



LED Lighting Design & Specification Guide

Considerations for harsh and hazardous area applications



Represented By:





LED lighting design & specification guide for harsh and hazardous area applications

Not all LED luminaires are created equal.



Reliable lighting is a critical aspect of workplace safety. Lighting systems must provide high visibility while minimizing shadows and glare to help create a safe and productive work environment for your employees.

LED solutions are well known for their improved light quality, long life and low energy consumption. But lighting in heavy industrial applications can often present unique challenges, such as high vibration, extreme temperatures, corrosion, water, dirt and potentially explosives gases or dusts. Each of these factors can severely impact the lifetime and performance of LED luminaires.

Therefore, it is essential to partner with a lighting manufacturer with a proven track record in both industrial lighting design and harsh and hazardous area certifications.

Eaton is that partner.

This LED Lighting Design and Specification Guide details key factors to consider when selecting a manufacturer for industrial lighting, and demonstrates how Eaton's Crouse-Hinds series LED solutions are built to withstand the toughest conditions, deliver maximum lighting performance and safety, and reduce expensive maintenance costs.

De-risk your LED lighting investment with Crouse-Hinds series LED solutions

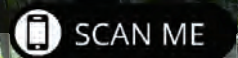
Key factors to consider for lighting reliability in challenging harsh and hazardous area environments

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For information on our global portfolio of innovative and reliable lighting solutions for harsh and hazardous areas,

Visit our website at www.eaton.com/lighting



Luminaire system design

Hazardous area light fixtures must meet specific safety standards, but these standards don't address luminaire performance and reliability. If your lights fail, workplace safety is compromised and maintenance costs rise significantly.

The following environmental challenges, and our corresponding system design methodology, demonstrate our commitment to delivering LED solutions that perform both safely and reliably for decades in the toughest operating conditions.

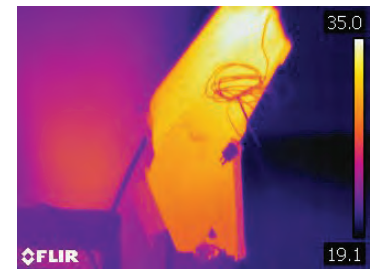


1 Effective heat dissipation / thermal management

A common misconception when considering fixture life is only accounting for the LED components. More often than not, the point of failure in an LED luminaire is the driver, and system construction along with ambient temperature figure heavily into driver lifetime.

LED luminaires operate much cooler than traditional lighting, but managing heat remains a major factor in maximizing lifetime. To ensure long life, LED luminaires should be constructed with robust and durable heat sinks that allow effective heat transfer from the LEDs to the ambient environment. Heat sinking, often designed as fins, allows for adequate air flow and increases the surface area for heat dissipation.

Effective thermal management will extend luminaire life, lower both lumen depreciation and color shift of the LEDs over time, and help obtain lower T-codes for luminaires used in explosive environments.



Thermal images of Champ-Pak CPMV LED wall pack

Our LED luminaires can take the heat

Crouse-Hinds series harsh and hazardous area LED fixtures are designed with high quality, die cast aluminum housings that provide an optimal thermal path to the heat sink assembly.

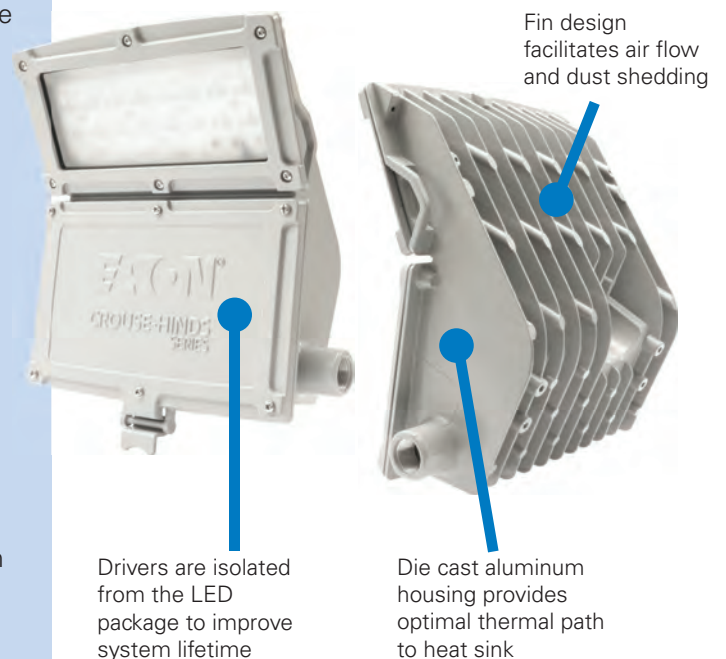
- Robust heat fins
- Ensures proper air flow
- Facilitates dust shedding

We also isolate the driver from the primary heat source (LED engine) in all our LED luminaires.

- Helps improve heat dissipation
- Helps reduce junction temperature

Our optimized thermal design, coupled with the rated life of our LED and drivers, means that the economic life of Crouse-Hinds series LED luminaires can be up to 170,000 hours at ambient temperatures between 25°C and 55°C.

Our design philosophy does not rely on thermal compensation to reach the product temperature ratings. This means you won't have to lower the luminaire's light levels to operate safely in applications with extremely high temperatures.



2 Superior corrosion resistance

Corrosion control can mean the difference between a trouble-free lighting installation and costly equipment failure. While corrosion in industrial environments is inevitable, all Crouse-Hinds series LED fixtures are manufactured using materials and finishes that provide the most efficient combination of strength and resistance to corrosive agents like water, acids, alkalies, salts and gases. Our decades of experience in corrosion control can help you reduce costly repairs and safety issues due to loss of light.



Copper-free aluminum housings with epoxy powder coat finish provides superior corrosion protection

Crouse-Hinds series LED housing materials

Copper-free aluminum:

Copper-free aluminum provides optimum protection against galvanic corrosion and is particularly resistant to salt atmospheres, sulfur gases and ammonium nitrate. Our copper-free aluminum alloy contains a maximum of 4/10 of 1% copper. Above this level, the rate of corrosion due to galvanic action within the structure of the metal increases rapidly.

Fiberglass-reinforced polyester:

Available in our LED linear portfolio, our proprietary formulation of fiberglass-reinforced polyester is designed for use in the harshest corrosive environments. Our GRP material is corrosion and heat resistant, fire retardant and withstands weathering over extended periods of time.

Crouse-Hinds series LED material finishes

Corro-free™ epoxy powder coat:

Crouse-Hinds series copper-free aluminum LED luminaires are all available with our Corro-free epoxy powder coat finish. The finish is applied electrostatically, resulting in a uniform coating that reduces galvanic action and provides superior adhesion over typical enamel, lacquer, aluminum paint or epoxy paint.

Don't forget about the screws and gaskets! All Crouse-Hinds series LED luminaires feature stainless steel hardware and silicone gaskets, which deliver excellent corrosion resistance to most chemicals and vapors. This helps reduce potential hassles and labor delays that can be caused by corroding steel hardware when accessing luminaires for routine maintenance or inspection.

3 Reliability in extreme ambient temperatures

The ambient temperature of your application is another important factor to consider when selecting luminaires for harsh and hazardous areas. Extreme high or low temperatures can heavily impact the lifetime of a light fixture if it is not properly designed and tested for such conditions.

Verify that the luminaire's certified operating temperature range aligns with the maximum or minimum ambient temperature experienced in your application.

Our entire portfolio of Crouse-Hinds series LED luminaires is tested and certified for use in both high and low ambient temperatures. Many of our LED families are rated to +65°C for extreme heat applications. So no matter where your lighting application is located, we have an LED solution that will perform safely and reliably for years.



Luminaire system design

4 Temperature ratings

When designing or specifying luminaires for hazardous areas, you must take into consideration the ignitable properties of the specific explosive hazard that will be present. The operating temperature of the luminaire must not exceed the ignition temperature of the gas, vapor, or dust encountered.

The National Electrical Code® requires that all heat producing equipment used in classified areas be marked to indicate its operating temperature or temperature range during use, identified by a “T-rating” number*. Products often have T-ratings for multiple ambient temperatures, as well as for the “simultaneous presence” of different hazards.

If the T-rating for your selected light fixture (*at the applicable ambient temperature*) is lower than the ignition temperature of the identified hazard, then the fixture is thermally suitable for that classified area.

Our Crouse-Hinds series LED portfolio delivers industry-leading T-codes. The cooler operating temperatures ensure safe, reliable operation in hazardous areas, including locations where ambient temperatures exceed 40°C. These applications may include indoor areas with high ambient temperatures, and outdoor areas with high atmospheric temperatures and direct sunlight.

Temperature classification according to NEC/CEC

Maximum temperature		Temperature class (T-code)	
°C	°F	Division	Zone
450	842	T1	T1
300	572	T2	T2
280	536	T2A	
260	500	T2B	
230	446	T2C	
215	419	T2D	
200	392	T3	T3
180	356	T3A	
165	329	T3B	
160	320	T3C	
135	275	T4	T4
120	248	T4A	
100	212	T5	T5
85	185	T6	T6

* Exceptions for when temperature ratings are not required to be marked can be found in NEC 501.130(B)(1) and NEC 502.130(B)(2).

5 Protection against water & dust ingress (Environmental ratings)

Lighting installations in harsh and hazardous areas commonly encounter windblown dust, rain, splashing water, and even hose-directed water during washdowns. It’s critical that the luminaires you select be designed and certified to keep water, dust and debris from entering the housing or lens and causing costly damage. A luminaire’s gaskets play a key role here.

The following two widely-used standards have been developed and adopted to specify an enclosure’s degree of protection against water and dust ingress.

IEC Ingress Protection (IP) Ratings

First number		Second number	
Degree of protection against solid objects		Degree of protection against liquids	
0	No protection	0	No protection
1	Objects equal to or greater than 50mm	1	Vertically dripping water
2	Objects equal to or greater than 12mm	2	Dripping water when tilted up to 15°
3	Objects equal to or greater than 2.5mm	3	Spraying water
4	Objects equal to or greater than 1.0mm	4	Splashing water
5	Dust protected	5	Water jets (6.3mm nozzle)
6	Dust tight. No ingress of dust; complete protection against contact	6	Heavy seas or powerful jets of water (12.5mm nozzle)
		7	Immersion in water up to 1m for 30 min
		8	Prolonged or indefinite immersion
		9K	Close-range high pressure, high temperature spray downs



Our Pauluhn DLL LED linear undergoing 2000psi high pressure hose test at 5 feet (1.5m) for 30 minutes

NEMA Enclosure Type Ratings common to industrial luminaires

Type	Fixture use	IP Equivalent
NEMA 3	Outdoor – rain, sleet, windblown dust, external formation of ice	IP54
NEMA 4	Indoor/outdoor – windblown dust and rain, splashing water, hose directed water, external formation of ice	IP66
NEMA 4X	Indoor/outdoor – windblown dust and rain, splashing water, hose directed water, external formation of ice, corrosion	IP66
NEMA 12	Indoor – circulating dusts, falling dirt, dripping oil, non-corrosive liquids	IP52

IP66 and NEMA 4X standard on Crouse-Hinds series LED luminaires!

How do we do it? All our gaskets are selected based on a chemical compatibility test with the relevant LED family. Our LED fixtures are then subjected to marine hose testing, which goes above and beyond standard IP testing. Gaskets used in luminaires certified for Class II, Division 1 locations undergo testing in accelerated aging conditions. And we seal our wire entries in the LED cavity to provide an additional layer of protection against humidity buildup in the conduit systems.

Additionally, many of our LED luminaires are engineered with special features designed to help specifically with water and dust shedding, such as angled housings and cone pendant mounting modules.



Angle housings and cone-shaped top hats mitigate water, dust and debris build-up

6 Vibration and Impact Resistance

Exposure to constant vibration, or unintentional impact or shock, could lead to premature failure if a luminaire is not properly designed and tested for these scenarios. At a minimum, light fixtures for use in harsh and hazardous areas should be tested and certified to UL 844, which includes a 35-hour vibration test at 2,000 cycles per minute.

Eaton's Crouse-Hinds Division exceeds UL 844 single-axis vibration standards by subjecting all our LED luminaires to an additional 6-hour, 3-axis vibration test at an acceleration of a least 1G.

To test luminaire durability against impact, we drop a 1kg weight onto the lens from 40cm (~15"), and verify that the lens shows no signs of damage.

With testing procedures that surpass industry standards, you can rest assured that Crouse-Hinds series LED luminaires will provide industry-best reliability no matter the operating environment.

7 Surge Suppression

Lightning strikes and current surges pose a costly threat to facility lighting systems. To protect against this, Crouse-Hinds series LED light fixtures are designed with built-in 4kV to 6kV surge suppression. This eliminates the need for additional protective devices.



Optics, Light Quality and Lenses

Installing LED luminaires in your workplace should result in improved illumination and light quality, as well as increased operator comfort. However, if quality optics, LED component selection, lens material, and direct light intensity are not factored into a luminaire's design, the result may be inconsistent color, wasted light, unwanted shadows & dangerous glare.

Read below to learn about important optics considerations and how Crouse-Hinds series LEDs help you minimize fixtures and maximize light distribution & uniformity.



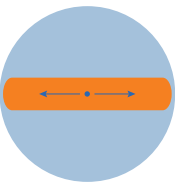
1 Optics that direct light where you need it

LEDs are highly directional, making them an excellent choice for precise area and task lighting in hazardous and heavy industrial environments. The optics design of an LED luminaire plays a critical role in providing efficient and optimized light distribution for individual applications. Look for luminaires with secondary optics available in specific beam patterns, as this will help eliminate gaps and dark spots, as well as reduce the number of light fixtures required in your application. Secondary optics will also reduce glare, ideal for applications which need constant human interface such as control rooms and monitoring stations with reflective computer screens.

Standard classification systems for light distribution patterns exist to help lighting designers and specifiers select the proper luminaire for their application. For area and roadway applications, the Illuminating Engineering Society of North America (IESNA) introduced a system of lighting "Types" that makes it easy to identify a fixture's distribution pattern. Floodlights and spotlights utilize a standard from the National Electrical Manufacturers' Association (NEMA), which classifies a fixture's horizontal and vertical light spread.

Below are common secondary optic beam patterns used across our LED portfolio, along with the types of industrial applications they are best suited for.

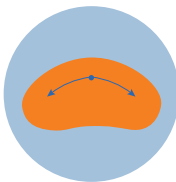
Type I distribution



Long and rectangular

- Mining conveyor belts
- Aisle ways & hallways
- Catwalks & walkways
- Ramps & loading docks
- Tunnels

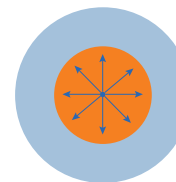
Type III distribution



Outward projection with minimal spillover on wall

- Narrow crosswalks or passages with wall fixtures
- Tunnels with wall mount
- Wall stanchion mount with 180° forward throw

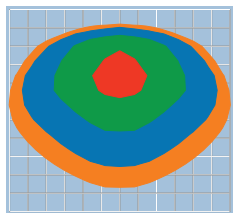
Type V distribution



Circular distribution

- Pendant, ceiling or stanchion mount overhead building
- Processing mills, industrial plants, large buildings, warehouses

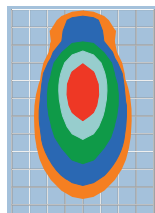
NEMA 7x6 distribution



Very wide spread

- Areas requiring large, even light levels with no "hot-spots"
- Very common pattern. Allows users to space light poles farther apart, saving money

NEMA 3x3 Distribution



Narrow & long spread

- Illumination of a specific object or piece of equipment from a greater distance

Our custom optics maximize directional light distribution

We engineer our Crouse-Hinds series harsh and hazardous area LED fixtures with custom optics *designed for each discrete LED power emitter*.

In addition to Types I, III, and V for our area lighting & NEMA 7x6 and 3x3 for our floodlights, our linear fixtures are available with narrow and wide beam optics. So whether you're lighting a conveyor belt, catwalk, tunnel, loading dock, processing area or warehouse, the result is improved workplace illumination, reduced glare, and minimized light spill.



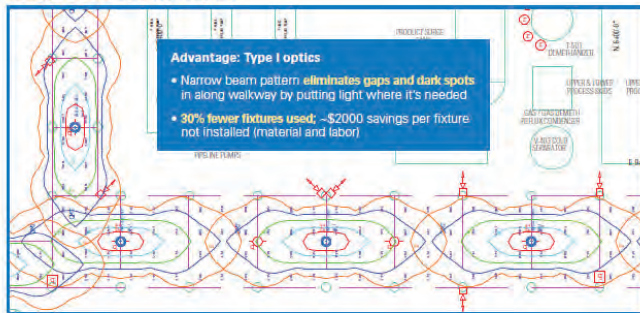
Type III optics on our Champ VMV LED minimize light spillover onto the walls and direct light to the ground where it's needed

Selecting the right optic for your application can have a significant impact on your investment - A real world example

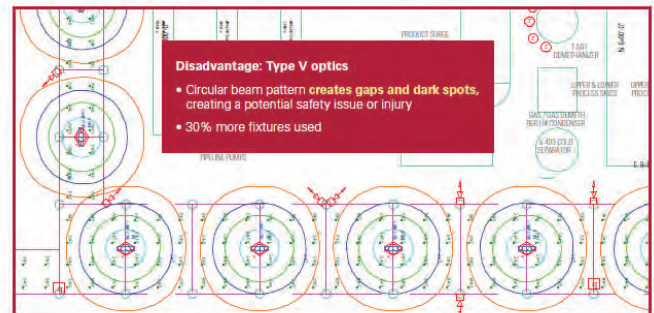
The lighting layouts below were developed by the Lighting Design team at Eaton's Crouse-Hinds Division for a cryogenic processing plant looking to eliminate dark areas on walkways underneath their pipelines. As you can see, our VMV LED luminaires with Type I optics delivered a linear beam pattern along the work plane, eliminating gaps and dark spots. And, because our optics distributed the light where it was needed most, the facility was able to reduce the necessary fixture count by 30% and realize significant savings on the overall lighting upgrade.



Champ VMV7L with Type I optics



Competitor with Type V optics



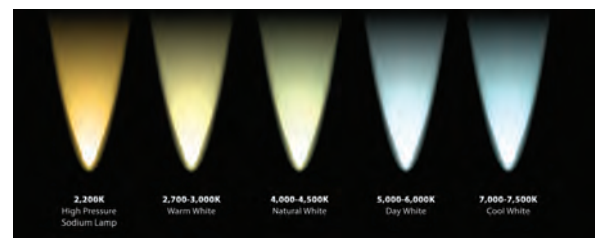
2 Color temperature, color rendering and footcandles

To ensure that an LED luminaire will provide high quality lighting, it's critical to understand and evaluate these three key measurements.

Color Rendering Index (CRI) - Per the Illuminating Engineering Society of North America, color rendering indicates the degree to which a light source shows the true colors of the objects it illuminates. It is expressed on a scale of 0-100. The higher the CRI, the truer people and objects will look. Though not required for every industrial lighting application, a high CRI is typically considered beneficial.

CRI values for industrial LED luminaires will vary by manufacturer due to the components used. Our recommendation is to select luminaires with a CRI value of 70 to 80, as this will provide accurate color and a safe work environment for performing precision tasks.

Correlated Color Temperature (CCT) - Color temperature refers to the degree of yellowness or blueness in the illumination hue. This is the "look" of the light, and it is measured in Kelvin. Ratings at the lower end of the Kelvin scale (~2000-3000K) are more yellowish in color and are referred to as "warm white". LEDs at the higher end of the scale (5000K+) are typically white to light blue in color and referred to as "cool white".



Color temperatures in the Kelvin scale

Because desired color temperature varies by application and customer preference, a reliable manufacturer will offer several color temperature options across their LED families.

Footcandles - Often with LED luminaires a heavy emphasis is put on lumens (the total amount of light output from a specific angle). However, this can be misleading. With LED being such a directional light, it requires fewer lumens than traditional light sources. Even when comparing LED fixtures across manufacturers, luminaire construction and optics play a major role in producing *productive* light, and a pure lumen-to-lumen comparison is not always relevant.



Instead, designers and specifiers should focus on a fixture's footcandles, which measures the usable light on the work plane. Footcandle readings tell you the amount of light actually illuminating the various areas of your installation.

Optics, Light Quality and Lenses

3 Dark Sky Friendly by design to minimize light pollution

According to the International Dark-Sky Association (IDA), light pollution is the inappropriate or excessive use of artificial light, and it can have serious environmental consequences for humans, wildlife, and our climate. Light pollution is made up of 4 primary components:

- **Glare** – excessive brightness that causes visual discomfort
- **Skyglow** – brightening of the night sky over inhabited areas
- **Light trespass** – light falling where it is not intended or needed
- **Clutter** – bright, confusing and excessive groupings of light sources

To combat light pollution, the IDA and Illuminating Engineering Society have developed *Five Principles for Responsible Outdoor Lighting*. Applying these principals to your design will help ensure that your lighting installation is functional while minimizing light pollution and wildlife disruption.

LIGHT TO PROTECT THE NIGHT
Five Principles for Responsible Outdoor Lighting



USEFUL		<p>ALL LIGHT SHOULD HAVE A CLEAR PURPOSE</p> <p>Before installing or replacing a light, determine if light is needed. Consider how the use of light will impact the area, including wildlife and the environment. Consider using reflective paints or self-luminous markers for signs, curbs, and steps to reduce the need for permanently installed outdoor lighting.</p>
TARGETED		<p>LIGHT SHOULD BE DIRECTED ONLY TO WHERE NEEDED</p> <p>Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.</p>
LOW LIGHT LEVELS		<p>LIGHT SHOULD BE NO BRIGHTER THAN NECESSARY</p> <p>Use the lowest light level required. Be mindful of surface conditions as some surfaces may reflect more light into the night sky than intended.</p>
CONTROLLED		<p>LIGHT SHOULD BE USED ONLY WHEN IT IS USEFUL</p> <p>Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.</p>
COLOR		<p>USE WARMER COLOR LIGHTS WHERE POSSIBLE</p> <p>Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.</p>

[www. https://www.darksky.org/joining-forces-to-protect-the-night-from-light-pollution/](https://www.darksky.org/joining-forces-to-protect-the-night-from-light-pollution/)

Crouse-Hinds series LED luminaires are Dark Sky Friendly by design

Below are few of the solutions we offer to help reduce light pollution and improve quality of life

Adaptive Controls	Custom Optics	Floodlight Visors	Warm White light	Lighting Layouts
 <p>Eliminate over usage of light and adjust light levels</p>	 <p>Direct light to only where it is needed.</p>	 <p>Minimize skyglow and light trespass</p>	 <p>Reduce over-lighting of areas and reflection</p>	 <p>Precise, efficient & environment-appropriate lighting designs</p>

4 Lens options that align with application requirements

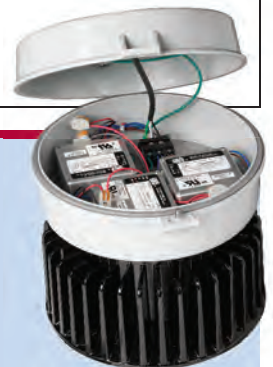
A luminaire's lens is another important factor in the overall quality and safety of an industrial lighting installation. While a clear glass lens is most common, it may not always be the best option for every application or market. A clear lens could result in unwanted and dangerous glare, depending on the luminaire's mounting height. Glass may not perform well in areas prone to impact or shock. And some specific industries, such as food & beverage, have additional safety requirements to take into consideration.



Crouse-Hinds series LED luminaires are available in a variety of lens materials and finishes to meet customer requirements or preferences. Read below to learn more about each option.

Champ VMV LED with diffused glass lens

Lens materials:	Lens finishes	Lens coating:
<p>Glass:</p> <ul style="list-style-type: none"> Reliable in both high and low temperatures Better resistance to chemicals & cleaning solvents Durable, but will shatter if broken <p>Polycarbonate:</p> <ul style="list-style-type: none"> Excellent impact resistance Provides reduction in weight Prolonged exposure to high heat and UV may cause discoloration 	<p>Clear:</p> <ul style="list-style-type: none"> Excellent optical performance Maximizes light output Glare and light intensity may be an issue <p>Diffused:</p> <ul style="list-style-type: none"> Eliminates glare in low mounting height applications Aesthetically pleasing Reduces overall lumen output and efficiency 	<p>Teflon or laminate:</p> <ul style="list-style-type: none"> Coating contains glass if lens breaks and prohibits shards from falling into the process area More commonly used in food & beverage and pharmaceutical applications Available with select Crouse-Hinds LED families



5 Driver design, redundancy & field replaceability

Drivers are used to power a luminaire's LEDs by stepping down the incoming voltage and converting it from AC to DC. They also protect the LEDs from fluctuations in current and voltage. Drivers are a critical component in the overall efficiency and longevity of a lighting fixture.

When evaluating harsh and hazardous LED luminaires for your installation, be sure to check the power factor and total harmonic distortion (THD) of the driver.

Power factor (PF) measures how much energy is converted into useful power in the LED driver, and it's identified by a number between 0 and 1. The higher the number, the more efficiently the driver is using electricity. We recommend using luminaires with a power factor of 0.90 or higher.

Total Harmonic Distortion (THD) indicates how efficiently the driver minimizes interference to other electrical equipment, and it should be as low as possible. A low THD indicates higher power factor, lower peak currents and temperatures, and higher efficiency.

Our drivers help ensure a safer, more reliable lighting system

- High efficiency **PF > 0.90**
- THD < 20%** minimizes electromagnetic interferences with equipment/machinery
- 4-hour burn-in** requirement on ALL drivers ensures component reliability
- Drivers are separated from the LED subassembly, allowing for **easy replacement in the field**, minimizing maintenance costs
- Built-in 4 to 6 kV surge protection** eliminates the need for additional protection devices. We recommend additional surge protection be handled in the panel

Installation & Maintenance Ease

Installing and maintaining lighting in industrial facilities is often a complex and costly task, as the majority of the fixtures are in dangerous and difficult to reach locations. Elevated mounting heights, obstacles, and other challenges can drive up both the dangers and the costs associated with these tasks.

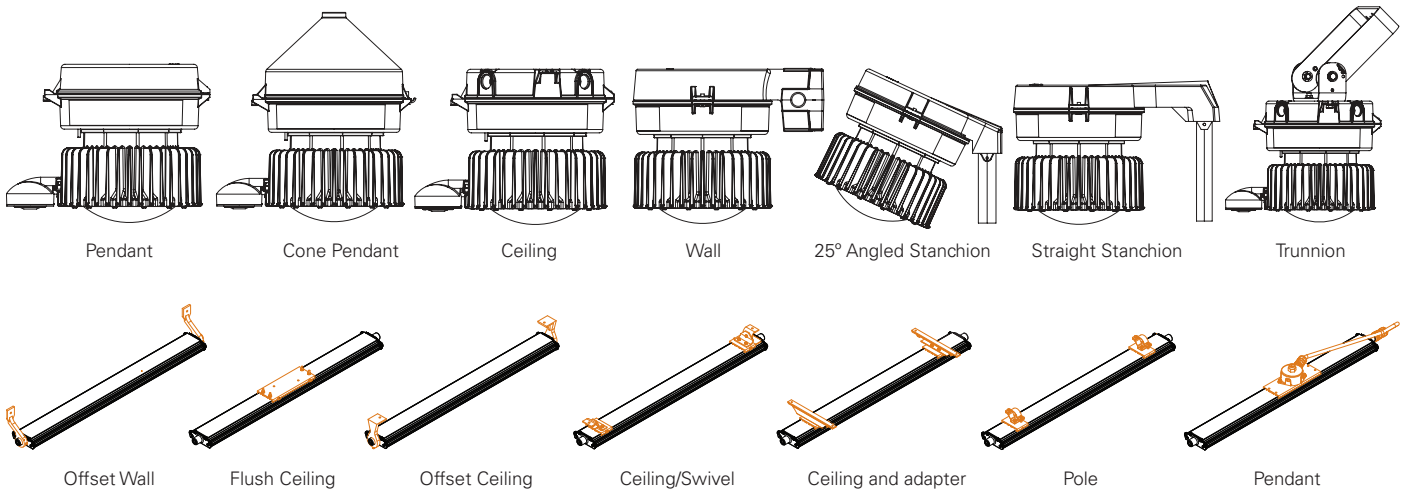
Be sure to evaluate a luminaire's mounting and wiring features. A well-designed light can reduce installation effort and significantly lower labor costs. This is especially important with retrofit projects, where labor costs are a key factor.



Crouse-Hinds series LED luminaires are designed with specific features to provide mounting flexibility and improve the speed and safety of the installation process.

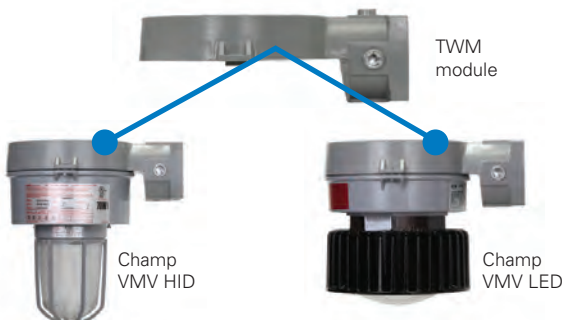
1 Multiple mounting modules for ideal luminaire placement

Fixture location placement and the proper mounting height are essential to designing a lighting installation that provides uniform illumination with minimal glare and light trespass. The numerous mounting styles available from Eaton's Crouse-Hinds Division offer unparalleled flexibility, ensuring that the fixtures are installed in the correct location to properly light your application.



2 Backward compatibility for simplified retrofits

Crouse-Hinds series LED luminaires utilize the same mounting modules as our legacy HID, fluorescent and incandescent products, simplifying installation and significantly reducing costs in retrofit projects. We also offer mounting adapters and kits for quick connection to other manufacturers' modules.



3 Wiring features that reduce installation effort

We engineer our LED luminaires to be as installation-friendly as possible. The features below help reduce installer effort, stress, and potential injury.

- Hinged support allows luminaire to hang from mounting module during wiring
- Lever lock connectors and terminal blocks for fast, plug and play wiring
- Quick clip accessory supports weight of the fixture during final tightening to the mounting module
- Quick-connect wire-free +ve/-ve connections between LED and mains (EVLL LED only).



4

Poles that eliminate the dangers of working from heights

For lights in elevated locations, OSHA/HSE regulations require fall prevention equipment any time a worker is exposed to a fall of six feet or greater. Since 2000, the #1 most frequently violated OSHA standard each year is General Requirements for Fall Protection. And while personal protection equipment will help protect workers from threat, there is still a risk of injury from a fall. Preventing the worker from being exposed to the threat altogether is the most effective risk-reduction measure.

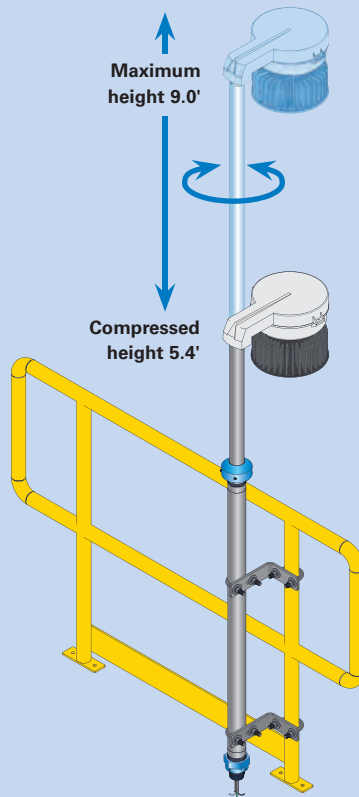
Safety lowering poles are an effective way to **transition from protecting the worker to eliminating the risk**. By enabling the luminaire to be lowered, the safety pole allows all installation or maintenance work to safely take place on the platform or walkway. This eliminates the timely and costly need for fall protection equipment and portable ladders or scaffolds.

Safety lowering poles are a good option for industrial lighting applications in hard to reach areas, as well as for any luminaires installed on walkways, platforms, stairways and conveyors where OSHA/HSE regulations require fall prevention equipment.

Make lighting installations safer, faster & easier with Crouse-Hinds series V-Spring telescoping light poles

Our patent-pending V-Spring light poles increase safety and decrease labor costs associated with lighting installation and routine maintenance.

- Spring assistance allows the luminaire to be lowered safely and easily – **eliminating the need for portable ladders and fall prevention equipment**.
- When compared to 45 degree lowering systems, the V-Spring's spring assisted vertical movement requires **65% less force to raise or lower and removes mechanical stress on the handrail by over 300%**.
- Easily extend to any height up to 9 feet – one product covers multiple mounting heights
- 360° pole rotation allows for effortless positioning of light
- Spring assist provides true controlled lowering and requires less force to raise or lower luminaire – no strain on worker
- Fixture housing will not fall from mounting module hinge hook during installation or maintenance
- No pinch points – protects hands and fingers
- 2" bottom pole for higher structural wind ratings
- Internal conduit protects wiring from spring assist mechanism
- Drain at bottom of pole assists in preventing moisture from entering conduit system
- Factory assembled wired and sealed for maximum environmental protection



Connected Technology

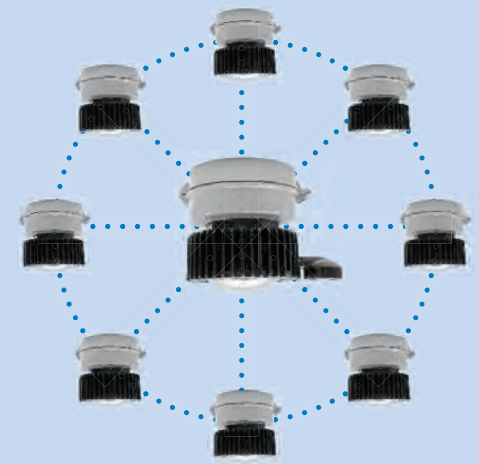
New connected technologies for harsh and hazardous lighting can help optimize your industrial lighting applications based on space and specific usage requirements.

Connected lighting helps reduce over-usage of luminaires, by allowing you to use light only where and when you need it. This can have a significant positive impact on energy efficiency and overall fixture life due to reduced run time.



We combined our advanced LED luminaires with communications and sensing technology to put full lighting control at your fingertips, allowing you to maximize energy savings and minimize maintenance costs.

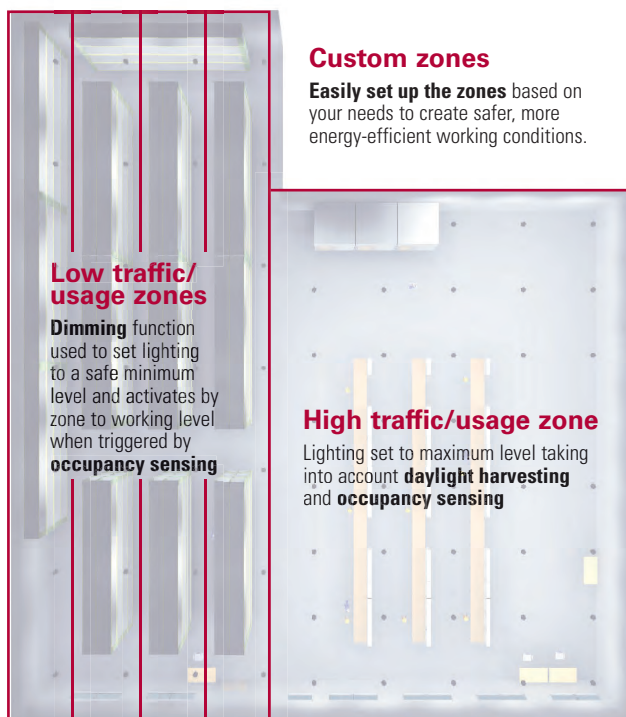
- **Advanced scheduling control** allows for improving energy efficiency during non-operational hours. Set up schedules for lights to be on and off at predefined times, removing the challenges of manual management.
- **Daylight harvesting** allows for use of the daylight and auto-adjusts the luminaire to maintain the desired light levels. It is best suited for outdoor environments or indoor areas where daylight is present during operational hours of a facility.
- **Fixture grouping** maximizes control in a defined area. By grouping luminaires, same control settings can be applied to them to increase efficiency and response time.
- **Occupancy sensing** automatically illuminates an area once presence is sensed and turns lights off when sensors stop detecting the presence.
- **Advanced dimming controls** help reduce energy consumption by lowering light output levels.



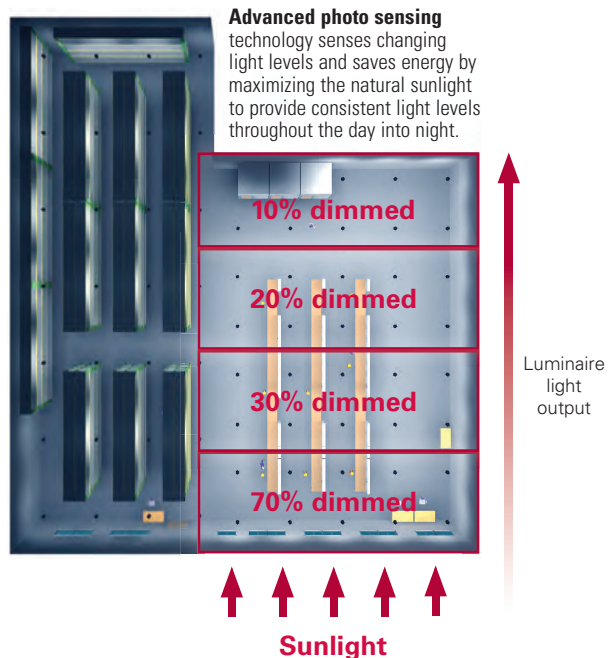
Connected lighting application example:

Multi-use area with high traffic production area and minimally used warehousing

Advanced scheduling and occupancy sensing



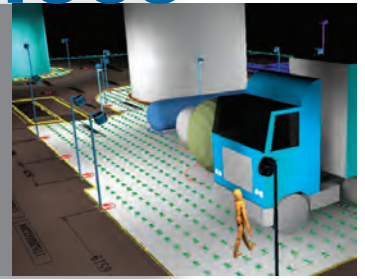
Daylight harvesting



Design and Support Services

Industrial lighting design and specification can be a complex, time consuming and labor-intensive process. Look to partner with a lighting manufacturer that offers services designed to simplify, streamline and speed up this process.

Eaton can be that partner, as we offer a number of convenient resources and services to reduce effort for Engineers, Designers and Drafters.



1 Complimentary lighting layout, analysis and design

From simple layouts to complex drawings, our Lighting Design Engineers deliver precise, efficient, application and environment-appropriate lighting designs. Our experts can save you time and money by creating a virtual model of a proposed design, revealing luminaire characteristics and effects within the installation.

- 3D fixture placement with access to alternate fixtures and mounting heights
- Point-by-point footcandle diagram calculations
- AutoCAD®-generated floor plan overlays
- Complete bill of material



2 3D Drawing and Design

Our CoSPEC online 3D design catalog offers the ability to select and view Crouse-Hinds series products in 2D and 3D formats. Then, with just a few clicks, you can download design content and parametric data in one of 100 different CAD, BIM, PDMS and graphics formats. File outputs are native to the chosen software, which eliminates translation errors and speeds the integration of the content into your project.

With CoSPEC, you can:

- Configure products to exact base catalog number/SKU.
- View your chosen product in 2D or 3D.
- Download 2D drawings or 3D models for integration into your design packages.



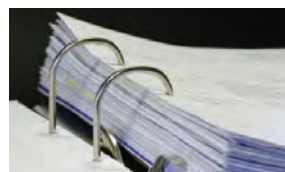
3 ROI Calculators

Utilize our online cost calculators to determine your specific savings realized with Eaton's Crouse-Hinds series LED light fixtures. These calculators allow you to enter design parameters unique to a project and view the specific savings and payback period realized.



4 Specification Guide Forms

Written to CSI guidelines, our Specification Guide Forms are ideal for designers whose customers have out-of-date or incomplete spec libraries. They're a quick and easy way to optimize the safety, reliability and efficiency of your design requirements.



5 Try Before You Buy Program

This program gives customers the chance to install and experience a Crouse-Hinds series LED fixture with NO RISK. Customers are given 60 days to try the luminaire before they are invoiced.

Any customer not satisfied may return the fixture within the 60-day trial period at no charge.



Additional Reference Info

Understanding LED component and system lifetime

LEDs are not likely to fail and burn out like traditional light sources. LEDs gradually decrease over time until they no longer produce useful light. End of life for an LED is the first time the fixture requires maintenance, which would likely be due to a noticeable decrease in light output or a driver failure, resulting in a lack of light output. Understanding L70 and LM-80 can help you evaluate LED fixtures.

Projecting LED life

L70 Rating

By industry standards, an LED light source is considered end of life when it loses 30% of its light, or what is known as the L70 rating. The L70 rating is calculated with data provided by an LED component manufacturer's LM-80 report and extrapolated using an industry accepted TM-21 calculator.



LM-80 standard

LM-80 refers to a method for measuring the lumen depreciation of solid-state light sources, such as LED packages, modules, and arrays. When an LED is manufactured, it must be entered into a series of tests at 3,000, 6,000, and 10,000 hours to measure performance at multiple temperatures and amperages.

After LM-80 testing is complete, the luminaire manufacturer can use it to generate a TM-21 report, which provides LED life projections in a luminaire. The TM-21 report uses statistical analysis and LED performance info, defined by the LM-80.

After the LED has been selected for the light fixture, its performance is measured to validate light output, LED junction temperature, and case temperature. The LM-80 data is used with this additional data to define the L70 rating of the LED.

A common misconception when considering fixture life is only accounting for the L70 rating. More often than not, the point of failure is the driver. Driver life is estimated using MTBF or accelerated thermal test data at elevated ambient temperatures which are then extrapolated using Bellcore or Milspec standards.

Fixture lifetime must take into account the lifetimes of both the LEDs and the driver. System construction, along with ambient temperature, figure heavily into fixture lifetime.

Projecting fixture/system life

Rated Life

Defined as the maintenance-free life of an LED fixture under worst-case operating conditions (fixture is always on, with a constant temperature environment typically at 55°C).



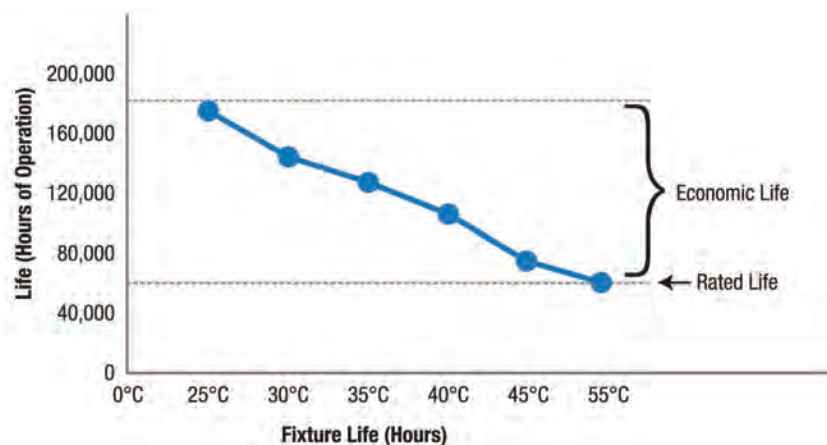
Economic life

The period of operation before fixture failure.

The biggest variable between rated and economic life is temperature, with rated life at a worst-case temperature, versus economic life where temperature will vary according to the actual installation.

The economic life of LED luminaires can be substantial. For example, at an ambient temperature of 40°C, the economic life of a Crouse-Hinds series LED fixture could be as long as 100,000 hours. At 25°C, the economic life would increase to 170,000 hours.

Economic life is an important concept when defining the total cost of ownership of an LED light luminaire. The figure below illustrates the relationship between economic and rated life.



Selecting the appropriate lumen levels

The tables below present basic guidelines for our recommended lumen levels according to a fixture's mounting height and when replacing an HID or fluorescent luminaire.

However, each lighting application is unique, and specific conditions will impact the information below. Contact our Lighting Application specialists for assistance with developing a lighting layout design that meets your exact needs and expectations. [Click here to learn more about our complimentary lighting analysis and design support.](#)

Mounting height

Mounting Height	Recommended Lumens	Recommended Crouse-Hinds series LED luminaires		
		NEC Division 1 & 2	IEC Zones 1 & 2	Harsh (Ordinary) Location
9-12 feet	3,000 lumens or less	Vaporgard V2L/V3L LED Champ VMVL3* Champ FMVA3* or CPMV3L	CEAG ExLin 3L-1 HPL-3L / HPLN-3L NLE-3L	Vaporgard Pro P2L/P3L LED Champ Pro PVML3 or WPMV3L Champ Pro PFMA3 PLE-3L
12-15 feet	5,000-7,000 lumens	Champ VMVL5* or Champ VMVL7* L Champ FMVA5* or CPMV5L Champ FMVA7* or CPMV7	CEAG PXLED5L CEAG ExLin 5L-1, 5L-2 HPL-5L / HPLN-5L NLE-5L	Champ Pro PVML3 or WPMV5L Champ Pro PFM5 PLE-5L
15-20 feet	7,000-11,000 lumens	Champ VMVL7, VMVL9, VMVL11* Champ FMVA7, FMVA9, FMVA11* Champ CPMV7L	CEAG PXLED10L CEAG ExLin 7L-2 HPL-8L / HPLN-8L NLE-8L	Champ Pro PVML7, PVML9, PVML11 Champ WPMC7L Champ Pro PFMA7, PFMA9, PFMA11 PLE-8L
18-30 feet	13,000-15,000 lumens	Champ VMV13L* Champ FMVA13, FMVA15*	CEAG PXLED15L	Champ Pro PVM13L Champ Pro PFMA13, PFMA15
25-40 feet	17,000-25,000 lumens	Champ VMV17L, VMV21L, VMV25L* Champ FMVA20, FMVA25*	CEAG PXLED20L, PXLED25L	Champ Pro PVM17L, PVM21L, PVM25L Champ Pro PFMA20, PFMA25
40 feet & up	40,000-50,000 lumens	Champ FMVA40, FMVA50*		Champ Pro PFMA40, PFMA50

* Champ VMVL and Champ FMVA luminaires are also certified for IECEx/ATEX applications

Replacing HID †

HID Lamp	LED Lumen Range
50 Watt	2,000
70-100 Watt	3,000
100-150 Watt	5,000
150-175 Watt	7,000
175-250 Watt	9,000
250-320 Watt	9,000-11,000
320-400 Watt	11,000
400-500 Watt	13,000-15,000
600-750 Watt	17,000-21,000
750-1000 Watt	25,000
1000-1500 Watt	40,000-50,000

† See "Mounting Heights" table above for recommended Crouse-Hinds series LED area lights

Replacing fluorescent

Fluorescent Lamp	LED Lumen Range	Recommended Crouse-Hinds series LED luminaires		
		NEC Division 1 & 2	IEC Zones 1 & 2	Harsh (Ordinary) Location
2 x 2 ft. T5/T8/T12HO	2,000	Hazard-Gard XPLA Champ MLLA	CEAG Ex-Lin CEAG eLLK LED CEAG nLLK15 HLL / nHLL	Champ Pro PLLA PLLE
2 x 4 ft. T5/T8/T12HO	4,000			
2 x 18W	3,000			
2 x 36W	5,000			
2 x 58W	7,000			
3 lamp T5HO	13,000			
4 lamp T5HO	17,000	Pauluhn Summit		Pauluhn APEX
6 lamp T5HO	25,000	Pauluhn Summit		Pauluhn APEX

Quick Selection Guide

Featuring the industry's broadest range of LED luminaires for global harsh, hazardous and industrial environments, Eaton's Crouse-Hinds can deliver a lighting solution that performs safely and reliably in even the worst operating conditions. All the while reducing your energy, maintenance and manpower costs.

Find out which solution is right for you using the selection table on pages 18 and 19 below.

Application	Crouse-Hinds series LED family	NEC/CEC Class I				NEC/CEC Class II				NEC/CEC Class III	ATEX/IECEX				Ordinary Location (Harsh Areas)	UL	CSA	CE	Emergency battery
		Div. 1	Div. 2	Zone 1	Zone 2	Div. 1	Div. 2	Zone 21	Zone 22		Zone 1	Zone 2	Zone 21	Zone 22					
High bay / mid bay	Hazard-Gard EVLLA	■	■	■	■	■	■	■	■	■						■	■		
	HPL/HPLN																	■	■ (HPL)
	Champ VMVL		■		■	■	■		■	■						■	■	■	■
	Champ VMVL Connected		■		■	■	■		■	■						■	■		
	NLE																	■	
	Champ Pro PVML														■	■	■	■	
	Champ Pro PVMA														■	■	■	■	
	PLE														■			■	■
Floodlight	CEAG PXLED																	■	
	Champ FMVA		■		■	■	■	■	■	■						■	■	■	
	Champ Pro PFMA														■	■	■	■	
Wallpack	AB05																	■	
	Champ CPMV		■			■	■	■	■	■						■	■		
	Champ Pro WPMV														■	■	■		
Targeted / low bay	Hazard-Gard EV LED	■	■	■	■	■	■	■	■	■						■	■		
	Vaporgard V2L/V3L		■			■	■	■	■	■								■	
	Vaporgard Pro P2L/P3L														■	■	■	■	
Linear	Hazard-Gard XPLA	■	■	■	■	■	■	■	■	■						■	■		■
	CEAG ExLin																	■	
	CEAG eLLK		■	■	■	■	■	■	■	■								■	■
	HLL																	■	■
	HRL Recessed																	■	■
	Champ MLLA		■		■	■	■	■	■	■						■	■		■
	Pauluhn Summit		■			■	■	■	■	■						■	■		
	CEAG nLLK		■		■		■		■									■	■
	nHLL																	■	■
	Champ Pro PLLA														■	■	■		■
	Pauluhn APEX														■	■	■		

To view our global portfolio of innovative and reliable lighting solutions for harsh and hazardous areas, please visit www.eaton.com/lighting



Crouse-Hinds series LED family											Beam Pattern						Color temp			Lens Options			Environmental						
	1000-4999	5000-6999	7000-8999	9000-10999	11000-12999	13000-14999	15000-19999	20000-24999	25000-39999	40000-49999	50000	Type V	Type III	Type I	NEMA 7x6	NEMA 3x3	Wide	Narrow	5000K	4000K	3000K	Glass	Polycarbonate	Clear	Frosted	Low ambient	High ambient	NEMA 4X	IP66
Hazard-Gard EVLLA		■	■	■	■	■					■							■		■	■		■			-25°C	+55°C	■	■
HPL/HPLN	■	■	■	■	■	■		■			■						■	■	■	■	■		■	■		-40°C	+55°C		
Champ VMVL	■	■	■	■	■	■	■	■	■		■	■	■					■	■	■	■	■	■	■		-40°C	+65°C	■	■
Champ VMVL Connected	■	■	■	■	■						■	■	■					■		■	■	■	■	■		-40°C	+65°C	■	■
NLE	■	■	■								■						■		■		■	■	■	■		-40°C	+55°C		■
Champ Pro PVML	■	■	■	■	■	■	■	■	■		■	■	■					■	■	■	■	■	■	■		-40°C	+65°C	■	■
Champ Pro PVMA		■	■								■							■		■		■		■		-40°C	+55°C		■
PLE		■	■	■							■							■		■	■	■	■	■		-40°C	+55°C		■
CEAG PXLED		■	■	■				■	■			■	■					■		■		■	■	■		-50°C	+55°C		■
Champ FMVA	■	■	■	■	■	■	■	■	■	■								■		■	■	■	■	■		-40°C	+65°C	■	■
Champ Pro PFMA	■	■	■	■	■	■	■	■	■	■								■		■	■	■	■	■		-40°C	+65°C	■	■
AB05	■										■								■		■					-55°C	+55°C		■
Champ CPMV	■	■	■															■	■	■	■	■	■	■		-40°C	+55°C	■	■
Champ Pro WPMV	■	■	■															■	■	■	■	■	■	■		-40°C	+55°C	■	■
Hazard-Gard EV LED	■										■							■		■		■				-30°C	+55°C	■	■
Vaporgard V2L/V3L	■										■							■	■	■	■	■	■	■		-30°C	+55°C	■	■
Vaporgard Pro P2L/P3L	■										■							■	■	■	■	■	■	■		-30°C	+55°C	■	■
Hazard-Gard XPLA	■		■															■	■	■	■	■	■	■		-40°C	+65°C	■	■
CEAG ExLin	■	■	■								■							■	■	■	■	■	■	■		-40°C	+55°C		■
CEAG eLLK	■	■									■							■	■	■						-25°C	+55°C		■
HLL	■	■									■							■	■	■						-40°C	+55°C		■
HRL Recessed	■	■									■							■	■	■						-40°C	+55°C		■
Champ MLLA	■		■															■	■	■	■	■	■	■		-40°C	+65°C	■	■
Pauluhn Summit						■	■		■									■		■				■		-40°C	+55°C	■	■
CEAG nLLK	■										■							■	■	■						-25°C	+50°C		■
nHLL	■	■	■								■							■	■	■						-40°C	+55°C		■
Champ Pro PLLA	■		■															■	■	■	■	■	■	■		-40°C	+65°C	■	■
Pauluhn APEX						■	■		■									■		■				■		-40°C	+55°C	■	■

For more information:

If further assistance is required, please contact an authorized Eaton Distributor, Sales Office, or Customer Service Department.



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