

**NOW THERE IS ENERGY-EFFICIENT LIGHTING
SPECIALLY DESIGNED FOR
PORTS, HARBORS, SHIPYARDS, MARINE TERMINALS, AND WATERWAYS**

**EXCLUSIVELY AVAILABLE FROM
ULTRA-TECH™ LIGHTING**

Energy efficient lighting has become a critical component of new sustainability and security initiatives for U.S. ports, harbors, and other marine facilities. Until now, no lighting manufacturer has addressed the highly challenging and rigorous requirements for industrial marine environments. Specifically, port and harbor lighting must be capable of delivering three to five foot candles at the ground and survive moisture, salt, heat, cold, ice, snow, high winds, and other weather conditions associated with coastal industrial properties. At the same time, new lighting should deliver better energy efficiency, higher light quality, and lower maintenance costs while being environmentally friendly.

Ultra-Tech Lighting, LLC has answered the need for a marine-specific line of high efficiency lighting with all-new Port-Bright™ fixtures that use magnetic induction lights (MIL) in conjunction with special ballasts, hardened lamp enclosures, advanced geometry, and **LUMENEC™** spectral technology. The result is a complete line of spectrum-appropriate lighting that can replace high pressure sodium (HPS), metal halide (MH), mercury vapor (MV), and other industrial lamps with greater energy efficiencies and substantially lower maintenance costs.

Understanding Port and Marine Facility Lighting Requirements –

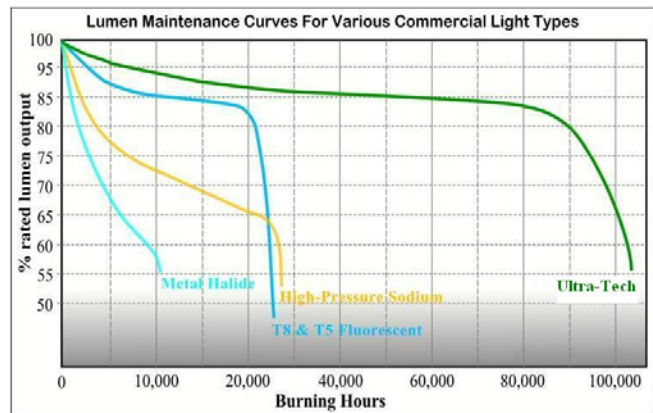
The Occupational Safety and Health Administration (OSHA) has established illumination standards and regulations for marine terminals and terminal facilities under Section 1917.123 and in compliance with United States Coast Guard regulations at 33 CFR 126.15(1) and (n), and 33 CFR 154.570 which sets out requirements for illumination at "designated waterfront facilities" and "large oil transfer facilities." In particular, rules set forth parameters for "work area operations" like cargo delivery and transfer facilities.

In brief, regulations require:

Foot-Candles **Area and Description of Operations**

5	General construction area lighting Working and walking areas shall be illuminated. Unless conditions described in the regulations of the United States Coast Guard (33 CFR 126.15(1) and (n), and 33 CFR 154.570) exist in the case of specific operations, illumination in active work areas (for example, cargo transfer points) shall be of an average minimum light intensity of 5 foot-candles.
3	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, cargo container handling and storage areas, loading platforms , refueling, and field maintenance areas.
5	Indoors: warehouses , corridors, hallways, and exit ways.
5	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading).
10	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms , carpenter shops, rigging lofts and active store rooms , mess halls, and indoor toilets and workrooms.)
30	First aid stations, infirmaries, and offices.

Since most labor and insurance contracts *require OSHA compliance*, it is extremely important to make sure any existing lighting or lighting upgrades fully comply with rules and regulations. Unfortunately, independent lighting audits of many marine terminals reveals major deficiencies in meeting minimum lighting standards. This is because facility designers and managers never had access to lighting **specifically designed to effectively adhere to these regulations**. Moreover, the performance of high intensity fixtures like mercury vapor, halogen, metal halide, and high pressure sodium rapidly deteriorates within a short time after being placed into service. In fact, many HID lights can lose 20% to 40% of their luminosity within the first 20% of their rated lifecycles. Thus, an HID lamp delivering 3 foot candles on the ground at the time of installation may only provide 1.8 foot candles within a few months of operation. This means that although the lamps may have been within specifications when installed, an OSHA inspection *would likely result in a failure* just months after lamps were placed in service.



Ultra-Tech™ Port-Bright™ lamps maintain more than 85% of their original lumen output for 90% of their 100,000 hour life cycle.

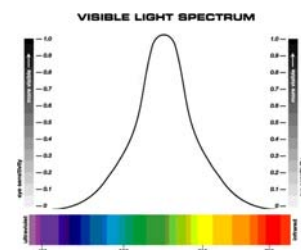
As the chart illustrates, Port-Bright™ lamps maintain more than 90% of their original lumen output for over 90% of their 100,000 hour expected life cycle. For example, Port-Bright™ high-mast fixtures designed to provide 5 mesopic foot candles of light with proper photometric layout on the ground from 150 feet will be specified for 5.9 foot candles upon installation, resulting in a minimum of 5 foot candles after the first 50,000 hours of operation. That is more than twice the expected life of the typical HID lamp and is equal to 5.5 years operating 24 hours per day, 365¼ days per year. However, Port-Bright™ MIL lamps have an expected life cycle of 100,000 hours, or 11 years operating 24 hours per day, 365¼ days per year. Since a typical port in latitudes from 23°N to 50°N experiences an average of 8.5 hours of night operation, ***Port-Bright™ light can last more than a quarter of a century at the appropriate specifications.***

Having the right light on the ground translates into ***higher productivity, greater safety, increased security and less risk.*** The extraordinary life cycle of Port-Bright™ fixtures can lower maintenance costs by more than 600%. This is because labor is usually the most expensive component of a lamp replacement. Typically, a Port-Bright™ fixture will remain in service and within specification more than five times longer than the next best HID lamp.

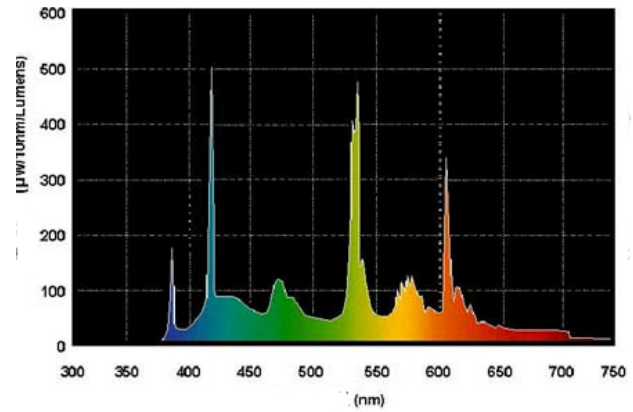
Light Quality –

There's more to lighting than simply foot candles on the ground. Conventional industrial lighting like HID, incandescent, and even new LED has spectral bias. This means that particular portions of the spectrum are skewed toward a particular color. The result can be imperfect color rendition and poor visual perception. The most obvious example of spectral bias can be seen in high pressure sodium lights that emit a monochromatic orange light. The extreme concentration in the orange/yellow range of the spectrum makes color distinction extremely difficult, if not impossible. This color also falls within the maximum sensitivity of sea turtles. By the same measure, other HID bulbs are extremely hot with temperatures exceeding 900°F. A great deal of infrared and ultraviolet light can be generated by these bulbs which may be measured by a light meter, but is invisible to the human eye.

Port-Bright™ MIL fixtures are “tuned spectrum” lamps that mimic the sun's light output ***within the visually effective range.*** The human eye resolves light between 400 and 790nm. Within this range, the human eye has greater sensitivity to the middle spectrum; green-yellow light. To balance the eye's color acuity Port-Bright™ bulbs use **LUMENTEC™** technology to produce just the right amount of light within the visual spectrum to maximize object resolution and color perception. However, the Port-Bright™ design engineers went several steps further. Marine environments present a variety of monochromatic backgrounds that have unique light reflective and absorbing properties. Most notably, there is the contrast between blacktop and concrete surfaces. These black & white spaces require the ultimate balance throughout the color range since black *absorbs* all light ranges and white *reflects* all ranges.

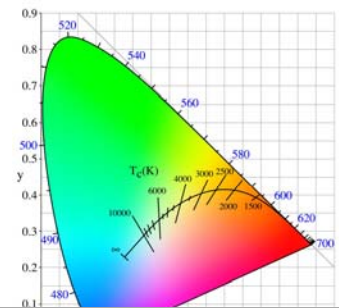


Port-Bright™ bulbs with **LUMENEC™** technology use a specialized phosphorous formulation that produces spectral peaks in conjunction with the eye's photosensitivity. However, these spectral adjustments are also highly correlated to the full visible spectrum of sunlight. The result is a more natural light that creates more significant contrasts against monochromatic surfaces that are the hallmark of ports, terminals, and marine facilities. In fact, Port-Bright™ illumination is so well tuned, most individuals can resolve clear glass against a black background. Outstanding reflective properties of Port-Bright™ fixtures allow workers to spot everything from grease and oil to black ice on work and road surfaces. The visual difference between Port-Bright™ luminaries and other industrial lights is truly extraordinary. No other lamps deliver the same visually effective lumens (VELs) at the same low wattages. Consider that a 1,000 watt metal halide lamp is easily replaced using twin 300 watt Port-Bright™ fixtures, saving 40% in power while generating higher quality light. Ballast efficiency can account for another 10% to 20% savings.



Port-Bright™ lamps are designed to provide maximum usable light for the human eye, but are eco-friendly, too.

In outdoor work areas, optimum lighting means achieving the highest color rendition index (CRI) with the maximum color temperature. Port-Bright™ lamps generate a CRI exceeding 85 at a color temperature of ~6,500K to 10,000K. Without becoming overly technical, artificial light below 5,000K is called “warm,” generating more yellow/red hues whereas light above 5,000K is described as “cool,” providing more of a pure white hue. The color temperature of a light source is the temperature of an ideal “black-body radiator” that radiates light of comparable hue to that of the light source. Daylight has a spectrum similar to that of a black body with a correlated color temperature of 6,500K.



As the table illustrates, Port-Bright™ is at the highest end of the lighting scale. Although there are specialty lights that can emit color temperatures above 6,500, they are not generally available for outdoor industrial applications and the “brightness” above 6,500K must be balanced to avoid adverse impacts on wildlife. On the other hand, color temperatures below 5,000K which are “soft” are not appropriate for outdoor work environments. The closer outdoor lighting is to natural daylight, the safer

5,500–6,000 K	Vertical daylight, electronic flash
6,500 K	Daylight, overcast PORT-BRIGHT™

Temperature	Source
1,700 K	Match flame
1,850 K	Candle flame, sunset/sunrise
2,700–3,300 K	Incandescent light bulb
3,000 K	Cool White/Soft White compact florescent light bulb
3,200 K	Studio lamps, photofloods, etc.
3,350 K	Studio "CP" light
4,100–4,150 K	Moonlight, ^[2] xenon arc lamp
5,000 K	Horizon daylight
5,000 K	Florescent light tubes or Cool White/Daylight compact florescent light bulb

and more healthful the workplace. Warm temperature lighting may also have an adverse affect upon many species that live in aquatic environments.

Port-Bright's high color rendition index is also a major enhancement for surveillance. Security cameras can more precisely render colors to identify vehicles, people, and other objects that may require scrutiny. Monochromatic lights like high pressure sodium make color identification impossible for most video camera surveillance systems.

Eco-Friendly Spectrum –



When designing Port-Bright™ lamps, Ultra-Tech Lighting considered every aspect of the industrial marine environment. For example, sea turtles are particularly sensitive to wavelengths between 560nm and 570nm¹ while having lower visual acuity in the blue range below 470m. Referencing the spectrum chart above, you can see a dip in output within this range. Since the human eye also has sensitivity within these

wavelengths, Port-Bright™ lamps are tuned with **LUMENEC™** technology to drop intensity in portions of the spectrum that would inappropriately attract turtles. Although the lamps are bright to the human eye, they are less likely to interfere with the marine environment. In contrast, metal halide lighting exhibits spectral intensities ***exactly within the wavelengths most detectable to loggerhead and green sea turtles***. This is also true for high pressure sodium lights despite their monochromatic output. ¹[*Photopic Spectral Sensitivity of Green and Loggerhead Turtles*, D.H. Levenson, S.A. Eckert, M.A. Crognale, J.F. Deegan II, and G.H. Jacobs; 2004 The American Society of Technologists and Herpetologists.]

The Port-Bright™ design philosophy is, “Less is more!” Modern research into human perception under artificial light reveals that a healthy eye can resolve the light of a single candle on a clear dark night at a level distance equal to thirty miles. Vision is a combination of photopic and scotopic acuity. Conventional light meter measurements concentrated upon absolute lumen levels regardless of the spectral range. This has resulted in substantial “over-lighting” than can have serious negative impacts upon surrounding areas and wildlife. By using the more appropriate *combination* of photopic and scotopic output (“mesopic”), a more precise visual experience can be achieved with far less power and less light pollution.

Equally important, fluorescent, LED, and HID lighting are subject to flicker at rates from 60 to 120 cycles per second. This causes “strobe effect” that can distort time and distance perception. We are all familiar with the effect of a strobe light upon motion. Port-Bright™ technology has no flicker. This is important for human performance *and wildlife* such as sea turtles. Flickering light has been shown to disorient turtle hatchlings. Anecdotal evidence has been seen in the increase of disorientation since the use of compact fluorescent bulbs in place of incandescent.

In addition, high-mast lighting is ***focused down-lighting*** which does not project horizontally beyond the intended illumination area. This is known as the cut-off. When designing an industrial marine lighting system, it is important to limit any unnecessary light pollution that can adversely affect the environment or comfort of surrounding neighborhoods.

What about Fog? –

There is a general misconception that yellow light “penetrates” fog better than white light or other colors. This belief comes from the common use of yellow fog lamps in motor vehicles. The reality is that yellow light is less disturbing to oncoming traffic if it is combined with the intensity of normal driving lights. Water droplets are reflective of all visual light to some degree. However, the objective in high-mast down-lighting and outdoor security lighting is to reach the intended target.

The geometry and lenses used in Port-Bright™ fixtures maximizes the intended focus and *is not significantly dispersed* by fog. Although fog can create haloling, most conditions will not significantly impact the amount of light delivered to the intended area.

Enormous Power and Maintenance Savings –

Magnetic induction lighting (MIL) was invented by Nikola Tesla in 1891. Therefore, MIL is the oldest *new* lighting technology available. It is simple, efficient, time-tested, and time-proven technology that can save 20% to 60% in energy for most port and marine terminal applications. This is because MIL bulbs generally produce more *usable* light per watt. In addition, MIL is “cold lighting technology,” operating at temperatures under 150°F. Very little energy is wasted in heat. Most of the energy is converted into visible light.

Port-Bright™ lamps go several steps further with totally unique fixture geometries that are matched to the custom designed MIL bulbs. Port-Bright™ single unit bulbs range from 40 watts all the way to 400 watts and can replace HID fixtures ranging as high as 4,000 watts. For example, the Sylvania 2,000 watt 115 volt metal halide bulb *with no fixture* retails for \$350.00 and produces 185,000 lumens at a color temperature of 6,000K. The bulb is rated for 3,000 hours. Less than 70% of the light output appears within the visual range. Port-Bright™ 300 watt high-mast lamps deliver 26,000 lumens *all within the visual range*. Although it may appear that five 300 watt Port-Bright™ bulbs would be needed to equal one 2,000 watt metal halide bulb, the higher color temperature combined with the greater intensity within the visually effective spectrum lowers this ratio to just three. However, even five 300 watt Port-Bright™ bulbs are 500 watts less than the single 2,000 watt metal halide. *The actual amount of power savings can be between 30% and 60%.*

The 2,000 watt metal halide bulb will need to be replaced 33 times to equal the service life of Port-Bright™ lamps. Typically, HID lamps have a rated life-cycle between 4,000 and 20,000 hours. Even taking the highest number, Port-Bright™ provides 500% savings in maintenance *including labor*.

Designed for the Marine Environment –

Hurricanes, salt, high moisture, hot, and cold weather are just some of the rigorous environmental conditions that impact lamp life and performance. All Port-Bright™ fixtures go beyond IP65 standards with heavy-duty housings and double-seal enclosures. Finishes are

specifically formulated to withstand the harsh salt air. Port-Bright™ lamps are built to last... and last.

All mounting hardware is galvanically matched to assure metal compatibility. Reinforced chrome brackets and stainless steel bolts are integrated to withstand 150 mph hurricane force winds. Equally important, Port-Bright™ geometry is designed to generate the least amount of wind drag and minimize “lift” caused by airflow over the fixture shape. In high winds, some shallow fixtures can actually act like airplane wings; exerting upward pressure or lift on mounting armatures and hardware. The radical edge of Port-Light™ high-mast fixtures disrupts the wind flow, preventing excessive lift. At the same time, the ballast housing is shaped like a foil that decreases horizontal drag. This allows Port-Bright™ to withstand wind conditions that would damage most generic HID and LED fixtures.

Given high labor costs, it is essential to install lamps that are designed from the top down to fit the specific and unique applications of ports, terminals, marinas, waterways, and harbors. No other lighting line has been created to meet this challenge. Every aspect of industrial marine applications has been taken into consideration in the design of Port-Bright™ outdoor fixtures. Ultra-Tech also has a complete line of indoor lighting that is created with the same level of consideration and detail. From refrigerated warehouses to offices, garages, stairwells, and mechanical rooms; there is an Ultra-Tech™ light that matches the application.

Port-Bright™ Advantages Go Beyond Lighting

Port-Bright™ technology provides a major environmental feature that goes beyond lighting. Today’s environmental awareness and our sustainability needs are addressed by the “Green” nature of MIL fixtures. Unlike fluorescent bulbs, mercury lamps, and other lighting that uses dispersed mercury, MIL bulbs employ a solid mercury amalgam slug that can be *clipped and recycled*. There are no PCBs or circuit boards like LED lamps. MIL glass bulbs are 100% recyclable. Even the induction magnets can be sent back to Ultra-Tech™ Lighting for recycling or simply disposed of as metal.



A small solid mercury amalgam ball is easily and safely snapped off for recycling. Magnets are recyclable metal and the remainder of the bulb is disposable glass.

With serious legislative proposals to impose high disposal fees on hazardous waste, the environmentally friendly design of MIL bulbs is an important consideration. The extraordinary 100,000 hour expected life-cycle represents eleven years, operating 365 days by 24 hours per day. For most applications, Port-Bright™ technology lamps will continue to perform for more than a quarter of a century. This means less maintenance, less disposal, less potential fees, and a more sustainable lighting.

By comparison, fluorescent and compact fluorescent (CFL) bulbs have liquid mercury that requires bulbs to be disposed of as hazardous waste. Breathing in vapors from a broken fluorescent bulb is highly toxic and can lead to mercury poisoning and respiratory problems. In fact, many lung disorders experienced by rescue workers and clean-up crews at the World Trade Center site have been linked to the thousands of fluorescent bulbs that were crushed and dispersed into the atmosphere.

Although LED bulbs do not contain mercury, the circuit boards that drive LED lamps can contain toxic chemicals such as PCBs. Since LED strips are frequently bonded or integrated into the circuit boards, expired lamps must be handled as hazardous waste.

The fact that Port-Bright™ lighting can reduce energy consumption by up to 60% represents a substantial decrease in carbon footprint, helping to curb greenhouse gas emissions such as CO₂, NOX, and SOX. According to the Energy Information Association (EIA), lighting accounts for up to 40% of overall electric consumption on average. This means that a 60% reduction in lighting power can drop overall energy use by more than 20%.

Preserving the Environment –

The most ideal outdoor artificial lighting is *no lighting at all*. Obviously, this is unrealistic in our modern world. Given this reality, utmost consideration must be given to a holistic approach that addresses a comprehensive set of parameters. Consider the Port-Bright™ differences –

- Silent ballasts and bulbs that do not produce high frequency hum or buzz that might otherwise disturb bats, birds, canines, and other species.
- Full diffusion nano-reflector technology that lowers glare to protect birds.
- Wide dispersion light source that spreads intensity to avoid retinal damage.
- Tuned spectrum to adhere to visual acuity of wildlife.
- Flicker-free to avoid disorientation among various species.
- Recyclable.
- Non-toxic.
- Dark Sky compliant with no backlighting, up-lighting or glare (BUG rating).

Ultra-Tech™ Lighting technology has been deployed in wildlife areas with minimal impact. Installations include Steamboat Springs Ski Resort in Colorado, Snowy Range located within the National Forest in Wyoming, Ragged Mountain in New Hampshire, and other ecologically sensitive regions.

From a health perspective, no other technology gives you all the features and advantages of Port-Bright™ technology while striving to be environmentally friendly. Find out more by contacting:

<p>Philip Gotthelf 800-356-7834 Philip@ultratechlighting.com</p>
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