ZLED™
LIGHTING
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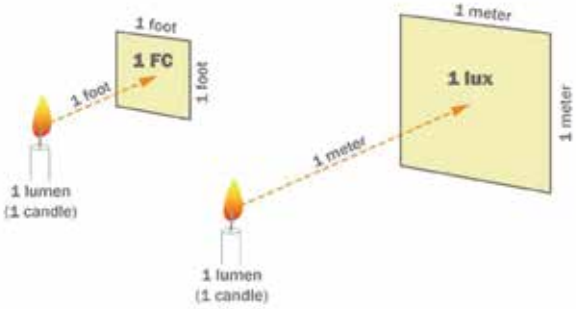
LIGHTING 101

LIGHTING

WHAT IS FC (FOOT CANDLE)?

Foot candle is a measurement of light intensity and is defined as the illuminance on a one-square foot(=lm/ft²) surface from a uniform source of light, also known as illumination intensity, internationally (lm/m²) (unit: lux), 1fc = 10.76 lux.



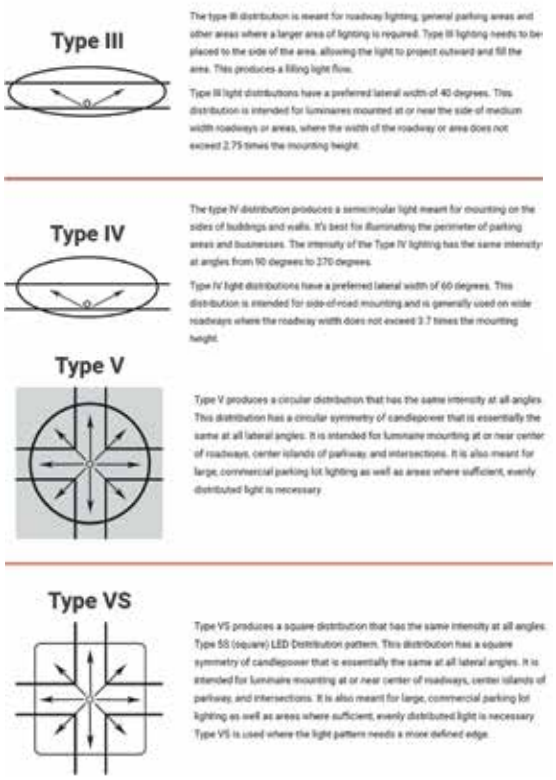
WHAT IS TOTAL HARMONIC DISTORTION (THD)?

THD is a measurement of the harmonic distortion that is present in a signal and is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

For LED lighting industry, THD should be less than 20%. Lower THD means pure signal emission without causing interferences to other electronic devices. Harmonic d istortion is a result of any electric load or circuit where non-linear loads are present, such as transformers and VFD's. True Harmonic distortion is based on the fundamental load distortion, meaning how much distortion is there under full load.

WHAT IS LIGHT DISTRIBUTION?

Type I, Type II, Type III, Type IV, Type V etc.



WHAT IS MICROWAVE SENSOR?

Microwave sensors, also known as Radar, RF or Doppler sensors, detect walking, running or crawling human targets in an outdoor environment. It generates an electromagnetic (RF) field between transmitter and receiver, creating an invisible volumetric detection zone.

When an intruder enters the detection zone, changes to the field are registered and an alarm occurs.

WHAT IS LUMEN EFFICACY?

Lumen efficacy is the amount of visible light per light source, measured by lm/watt.

The higher the number the better. That means, more electricity has transformed into light, less heat produce. Therefore, choose the lumens output over wattage option. That is to say, if there is a 15W 120lm/w t8 tube and a 18W 100lm/w t8 tube, the same lumen output (lighting effect), but 15W can save more energy and reduce electricity bill.

WHAT IS LM79 LM80 L70 TEST REPORT?

LM79 is the Illuminating Engineers Society of North America (IES) approved testing method to generate electrical and photometric measurements of solid-state lighting (LED) products. It is an electrical and photometric test of LED luminaires. Measurements include total flux (light output), electrical power (wattage), lumens per watt (efficacy), and chromaticity.

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WHAT IS LM80?

LM80 is the Illuminating Engineering Society of North America (IES) approved method for the Electrical and Photometric Measurements of Solid-State Lighting. It measures an integral lamp as a whole system according to a standard process using specified equipment. In other word, it solely measures the lumen depreciation of the LED module.

WHAT IS L70?

LM70 is the amount of time it takes for a light to degrade to 70% of initial lumen output.

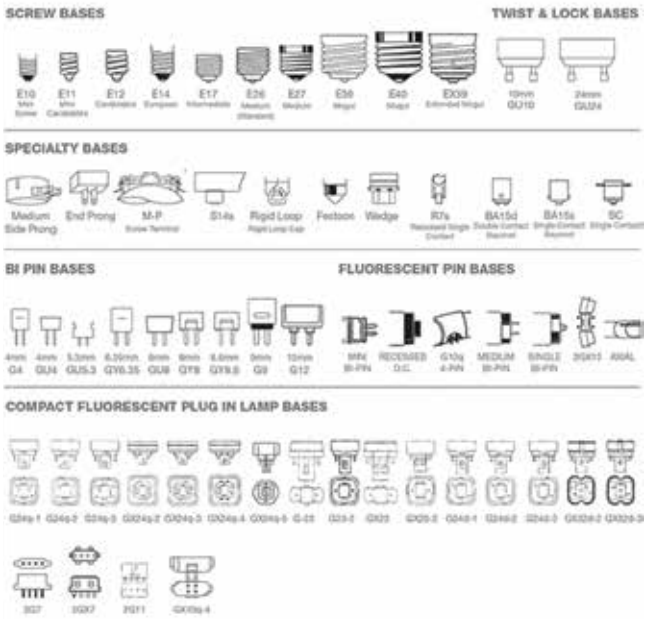
HOW IS THE LED LAMP OR LED FIXTURE LIFESPAN 50,000 HOURS TESTED?

The LED lifespan 50,000 hours is an estimate value based on the test TM-21, LM79 test report, and not the genuine data. Its genuine lifespan depends on how long every-day use is and how hot or cold your application. These factors affect the light lifespan.

	LED	CFL	Incandescent	Halogens
Efficiency	1st place	2nd place	4th place	3rd place
Connectivity	1st place	4th place	3rd place	2nd place
Lifespan	1st place	2nd place	4th place	3rd place

HOW MANY KINDS OF SOCKET BASES ARE THERE FOR LED LIGHTING?

There are several Edison socket bases in United States, E12 (candelabra), E17 intermediate base, E26 medium base, E39 mogul base.



WHAT IS IP RATING?

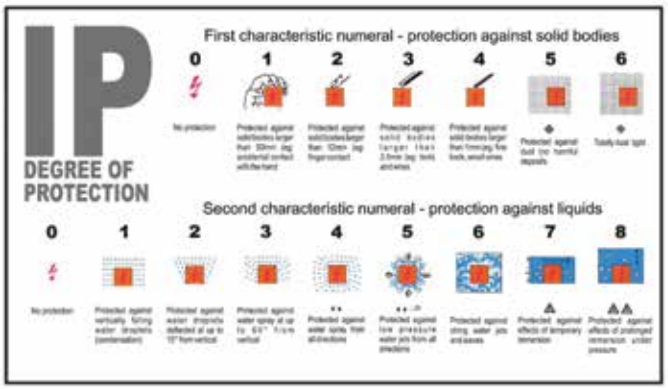
This is a rating system that defines the ability of a product to be able to work in different environments.

IP is an acronym “Ingress Protection”. It is a measurement of the protection an item will have against solid objects (dust, sand, dirt, etc.) and liquids.

An IP rating is comprised of 2 numbers. The first number refers to the protection against solid objects (dust, etc.) and the second number refers to protection against liquids IP65 = Water resistant. “Protected against water jets from any angle” *Do NOT submerge IP65 LED lights, these are not waterproof.

IP67 = Water resistant plus. “Protected against the events of temporary submersion (10 minutes)”*Do NOT submerge IP67 LED lights for extended periods, these are not waterproof.

IP68 = Waterproof “Protected against the events of permanent submersion up to 3 meters”.



WHAT IS AMBER LIGHT?

Is it the same with warm white yellowish light?

Amber light is yellow light, but it is pure yellow light, no other light wave and not like the warm white light which contains several kinds of light wave.

WHAT IS PWM DIMMER?

PWM stands for Pulse Width Modulation which is a specific way that LED lights are dimmed. Basically, this dimmer works by sending a pulse or flicker to the light at a rate that the eye cannot detect in order to achieve 256 levels of dim.

WHAT IS IR REMOTE CONTROL?

An IR remote is short for Infrared, meaning it has to be pointed directly at the Infrared sensor on the controller in order for the remote to function.

WHAT IS OCCUPANCY SENSOR?

It is an indoor motion detecting device used to detect the presence of a person to automatically control lights or temperature or ventilation systems. The sensors use infrared, ultrasonic, microwave, or other technology. The term encompasses devices as different as PIR sensor, hotel room keycard locks and smart meters.

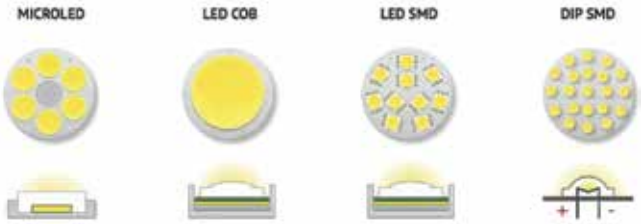
WHAT IS PHOTOCELL SENSOR?

Photocells are sensors that allow you to detect light; turning exterior lights on at sunset and off at dawn.

Because they sense ambient light levels, photocells automatically adjust to seasonal changes in the day/night cycle and are unaffected by daylight-saving time. Photocells controlling exterior lights combined with timers that turn on interior fixtures create the illusion of occupancy when you're not home and can deter intruders. Other photocell uses include turning on parking lot or street lights after dark, adjusting indoor dimmers to compensate for changing natural light levels or switching illuminated business signs on or off.

WHAT IS SMD AND COB?

SMD is short for surface mounted diode, commonly seen in light bulb and strip light, typically producing 4-5lm per diode on a chip, and it is often an array of LED on a PCB board. Therefore, SMD beam angle is wider than COB, but a frosted reflector is required to hide the array. COB is short for chip on board, which contains multiple diodes in a single wafer or chip. So, COB chips wattage can be made very high and require good thermal design to make efficient heat dissipation out of the wafer.



LED – LIGHT-EMITTING DIODE

A Light Emitting Diode (LED) is a semiconductor device, which can emit light when an electric current passes through it. To do this, holes from p-type semiconductors recombine with electrons from n-type semiconductors to produce light. The wavelength of the light emitted depends on the bandgap of the semiconductor material. Harder materials with stronger molecular bonds generally have wider bandgaps. Aluminum Nitride semiconductors are known as ultra-wide bandgap semiconductors.

INCANDESCENT LAMP

The incandescent light is your classic light bulb. It produces light by heating a wire filament to a temperature that results in the generation of light. The metal wire is surrounded by a translucent glass bulb that is either filled with an inert gas or evacuated (a vacuum).

FLUORESCENT BULBS

Fluorescent lighting usually is a tubular electric lamp having a coating of fluorescent material on its inner surface and containing mercury vapor whose bombardment by electrons from the cathode provides ultraviolet light which causes the material to emit visible light.

IES FILES

An IES file is a text file that describes the intensity of a light source at points on a spherical grid. It provides more photorealistic lighting effects in rendered images than other types of light distribution.

POWER

WHAT IS POWER FACTOR?

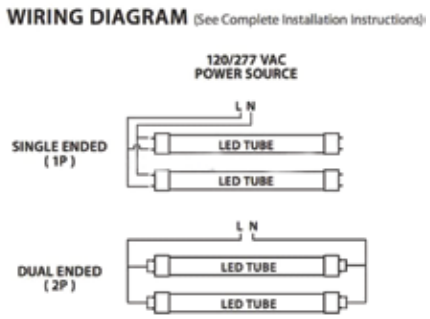
Power factor is a measure of the efficiency of power supply based on KVA reduction of the LED driver, the higher the rate is, the more efficient to transform the electricity into light. Power factor calculation is KW/KVA.

That is to say, the driver itself consumes less power. Usually, LED driver power factor is over 0.9.

WHAT IS SINGLE ENDED POWER? DUAL ENDED POWER? (DOUBLE ENDED POWER)

In single ended powered tubes, you power only one end. This type of installation is referred to as un-shunted. Since the tube has two pins on that end, you would send line to one pin and neutral to the other. (think of line and neutral as the black and white wires of electrical wire)

In double ended powered tubes, you power both ends, one with line source, the other with neutral. This type of tubes' installation is referred to as shunted.



WHAT IS 0-10V, 1-10V DIMMING?

0-10V is an analog lighting control protocol. Basically, a 0-10V control applies a voltage between 0- and 10-volts DC to produce a varying intensity level. The controlled lighting should scale its output so that at 10V, the controlled light should be at 100% of its potential full output, and at 0V it is at the lowest dimming level completely off. With a 1-10V dimmer, it cannot dim the light completely off, but will hold a 10% light output.

WHAT IS AC AND DC?

AC stands for alternative current; this is the electricity that is used in most homes and commercial spaces. It's often referred to as line voltage and number differs from country to country. US line voltage is typically 90V-220V. DC stands for direct current. Most LED strips on the market use low-voltage DC. A transformer or low-voltage battery is often required to step-down the AC voltage to a suitable level for the LED strips, which is normally 12V or 24V DC.

WHAT IS CONSTANT CURRENT & CONSTANT VOLTAGE?

A constant voltage power supply is an electrical power source that regulates voltage to a constant level. In the case of LED tape lights, a constant 12V or 24V, depending on the LED tape being used, would be required.

CONSTANT CURRENT DRIVERS

Constant current LED drivers are ideal for general lighting fixture applications in industrial, commercial, and residential environments where efficiency matters most. Constant current LED drivers maximize light output without over stressing the LEDs to provide consistent, even light. By controlling the maximum current going through the system, these LED drivers prevent thermal runaway.

These drivers are required when the driver is used to power the LED load directly. With constant current drivers, the output current is fixed by the driver, while the output voltage varies depending on the LED load. The more LEDs the driver is powering, the greater the output voltage will be, up to a maximum as allowed by the driver specifications.

CONSTANT VOLTAGE DRIVERS

These drivers are required when another LED current controlling device, such as a built-in resistor or regulating driver is already connected directly to the LED load. With constant voltage drivers, the output voltage remains fixed (typically at 12Vdc or 24Vdc) at any current level, up to a maximum allowable current, as dictated by the maximum output power of the driver.

To correctly select a constant voltage driver, you need to know the following:

• The MAXIMUM POWER required by the LED modules in the system equally the VDC of the output side of the driver.

• The total power consumption of the LED modules in the system must not exceed the MAX OUTPUT wattage of the LED driver. Best practices dictate the total wattage should be at least 10% higher than the maximum LED load on the driver.

480V VOLTAGE

480V 3 phase is an electrical power typically used in industrial and commercial settings. It is a high voltage system that can provide a lot of power to run large machinery or equipment.

120-277V VOLTAGE

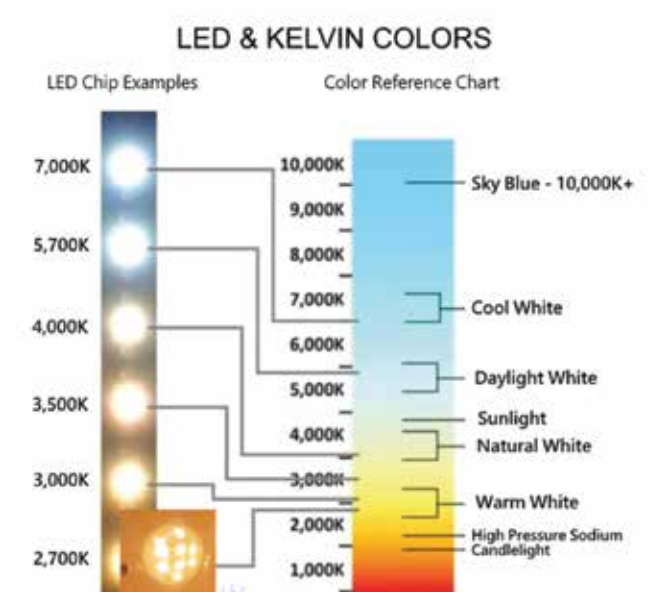
This means the driver will work on any voltage between 100 volts and 240 volts as well as 277 volts.

COLOR TEMPERATURE

WHAT IS COLOR TEMPERATURE (CRI)?

Color temperature is to describe the light appearance provided by a light bulb (lamp). It is measured in degrees of Kelvin (K) on a scale from 1,000 to 10,000. 2700K-3500K is warm white, 3500K-4500K is daylight/natural white, and over 5000K is referred to as cool white.

KELVIN RANGES IN LIGHTING AND THEIR BEST APPLICATIONS



6,500K – Daylight

Lights in the 6,500K range are noticeably blue, even deep in color giving off an energized and alert feeling. Color temperatures in this range are closest to light emitted from the sun and make these lights ideal for agricultural settings, especially indoor farming or growing.

5,000K – Bright White

Lights in this range give off bright white color and feel crisp and vibrant. These lights are ideal for use in warehouses, where adequate lighting is required and bright light is necessary for workers to perform tasks; sports fields and stadiums where games are sometimes televised and the need for crisp, bright light is high; and healthcare facilities like hospitals, dentist and doctor offices where crisp, bright lighting is necessary for healthcare professionals to perform serious tasks on patients.

4,100K – Cool White

Lighting in this color temperature range is cool white in color and gives off a clean and focused feeling. They are ideal for places where crisp lighting is necessary, including garages and grocery stores. Garages tend to be work spaces for many people, so having proper lighting that brings clarity to the space can provide a safer working environment.

Grocery stores tend to use lights that have higher temperature colors compared to retail stores to create a better environment for shoppers to read labels. This type of lighting also makes the colors on labels pop a bit, which can make the packaging more appealing to shoppers.

3,500K – Neutral White

Neutral warm, white lights are best used in office settings and retail stores as they give off an inviting yet balanced feel. The lights in this color temperature range are bright enough to keep employees in offices relaxed but alert enough to perform their work tasks. Retail stores tend to use warm white lighting because it is inviting and friendly for customers. Light in this range is still bright enough for shoppers to see labels and the true qualities of the products, but not too blue to make people look less flattering.

3,000K – Soft White

Lights in this color temperature range are soft white in color and tend to be used most in households, specifically in bathrooms and kitchens where bright light is not necessary. This type of lighting gives off a calm and warm feeling. Bathrooms do not require bright white lighting, especially with the presence of mirrors and glass that can create negative glare. Kitchens are gathering places for family and friends, so having soft and warm lighting temperatures create a warm, cozy and friendly atmosphere.

2,700K – Warm White

Lights in this range are a warm white in color and most common in other areas of the home, specifically in living rooms and bedrooms where people tend to spend their time relaxing. These lights give off an intimate, personal and cozy feel. They are also ideal for restaurants where ambient settings are preferred. Hotels also tend to use lighting in this color range because it mimics living room lighting, making the hotel inviting and friendly.

RETROFIT

WHAT IS HID LED RETROFIT?

LED retrofit refers to any renovation of an old HID bulb that has an Edison socket base E26 (medium) E39 (mogul) base such as: Metal halide (known as MH), High pressure sodium (known as HPS), Mercury vapor (known as MV) into LED lighting bulbs with E26 E39 base in order to keep the old lighting fixture and save cost.

PRODUCTS

WHAT IS UL TYPE A+B, TYPE A, TYPE B, TYPE C LED T8 TUBE?

Type A + B (Internal driver): 2ft, 3ft, 4ft, 8ft and U-bend LED "tubes" operate utilizing the existing fluorescent ballast and also have the ability to operate utilizing line voltage if the fixture is rewired to bypass the ballast. These tubes connect to the fixture using standard G13 pin-base connections to the lamp holders.

Type A (internal driver): 2ft, 3ft, 4ft, 8ft and U-bend LED "tubes" employing lamp holders to connect to the fixture being retrofitted and are designed to be "plug and play" replacements for 2ft, 3ft, 4ft, 8ft, T8, and T12 fluorescent lamps.

It operates utilizing an existing fluorescent ballast and does not require mechanical or electrical changes to the fixture. Type B (internal driver): 2ft, 3ft, 4ft, 8ft, and U-bend LED "tubes" employing lamp holders to connect to the fixture being retrofitted, but do not operate utilizing the existing fluorescent ballast. These products require rewiring of the existing fixture to bypass the ballast and send line voltage directly to the lamp holders.

Type C (external driver): 2ft, 3ft, 4ft, 8ft and U-bend LED "tubes" employing lamp holders to connect to the fixture being retrofitted.

Do not operate utilizing the existing fluorescent ballast and require rewiring of the existing fixture to replace the ballast with an external driver. The lamp holders are then wired to receive only the low- voltage electricity that is supplied by that external driver.

WHAT DOES BALLAST COMPATIBLE T8 BULB & BALLAST BYPASS T8 LIGHT BULBS MEAN?

Ballast compatible T8 tube can work directly with traditional ballast such as magnetic ballast or electronic ballast.

You don't need to remove the ballast, just screw the T12 or T8 fluorescent out and screw in the ballast compatible t8 tube, no need rewiring, no hassle, plug and play tube, very convenient.

While for the ballast bypass T8 tube, on the other hand, cannot work together with the ballast when retrofit the T8 T12 fluorescent. You need to remove ballast and starter, then direct wire to the LED tubes, in this way, it can work. Some ballast bypass T8 tube light is single ended power; others are dual ended power or double ended power; their wiring diagram is different. Therefore, hire a qualified professional electrician to retrofit T8 tube safely.

EMERGENCY BACKUP KITS FOR FIXTURES

Battery backup options for a range of fixtures, retrofits and high bays that provide emergency light in times of power loss. When an outage occurs, battery backup options automatically kick into action, delivering battery power to designated fixtures, providing up to 90 minutes of light to help guide the occupants of a space to safety.

In commercial applications and businesses, occupant safety is the top priority and in the event of a power outage, battery backup can provide the necessary light to ensure safety for everyone.

WATTAGE & COLOR TEMPERATURE SELECTABLE

Field-selectable or field-adjustable fixtures are lighting products that use LED technology to allow users to customize color temperature and lumen output. Lights can range from warm to natural to cool according to preference or to enhance a commercial environment.

Illuminating ENGINEERING SOCIETY

IES EDUCATIONAL OPPORTUNITIES

The Illuminating Engineering Society offers educational lighting courses throughout the United States.

IES Fundamentals of Lighting is offered throughout North America as a ten-module course designed to provide a foundation of light and lighting. Learn from experts to build a lighting vocabulary, and navigate key concepts in the practice of lighting including: lighting history, controls, codes, design, and more. We recommend seeking out this course in your local area to continue your lighting education, and the program offers IES CEUs, AIA LU's, and USGBC's CE.

FOL Around the Country
"Fundamentals of Lighting" is another valuable course.
Click this link to find events nearby:
https://www.ies.org/events/

LED LIGHTING PROJECT CHECKLIST

This checklist was created as a reminder of all the questions that need to be asked to ensure that we are supplying the customer the correct product for their particular project.

RETROFITS	ANSWER	ADDITIONAL COMMENTS
What style fixture is being retrofitted? Shoebox, wall pack, flood etc.		
What wattage is the existing lamp?		
What size, length and width is the existing lamp?		
What color temperature is needed?		
Is the existing socket medium or mogul etc.?		
Is the existing lamp horizontal or vertical?		
What is the voltage needed?		
Are there any damp or wet location needs?		
Is there a specific footcandle requirement?		
Is the client happy with their current light output or would they like to increase it?		
Are there any non-glare requirements?		
Is there a current contractor to do the install? IF NOT		
Can we assist with any utility rebates?		
Is it possible to get a cut sheet of the existing fixtures?		
Is the current fixture being dimmed?		
Is glare an issue? Should we supply a non-glare lamp?		
Is there a specific warranty needed?		
Are the fixtures on an emergency circuit?		
What is the approximate age of the current fixtures?		
What current issues does the client have with their existing lighting system?		
If there are compact fluorescent lamps what pin configuration are they?		

RETROFITS	ANSWER	ADDITIONAL COMMENTS
What beam spread is needed? See attached Light Beam Angle Chart Tab for detailed info.		
What is the height of the ceiling if indoors?		
If outdoors, what is the mounting height?		
Are these fixtures to be interior or exterior? If exterior are they under a canopy?		
What wattage is needed?		
What color lamps are needed? 3000K etc.		
Is there a specific footcandle requirement?		
Are the fixtures to be dimmed?		
Is there an existing dimming system? If so what brand?		
What is the voltage needed?		
Can we assist with any utility rebates?		
Do they have a current contractor to do the install?		
Is there a specific warranty needed?		
Will these fixtures be on an emergency circuit?		
Are occupancy sensor or photo electric sensors needed?		
Do you have a preference for direct or indirect lighting?		
What beam spread is needed? What beam spread is needed?		

This is not a manual but a guide for lighting education. This will be updated periodically as lighting technology changes and improves.

If you have any questions, please feel free to call us at 800-679-9243 and we will gladly try to answer your questions or solve your problem.

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