higher or lower decreases uniformity.



Setback Distance = Height of Aiming Point

### Setback

- Optimal setback is equal to the height of the aiming point.
  - » If the aiming point is 12' up the wall, the setback should be 12'.
  - » Decreasing setback increases light levels, but decreases uniformity.

### Spacing

- Acceptable uniformity is achieved by spacing fixtures at two times setback.
  - » If the setback is 12', floodlights should be spaced 24' apart.
  - » This spacing interval allows floodlight beam to overlap for uniformity.
  - » Increasing spacing will decrease both uniformity and light levels.



Top Right, Above & Below

SLS and SLM floodlights accent the architecture of the hotel.

Top Left

Architectural floods illuminate the world and CDB uprights accent columns and arches



## Color and Control:

Whether you need to enhance existing color or inject color to create an entirely new scene, we have the accessories you need. LSI offers dichroic coated or colored glass color filters in a wide variety of hues. Color filters combined with our high performance optics allow you the ultimate in creative control.

The standard colors shown below represent the most popular primary hues.



Medium Blue (CFB)



Medium Green (CFG)



Lemon Yellow (CFY)



Flame Red (CFR)

Other accessories allow you to shape the beam and control glare.

- Linear Spread Lenses
- Prismatic Spread Lenses
- Internal Source Shields
- Hex-Cell Louvers
- Directional and Non-Directional Louvers
- Barn Doors
- Directional and Downlight Shields

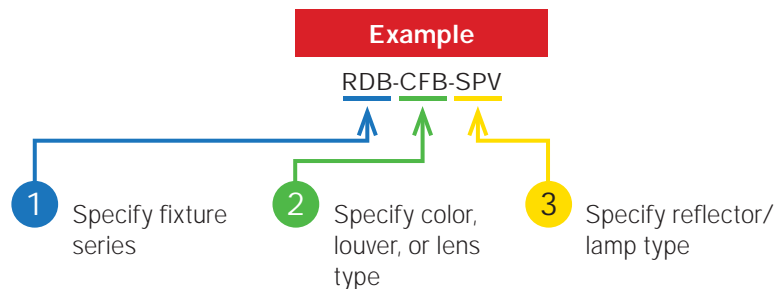
Accessories block light emerging from the luminaire, increasing operating temperatures, which may affect the maximum allowable wattage. Using multiple accessories does affect the maximum allowable luminaire wattage. Please consult the Maximum Wattage Table on the next page to determine the appropriate wattage for the accessories you specify.

How to specify filters, louvers, and spread lenses:



Right & Above  
Groups of RDB Series inground uplights with dichroic red, green, and blue filters in combination with halogen lamps are used to turn the wall into a kinetic light sculpture.

Below  
MDB inground uplights with DMH/A optics accent architectural features of this memorial.



### Maximum Wattage Table

Product	Optics or Lamp	RTL1	INL/IDL Louver	Hexcell Louver	Color Filter	Rock Guard	Spread Lens	Louver & Color Filter
RDB	FLV/FLF	100 HID	175 HID	NA	100 HID	175 HID	100 HID	100 HID
RDB	SPV/SPF	100 HID	ISS2	NA	100 HID	175 HID	100 HID	100 HID
RDB	AWW	NA	NA	NA	100 HID	175 HID	NA	NA
RDB	SWW	NA	NA	NA	NA	150 HID	NA	NA
RDB	PAR	100 HID	175 HID	100 HID	100 HID	175 HID	100 HID	100 HID
RDS	FLV/FLF	70 HID	NA	70 HID	70 HID	100 HID	70 HID	70 HID
RDS	SPV/SPF	70 HID	NA	ISS2	70 HID	100 HID	70 HID	70 HID
RDS	AWW	NA	NA	NA	70 HID	100 HID	NA	NA
RDS	PAR	70 HID	NA	70 HID	70 HID	100 HID	70 HID	70 HID
CDB	SVF/SVS	100 HID	175 HID	175 HID	100 HID	175 HID	100 HID	100 HID
CDB	SHB	NA	175 HID	NA	100 HID	175 HID	NA	NA
CDB	PAR	100 HID	175 HID	175 HID	100 HID	175 HID	100 HID	100 HID
MDB	VFA/VSA	NA	NA	70 HID	70 HID	100 HID	70 HID	70 HID
MDB	PAR20	NA	NA	50 QZ	50 QZ	100 HID	50 QZ	50 QZ
MDB	PAR	NA	NA	90 QZ	90 QZ	100 HID	90 QZ	90 QZ
CBM175	FCB	NA	NA	NA	100 HID	NA	100 HID	NA
CBM175	SCB	NA	NA	100 HID	100 HID	NA	100 HID	100HID
CBM175	PAR	NA	NA	120 QZ	120 QZ	NA	120 QZ	120 QZ
CBM	FCB	NA	NA	NA	70 HID	NA	70 HID	NA
CBM	SCB	NA	NA	70 HID	70 HID	NA	70 HID	70 HID
CBM	PAR	NA	NA	90 QZ	90 QZ	NA	90 QZ	90 QZ
CBS	PAR	NA	NA	50 QZ	50 QZ	NA	50 QZ	50 QZ
BAL3	ALL	NA	NA	175 HID	175 HID	NA	175 HID	175 HID
BAM3	PAR or R	NA	NA	100 HID	100 HID	NA	100 HID	100 HID
BAS3	PAR	NA	NA	50 QZ	50 QZ	NA	50 QZ	50 QZ
LVCBS	MR16	NA	NA	35 QZ	35 QZ	NA	35 QZ	35 QZ
LVCBM	PAR36	NA	NA	75 QZ	75 QZ	NA	75 QZ	75 QZ
DRS	ALL	NA	NA	NA	175 HID	NA	175 HID	175 HID
DRM	ALL	NA	250 HID	NA	250 HID	NA	250 HID	250 HID
ALV 11	ALL	NA	NA	35QZ	20QZ	NA	35QZ	20 QZ
ALV 16	ALL	NA	NA	50QZ	35QZ	NA	50QZ	35QZ
ALV 20	ALL	NA	NA	60QZ	50QZ	NA	60QZ	50QZ
ALV 30	ALL	NA	NA	75QZ	50QZ	NA	75QZ	50QZ

Use of RTL, Louvers, Color Filters, and other accessories lowers maximum wattage.

Do not exceed maximum wattage listed in this table.

Do not use accessory combinations other than those listed in this table.

Luminaires equipped with accessories require regular maintenance.

LSI is not responsible for failures due to excess wattage, improper accessory combinations or inadequate maintenance.

1. RTL can NOT be used in combination with Louvers, Color Filters, or Rock Guards
2. Spot optics have an Internal Source Shield (ISS) and should not be used with other louver
3. Accessories for aluminum bullets require use of cast shield with lens.

# Luminaires and People

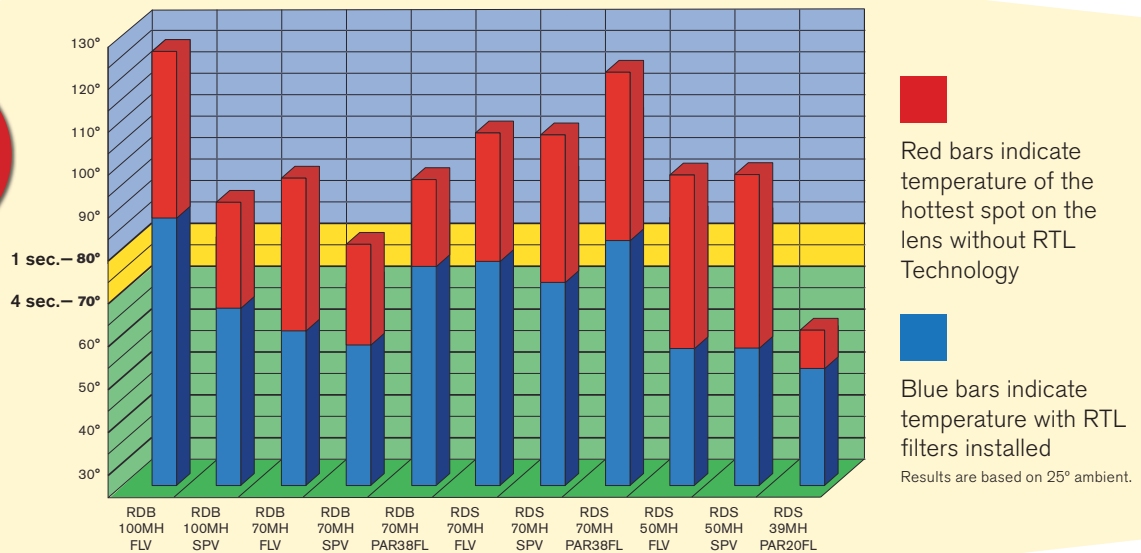
People are not just observers, they move around in the illuminated space designers create, and interact with it and each other in a variety of ways. You must plan for their presence, actions and activities.

All traditional luminaires (including bollards, floodlights, bullets, and inground uplights) get hot during operation. Therefore, pedestrian traffic should always be considered when locating luminaires, selecting wattage, and choosing external accessories to avoid creating heat hazards.

External accessories can become tripping hazards so exercise caution when selecting them and determining luminaire location.

## LSI's Greenlee RTL System

In response to concerns about lens temperatures, LSI researched standards and technology on a global basis, and developed its RTL (Reduced Temperature Lens) System for inground fixtures. The RTL System significantly reduces lens temperatures, per EN 563:1994 a stringent European standard for "Temperatures of Touchable Surfaces" Our success is shown in the accompanying chart.



Material	1 Second Contact Period <sup>1</sup>	4 Second Contact Period <sup>1</sup>
Coated Metal	74°C	61°C
Glass	80°C	70°C
Composite (plastic)	85°C	74°C

<sup>1</sup> Based on Bs EN 563:1994

## RTL Facts and Advisories

- **RTL filters are placed under the lens, above the lamp/reflector.**
  - » Only visible light energy is allowed to pass through the RTL filter.
  - » RTL filters redirect infrared energy from the lamp and ballast.
  - » Heat is retained in the luminaire, dramatically reducing lens temperature.
- **RTL filters are available for RDB, RDS, and CDB Series luminaires.**
  - » Maximum Luminaire Wattage is reduced when using RTL filters.
  - » Use of other accessories is restricted when RTL filters are specified.
  - » RTL filters are not compatible with AWW, SWW, SHB, or DMH/A wall wash optics.
- **Regardless of lens temperature, LSI does not recommend walking or standing on inground luminaires.**

## LSI Architectural Outdoor Lighting Fixture Application Chart

Down Lighting & Moonlighting									
Bullets & Accent Lights	ALV 11	ALV 16	ALV 20	ALV 30	BAS	BAM	BAL	CBS	CBM
Floodlights	DRS	DRM	703	LF					
Wall Mounted Lights	ALV WCD 16	ALV WCD 20	ALV WCD 30	WDRS	CHWS	CHWM			
Area Lights	LS	LM							
Uplighting									
Inground & Well Lights	RDS	RDB	CDB	MDB	ALV DBN	101	300		
Bullets & Accent Lights	ALV 11	ALV 16	ALV 20	ALV 30	BAS	BAM	BAL	CBS	CBM
Floodlights	DRS	DRM	703	LF					
Wall Mounted Lights	ALV WCU	CHWS	CHWM	WDRS					
Accent & Spot Lighting									
Bullet & Accent Lights	ALV 11	ALV 16	ALV 20	ALV 30	BAS	BAM	BAL	CBS	CBM
Floodlights	DRS	DRM	703	LF					
Inground & Well Lights	ALV DBN	RDS	RDB	CDB	MDB	101	300		
Wall Mounted Lights	ALV WCU	ALV WCC	ALV WCD	CHWS	CHWM	WDRS			
Flood & Area Lighting									
Area Lights	LS	LM							
Floodlights	DRS	DRM	703	LF					
Bollards	VBR	VBS	BVR	BVS	HYPR				
Wall Mounted Lights	CHWS	CHWM	WDRS	LS	LM				
Bullet & Accent Lights	BAM	BAL	CBM	ALV 30					
Silhouetting									
Inground & Well Lights	RDS	RDB	MDB	CDB	ALV DBN	101	300		
Bullet & Accent Lights	BAS	BAM	BAL	CBS	CBM	ALV 11	ALV 16	ALV 20	ALV 30
Floodlights	DRS	DRM	703	LF					
Wall Mounted Lights	ALV WMD	ALV WCD	ALV WCU	ALV WCC	CHWS	CHWM	WDRS		
Path & Spread Lighting									
Path Lights	ALV PSA	ALV PST	BAA	TAA	TSA	TSS	SSS	ALV WMD	
Bollards	VBR	VBS	BVR	BVS	HYPR				
Bullet & Accent Lights	BAS	BAM	BAL	CBS	CBM	ALV 11	ALV 16	ALV 20	ALV 30
Floodlights	DRS	DRM	703	LF					
Step Lighting									
Bullet & Accent Lights	ALV 11	ALV 16	ALV 20	ALV 30	BAS	BAM	BAL	CBS	CBM
Path Lights	ALV PSA	ALV PST	ALV 11	ALV 16	TSS	TSA	BAA	TAA	SSS
Recessed Wall Lights	ALV WMD								
Flag Lighting									
Inground & Well Lights	RDS	RDB	MDB	CDB	101	300			
Bullet & Accent Lights	BAS	BAM	BAL	CBS	CBM	ALV 20	ALV 30		
Floodlights	DRS	DRM	703	LF					
Wall Washing									
Inground Lights	RDS	RDB	CDB	300					
Floodlights	DRS	DRM	703	LF					
Wall Mounted Lights	WDRS	CHWS	CHWM						
Grazing & Shadowing									
Bullet & Accent Lights	BAS	BAM	BAL	CBS	CBM	ALV 11	ALV 16	ALV 20	ALV 30
Floodlights	DRS	DRM	703	LF					
Inground Lights	RDS	RDB	MDB	CDB	101	300	ALV DBN		
Cross Lighting									
Bullet & Accent Lights	BAS	BAM	BAL	CBS	CBM	ALV 11	ALV 16	ALV 20	ALV 30
Floodlights	DRS	DRM	703	LF					
Safety & Security Lighting									
Wall Mounted Lights	CHWS	CHWM	WDRS	ALV WCU	ALV WCD	ALV WCC			
Floodlights	DRS	DRM	703	LF					
Bullet & Accent Lights	BAS	BAM	BAL	CBS	CBM	ALV 11	ALV 16	ALV 20	ALV 30
Path Lights	ALV PSA	ALV PST	BAA	TAA	TSA	TSS	SSS	ALV 11	ALV 16
Inground & Well Lights	RDS	RDB	MDB	CDB	101	300	ALV DBN		
Recessed Wall Lights	ALV WMD								

# Flag Lighting Guide

50'

U.S. flags must be illuminated when flown at night. Visibility is dependent on the relative positions of the luminaire, flag, and viewer, as well as on ambient light levels and contrast ratios with respect to other objects in the field of view. These rules of thumb should result in a satisfactory installation, regardless of the many variables involved.

40'

1. Always use multiple luminaires to ensure flag is adequately illuminated, regardless of wind direction. Two per flag is good and three per flag is better.
2. Inground fixtures should be set back from the pole one-third to one-half the length of the flag. Floodlights may be set back from the pole one-half to one full pole length.

30'

3. Three luminaires in a triangular pattern produce the best effect.

Light levels shown below are average maintained footcandles from a single luminaire.

20'

Pole Height	Flag Size	Fixture Setback	Single Fixture Levels*	Catalog Number
<b>Inground</b>				
20'	3' x 5'	3'	3-4	RDS-100MH-120-SPV
30'	5' x 8'	4'	2-3	RDS-100MH-120-SPV
40'	6' x 10'	5'	4-5	RDS-175MH-120-SPV
50'	8' x 12'	6'	3-4	RDS-175MH-120-SPV
<b>Bullets</b>				
20'	3' x 5'	10'	5-6	BAL-SP/CBM-175MH-SCB
30'	5' x 8'	15'	2-3	BAL-SP/CBM-175MH-SCB
40'	6' x 10'	20'	1-2	BAL-SP/CBM-175MH-SCB
50'	8' x 12'	25'	5-1	BAL-SP/CBM-175MH-SCB
<b>Floods</b>				
20'	3' x 5'	10'	3-4	DRS-100MH-MT-SP-BRZ
30'	5' x 8'	15'	2-3	DRS-175MH-MT-SP-BRZ
40'	6' x 10'	20'	3-4	DRM-250MH-MT-SP-BRZ
50'	8' x 12'	25'	4-5	DRM-400MH-MT-SP-BRZ

\*Average Maintained Footcandles with meter tilted 45-degrees. Different levels will result with other meter tilt factors.



Left  
CDB uplights illuminate the flags.

Opposite Page  
Bullets with metal halide lamps accent trees and architectural features.





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