

Hadco LED Products

Hadco has long recognized the need for low maintenance, low energy consumption, and strong lumen output in landscape lighting. Over the years many products have accomplished one or two of these goals but never all at once...until now. Recent developments in LED (light emitting diode) technology have made it possible. Historically, LED's produced such a low light that they were limited to simple glow points on equipment indicator panels. That has changed and Hadco has changed with the times by developing a family of specification grade landscape LED products.

To meet the needs of Specifiers, Contractors and end users Hadco has created a broad family of LED products. These include a Bullet fixture in both spot and flood, three styles of Path lights in two wattage's, an inground fixture in both spot and flood, a steplight fixture in two wattage's, and an underwater flood. In keeping with the Hadco commitment to deliver the best quality product possible we have selected proven designs to retrofit with LED's.

Today many LED manufacturers are making some remarkable claims on life, lumens and product durability. Hadco has carefully sifted through these claims by testing products from various manufacturers. The Lumiled products Luxeon I, and Luxeon III became the clear choice at the time of our product testing and have been adopted across the board for use in all our landscape LED fixtures. These shockproof, vibration proof LED's are distinct in that they are dimmable below 10.8V. The lower voltages allow you to use smaller transformers. Our fixtures have zero lamp maintenance and much lower fixture temperatures when compared to equivalent halogen units. The high quality, long life, durability and various optic choices have ensured that Hadco's products contain the very best in LED technology available. While it is believed these products may last longer than 70,000 hours, Lumiled rates them conservatively for 50,000 hours.

The first and most crucial aspects of product development, when working with LED's, is ensuring thermal conditions are within the LED specifications as temperature greatly effects the life and light output. LED's lose lumen output dramatically once they surpass optimal thermal temperatures. Keeping our MCPCB (Metal Core Printed Circuit Board) temperature under 60°C was tested under worst case scenarios to ensure that when a customer puts our product in a formidable set of conditions, the life and light of our product is not diminished. Each of Hadco's LED fixtures contain a unique heat sink specifically designed for the fixture housing, LED configuration and maximum thermal reduction. At room temperature of 25 degree C our Bullets outside housing temperature registers a cool 46 degree C with a lens temperature of 42 degree C. Our inground fixtures outside housing temperatures registered 45 degree C with a 49 degree C lens temperature.

The proprietary drivers jointly designed with ADVANCE TRANSFORMER for our landscape LED family regulates voltage to a constant 700ma. This provides exactly the right voltage to the LED's allowing the maximum lumen expression while taking advantage of the longest life cycle for the Luxeon III LED's. The Drivers used in the bullet, path lights, inground and underwater fixtures will actually run properly on source voltage of 10.8-17.5 while delivering to the LED the 700ma needed without variance. This is very helpful when having to calculate voltage drop in a low voltage installation. Another benefit found in our design is that the driver is built into the fixture eliminating the need for secondary driver placement. This compact design provides convenient installation while supplying LED fixtures with some of the best light output we have seen to date in the market place. All of our led fixtures run off 12V systems produced by magnetic transformers. Electronic 12V transformers cannot be used as they create a modified sine wave that strobos the LED's. Finally, As an added feature our inground and underwater LED products contain a thermal regulator to ensure the fixture remains cool and the LED life meets or exceed 50,000 hours.

Ensuring correct light distribution has driven Hadco to include various options in our LED optics. We offer a 12-degree spot and 25-degree flood in our bullet (BLN5D4/BLW5D4), inground (ILN5D4/ILW5D4) that is comparable to a 20Watt MR16 enabling these products to meet most needs (see attached photometry for comparison). Add our spreads lens to the inground or underwater fixture and you significantly broaden your light radius. Working with the side emitter optics available with the Luxeon III our pathlight RL4D3 casts a beautiful and wide horizontal light pattern (see attached photometry). The 80-degree holographic defuser used in our pathlight ML4D3 furthers our unique optic package (see attached photometry) by blending the individual LED's creating the appearance of a single lamp. The color temperature of all our LED fixtures will range between 5,000-5,200 Kelvin.

Compared to halogen lamps (an industry standard for landscape) the LED lasts up to 25 times longer (based on a 2000 hour 20W BAB Halogen). Our LED fixture gives comparable lumen output as a 20W BAB Halogen lamp using significantly less energy. This equates to approximately 40% savings. When we compare a 20W Halogen with 6 Watts of a Luxeon LED there is an energy savings of \$30.00 in two years and \$115.00 over 5 years. (Assuming: \$.10/KWhr, a \$1.50 halogen lamp, \$5.00 transformer cost per lamp, 2000 hr. life, \$15.00 lamp change out cost, \$3.00 per Watt of Luxeon, % 1.50 per Luxeon driver cost). Keep in mind that at 50,000 hrs our fixtures still maintain 70% lumen maintenance. This simply means that at 50,000 hrs you are still getting 70% of the lumen expression the LED's had in the beginning of their life cycle. Compared to Incandescent, Mercury Vapor, Metal Halide or High Pressure Sodium, all of which have instant failure at the end of their life cycle, our led fixtures have a slow decline over a long period of time. Add in the fact that these fixtures are maintenance free and the payoff becomes significant.

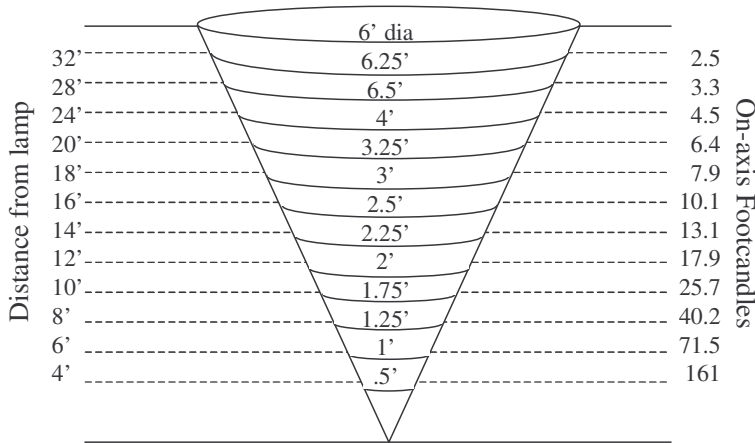
Hadco's LED Fixtures are perfect for hard to reach places, areas difficult to maintain, in trees and in ponds, placement requiring scaffolding to install. This family of LED fixtures has great potential for commercial and residential application. Both markets will reap tremendous benefit from the low energy consumption, strong lumen expression and extremely long life. The simplicity of installation and zero maintenance appeal to the high end resort industry and the upscale homeowner. LED's present a new growth market for the lighting industry and Hadco will be there to supply your industry segment with the highest quality and broadest selection of products available anywhere.

Hadco will aggressively defend all of its intellectual property. We reserve the right to change details of design, materials and finishes in any way that will not alter installed appearance or reduce function and performance.

Specific Product Specifications

	<u>ML4D3</u>	<u>CL2D2</u>	<u>RL4D3</u>	<u>ILN5D4,ILW5D4,ULW5D4</u>	<u>BLN5D4,BLW5D4</u>
<i>Electrical:</i>					
Input Voltage Range (VAC)	10.8 - 17.5	10.8 - 17.5	10.8 - 17.5	10.8 - 17.5	10.8 - 17.5
Nom Input Power (W) 12 VAC Nom	9.3	6.2	9.3	12.4	12.4
Nom Input Current (A) 12 VAC Nom	1.0	0.7	1.0	1.4	1.4
<i>EMI (Electro-magnetic Interference)</i>					
	Class A	Class A	Class A	Class A	Class A
<i>Thermal/Mechanical:</i>					
<i>Optical:</i>					
Number of LEDs	3	2	3	4	4
Distribution of Light	See Charts	See Charts	See Charts	See Charts	See Charts
Color Temperature (K)	5000-5200	5000-5200	5000-5200	5000-5200	5000-5200
Lumen output at 50000 hrs.	70%	70%	70%	70%	70%
<i>Other:</i>					
Lifetime (Hrs) @ T _{ambient} =25°C, V _{in} =12VAC, T _l ≤90°C	50,000	50,000	50,000	50,000	50,000

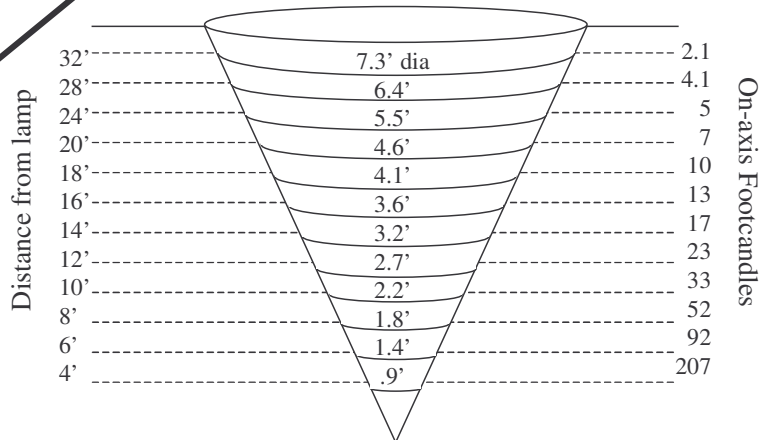
**BLN5D4 Spot (12° lens)
LED**



Shape of cone is not to scale

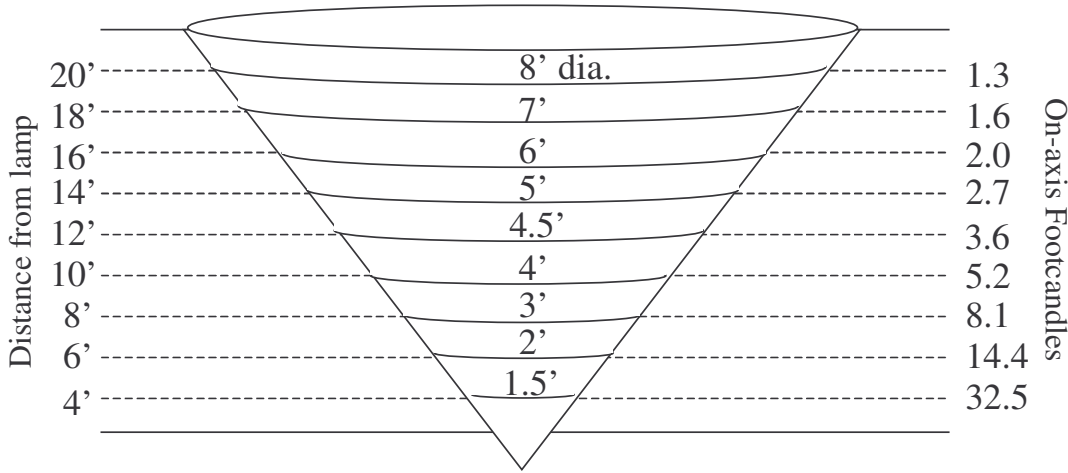


**20W MR16
ESX NSP 13°**



Shape of cone is not to scale

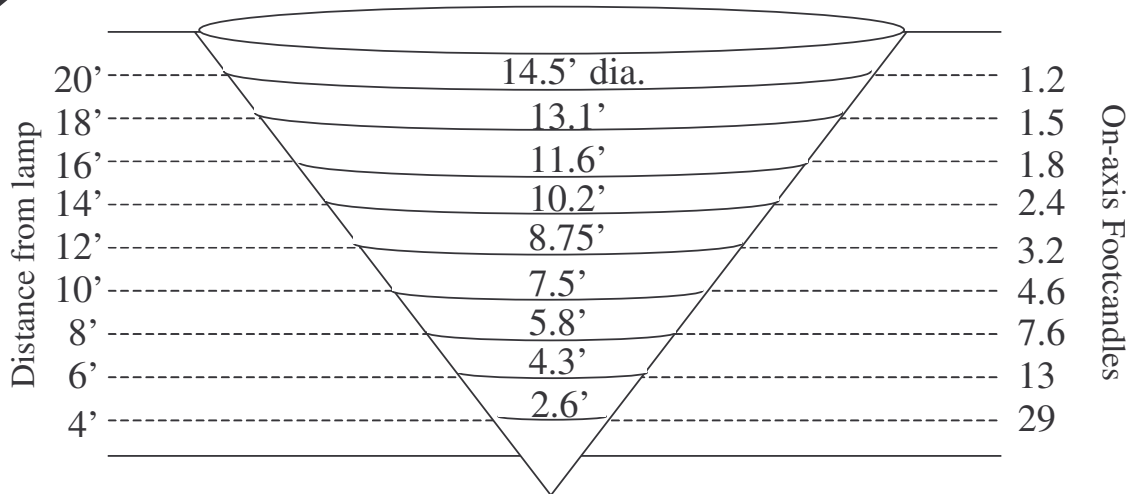
BLW5D4 Flood (25° lens) LED



Shape of cone is not to scale



20W MR16 BAB WFL 40°



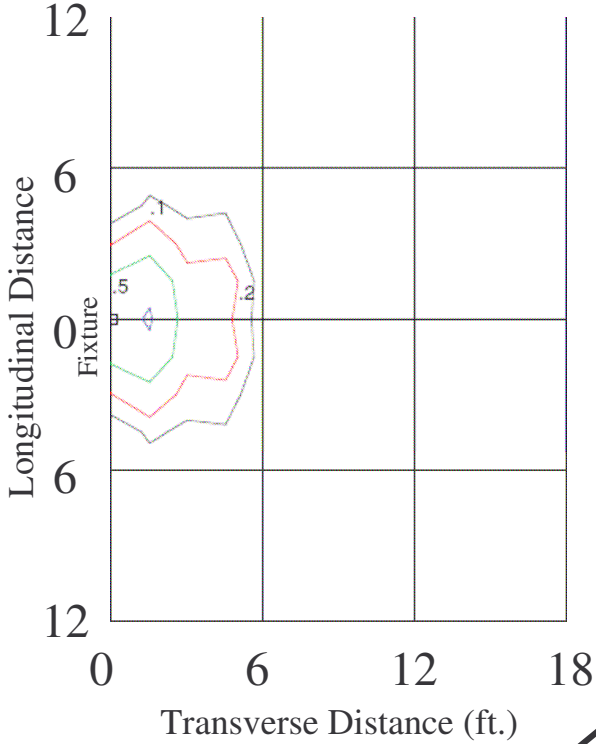
Shape of cone is not to scale

RSC2 - LED

Distribution: Symmetric

Lamp Wattage: 5-1W LED

Mounting Height: 3 Foot

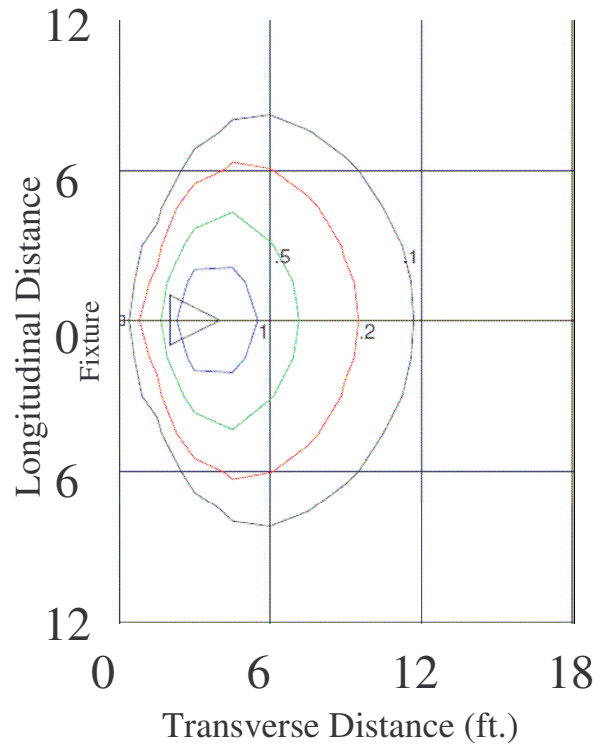


RSC2 - Incandescent

Distribution: Symmetric

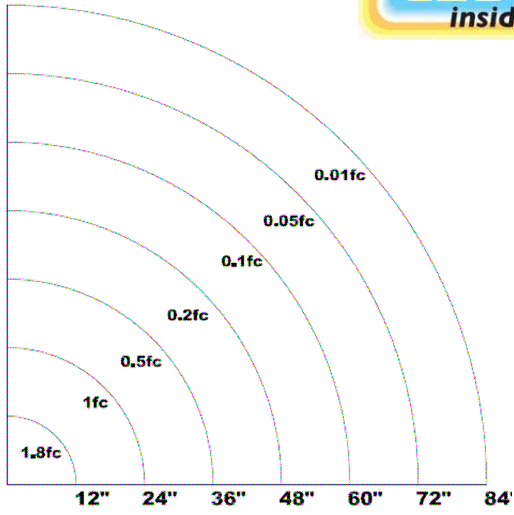
Lamp Wattage: (2) 18W 1141

Mounting Height: 3 Foot

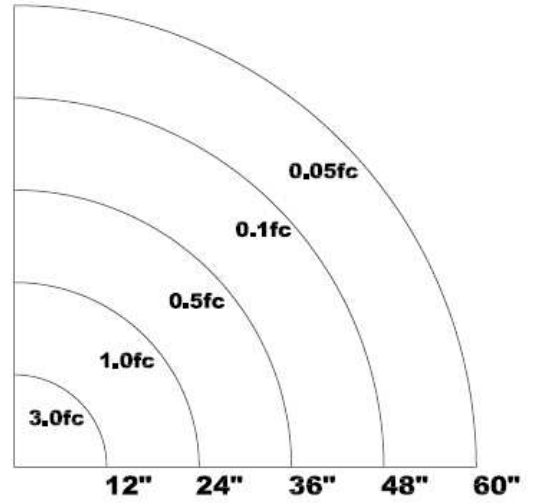


ISO Foot Candle Chart

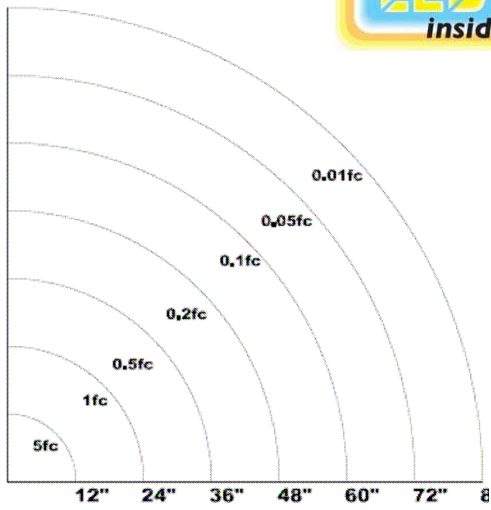
RL4D3 Pathlyte:
Three (3) Type III LED's



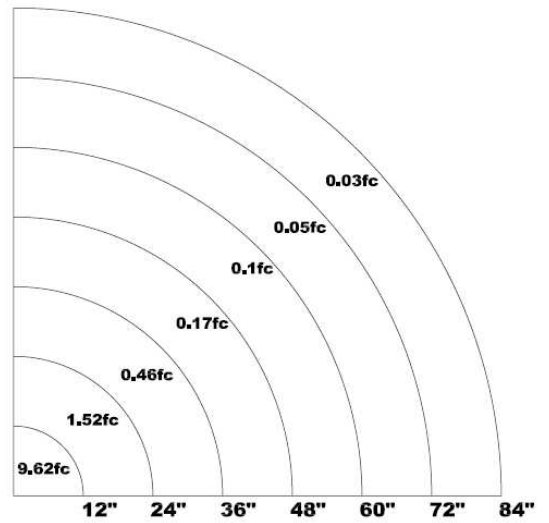
RL4 Pathlyte
20-Watt Maximum T3 Lamp



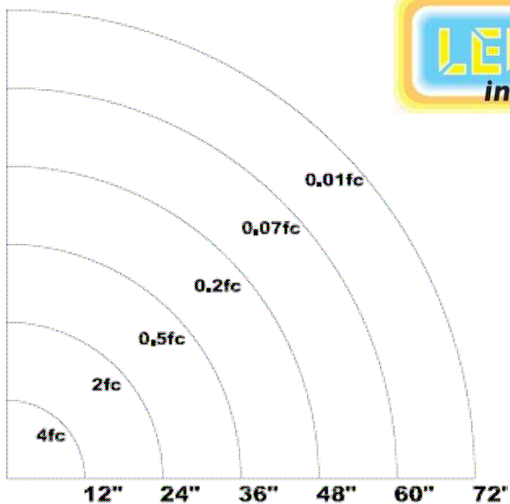
ML4DL Pathlyte:
Three (3) Type III LED's



MUL4 Pathlyte
20-Watt Maximum T3 Lamp



CL2D2 Pathlyte:
Two (2) Type III LED's



CPL21 Pathlyte
20-Watt Maximum T3 Lamp

