Technology

HELLA Worklights: Tested and durable

Hella marine LED based lamps provide power saving, highly visible and ultra durable lighting for reliability and safety at sea.

Benefits of LED lighting technology:

Ultra Low Power Consumption
Combining efficient LED light sources with advanced optic technology, Hella marine LED products deliver more light output per watt than traditional bulb lamps and thus provide considerable power saving.

Hella marine NaviLEDPRO navigation lamps use less than 10% of the power required to run a 25W incandescent bulb navigation lamp certified to the same visible distance.

Multivolt™ technology for durability and safety
Advanced Multivolt™ circuitry provides a uniform level of intensity for reliable and safe illumination across a range of DC inputs such 9-32V DC. Multivolt™ LED lamps can be connected to 12 or 24 volt systems without modification, providing full light performance and automatic compensation for low battery voltages and voltage drop over long cables and connections. Hella marine Multivolt™ LED lamps are also reverse polarity and spike protected for enhanced durability even under severe voltage fluctuations.

No bulbs, No maintenance
Ultra long service life Hella marine LED technology has no filaments to break, thus making the LED lamps extremely shock and vibration resistant for reliable illumination and safety. Our engineering team has developed a unique range of highly demanding tests to lift product reliability to new standards.

Fully sealed for life
Each Hella marine LED lamp is a completely sealed opto-electronic device. Proven design, precision engineering, and the use of high impact acrylic materials ensures superior resistance to water, impact, UV and

general wear and tear.

Safe and highly visible
Advanced LED navigation lamp optics deliver optimal horizontal and vertical light distribution according to international standards. They provide enhanced visibility compared to bulb navigation lamps. Cut-off angles are ultra precise, clearly indicating a vessel's movement and heading.

Superior Lens and Optic Materials
All Hella marine LED Navigation lamps feature extra thick lenses - providing a long term lighting solution and environmentally friendly choice. In 2007 Hella marine took the development of ultra durable LED Navigation lighting to a new level by specifying Grilamid, a high performance polyamide manufactured in Switzerland, for the lens of the BSH certified NaviLED PRO series.Also used for the lens of the NaviLEDTrio Tri Colour lamp, Grilamid is a revolutionary new transparent plastic with an exceptionally high impact strength and resistance to UV and chemical damage.

Pre-wired with marine cable
Hella marine LED lamps are pre-wired with quality marine specification tinned cable. The cable is completely sealed to the lamp body providing time saving at installation and reliable electrical connection.

Electromagnetic Compatibility (EMC)
All Hella marine LED products are electronic devices. Their electrical circuits contain components that suppress possible interference, both emission as well as susceptibility to emissions, to the limits prescribed in international standards.

LED Interior and Exterior Lighting

Hella marine LED lighting products are sophisticated opto-electronic devices designed for durable, energy efficient, maintenance free operation.Recent quantum leaps in the luminous intensity of LEDs per watt have allowed marine lighting systems to develop significantly to effectively illuminate a vessel's interior.

To take advantage of the ever increasing efficacy of the most advanced LEDs, efficient optic designis essential to capture and spread the available luminous flux emitted by the LED and to evenly illuminate areas. With significant advances of LED brightness, eye safety considerations are increasingly important. It is essential for high power LEDs to be coupled with optic designs that protect the eye's retina from possible damage when viewed directly. It is desirable for the entire lens area of a lamp to be evenly illuminated via an efficient optic rather than using a multiple of LEDs without any optic. Easily visible LEDs inside a luminaire without any optic or lens protection can cause a degree or even significant eye discomfort if viewed directly.

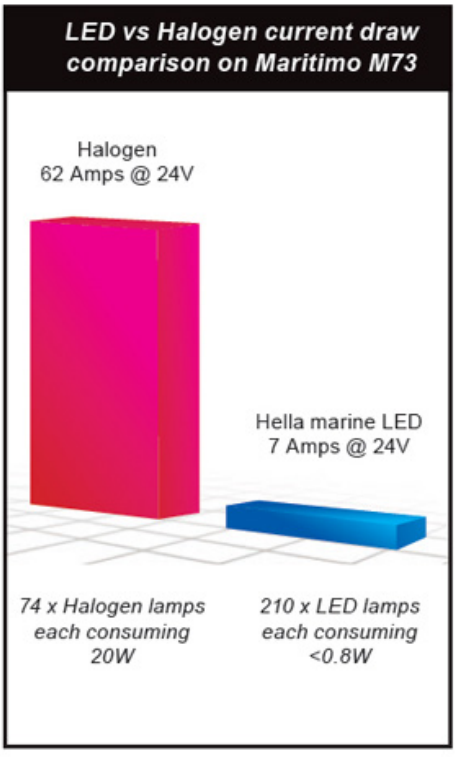
Quality LED lighting provides many significant advantages over traditional filament based sources. Significantly reduced power consumption, increased reliability, reduction in radiated heat and attractive ambient effects are all benefits of modern LED lighting systems. The following are key considerations when selecting LED lighting for marine interior and exterior applications.

Power saving on board

The single most influential driver for LED technology on most yachts and powerboats is the considerable power saving on offer compared to incandescent lamps. Lighting systems are a major part of a vessel's electrical architecture where consumption can be dramatically reduced. The opportunity to save hundreds of amp hours is available now.

As a recent example, the entire Hella marine LED lighting system specified for a Maritimo 73ft motor yacht draws less than 7 Amps. To illuminate the same interior layout with halogen lamps would have totalled over 62 Amps. The reduction in cable size and weight together with the safety aspects of an almost zero heat signature was also highly beneficial.

The majority of the lamps specified for the Maritimo 73 system are the compact 'Rakino' series LED downlights. Each lamp consumes less than 0.8W yet produces the equivalent light output of a 10W halogen lamp. Such efficiency is class leading.



Hella marine reliability

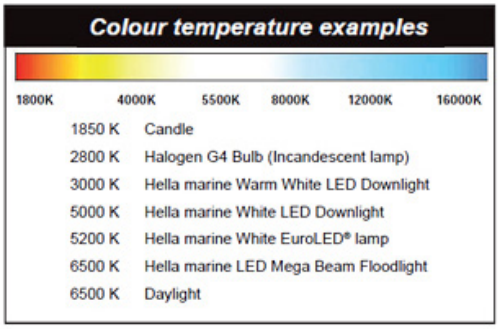
Due to their solid state nature, LEDs do not have filaments to break, however LEDs do require precise current regulation and voltage protection to provide long term reliability.
For LED lighting manufacturers, many design and engineering milestones are required to produce durable products that provide ongoing performance in marine applications.
Hella marine LED products feature several key advantages such as completely sealed housings, sealed cable entries, effective electronic protection, shock, vibration and impact resistant components that all contribute

towards outstanding reliability. Compared to incandescent lighting, where a filament inside a bulb may break at any moment, Hella marine LED lighting is ‘fit and forget’.

Many LED lamp manufacturers claim operating lifetimes of 50,000 or 100,000 hours, however in many cases these claims are generalized. The high power LED devices are often too new to have been thoroughly tested for such periods. These lifetime estimates are often based on LED component specifications from the device manufacturer rather than the life of the complete lamp in a marine installation.

In the harsh marine environment, salt air corrosion to circuit boards, light degradation due to excessive heat, vibration fatigue, shock loads, voltage fluctuations and low battery voltages all contribute to reduce the operating life of LED lamps without thorough engineering and electronic protection. The supplier’s warranty policy, integrity and track record is often a more accurate benchmark on the lifetime and quality of the LED lamp under consideration.

Colour Temperature and Rendering



Until recently, the lack of high quality white LED devices with sufficient intensity has been the major factor preventing the acceptance of LEDs for general marine lighting purposes. LEDs had a reputation for appearing ‘cold’ and ‘blue’ due to there phosphorous coating heritage. However today’s high efficacy devices can rival traditional incandescent light sources for colour and ambience.
When selecting LED interior lighting, colour temperature is an important consideration. Colour temperature is measured in Kelvin and describes the effect of heating an object until it glows incandescently. The emitted radiation, and apparent colour changes in proportion to the temperature; envisioned when considering hot metal in a forge that glows red, then orange, and then white as the temperature increases.
Hella marine describes higher colour temperatures (>5200K or more) as ‘cool’ white, and lower colour temperatures (K range) as ‘warm white’. ‘Neutral white’ is in 4200K range. Cool white is recommended for visual tasks, work areas such as engine rooms, and exterior lighting. Warm white light is suggested for interior spaces as it adds life and vibrancy to people and objects, is considered more flattering to skin tones or fabrics, and makes food look fresh and attractive.

White light

Warm white light

Formula Icon 54 www.formulacruisers.co.nz

These colour choices should only be an approximate consideration however. Cool white will accentuate blue and green hues in certain fabrics and surfaces, and where there are stainless steel or gel coat surfaces.

Lighting designers may specify cool white for galley areas and warm white where there is an abundance of varnished timber work instead of high gloss gel coat surfaces.

Light Output

For an effective comparison of the different products from marine LED manufacturers, many factors must be considered. The best lamp for a given application is no longer the one that solely meets a style requirement. Today, power consumption, efficiency, output and beam angle must be considered together with light colour, shape, and the aesthetics and finish of the housing itself.
The following performance data is worth considering -

Luminous Flux
Measured in Lumens (lm), luminous flux describes the total quantity of light produced from a lamp. The higher the lumen count, the more intense the light output.

Luminous intensity
Measured in Candela (cd), luminous intensity is the luminous flux at a particular angle from the light source. Peak candela occurs at 0 degrees, i.e. directly below a lamp.

Illuminance
Measured in Lux (lx), Illuminance is equal to luminous flux divided by the illuminated area.
One lux is equal to one lumen per square meter.

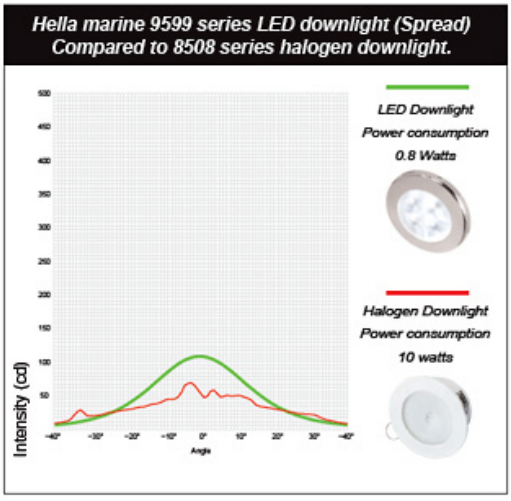
Luminous Flux (Lumens) / Area = Illuminance (Lux).
or
Illuminance (Lux) x Area = Luminous Flux (Lumens)

If both the area to be illuminated and the desired level of illumination are known, the total number of lumens required can be calculated. Divide the total lumens by the output of the LED lamp under consideration to determine the number of fixtures required to deliver the desired light output.

Eg, A powerboat salon of 10 square meters and the desired illumination level is 120 Lux, a total of 1200 lumens are required. If the LED lamp under consideration has a luminous flux of 80 lumens, 15 lamps will be required (1200 / 80 = 15).

For further comparisons it is also important to consider the beam angle of an LED lamp, and the lux levels available at varying distances from the device. Narrow light beams may provide effective intensity directly under the fitting, but may not evenly illuminate an interior as the light may be too narrow with many shadows between effectively lit areas.

Efficacy



Like efficiency, the efficacy of an LED lamp is the amount of light it produces per unit of electrical power it consumes (lumens per watt). The higher the lumens per watt, the higher the efficiency.
E.g. A single Hella marine 9599 series white LED downlight consumes less than 0.8W and produces around 80 lumens. 80 / 0.8 = 100 lumens per watt.

It may also be an interesting comparison to divide the luminous flux of a lamp by its cost to derive lumens per dollar. The more lumens per dollar (flux per bucks), the more light for your investment.
Also, it is important to determine that the efficacy of the LED lamp is measured as the devices total efficacy, not the efficacy of only the LED(s) employed. Power consumed to run an electronic power supply driving and controlling the LED(s) is always a contributor to the lamps total consumption.

Heat reduction and thermal management

With the power saving benefits of efficient LED based devices also comes heat reduction benefits. The sometimes dangerously high temperatures of 10W and 20W halogen lamps onboard can be eliminated with high efficiency LED technology. This allows boat builders and designers a wide scope of installation possibilities where the air cavity behind incandescent lamps, traditionally reserved for cooling, is no longer required. Efficient LED lamps can be mounted into solid surfaces and composite structures without risk of fire or heat damage to surrounding materials.

Well engineered thermal management of an LED device is essential for long-term durability. A common misconception is that LED's do not generate heat. LEDs consume power and some of this power is also converted into heat, even in the most energy efficient LEDs. In contrast to incandescent lamps however LED's like to 'run cold'. As a rule of thumb, the hotter an LED runs the faster it will degrade. A lower, and in extreme cases much lower light performance will result.

High performance LED's do generate heat, which needs to be coupled to surfaces designed to efficiently transport the heat away from the LED itself. LEDs that overheat, meaning the junction temperature of the LED rises above a set threshold, will permanently degrade and significantly reduce their luminous efficacy.

A noticeably 'hot to touch' exterior surface of a high output LED interior lamp provides some indication that the light output of the device will deteriorate within a few hundred hours. Hella marine LED lamps will operate 'cool' or 'slightly warm' to the touch after many hours of operation.

Hella marine thermal management expertise, coupled with proven optics and electronic design, ensures the long term durability with minimal degradation over many years of service.

Lens and Optic Technology

To maximise the ever increasing efficacy of advanced LEDs, efficient optic design is essential to capture and spread the available light and to evenly illuminate areas on board.

Unlike incandescent light sources, LED devices begin with a directional light pattern. The goal for optics designers, working an application such as interior down lighting, is to create optics and lens patterns that produce an effective spread of homogeneous illumination throughout the interior. This even spread of light is often more important than how intense a lamp looks when viewed straight on.

All Hella marine LED lamps use efficient optics, lens designs or Free-Form reflector technology to accurately capture and distribute large percentages of available light from the LED source or sources.

Examples include:
- Oblong LED step lamps with a 30 degree down angle light beam to illuminate the tread of steps and stairs without dazzle from the lamps themselves.
- Round and Square LED courtesy lamps providing attractive uniform light patterns via an efficient optic and lens with embedded glass spheres for minimum light losses.
- EuroLED lamps employ an finely machined optic and lens combination to provide an even spread of bright white light with minimum light losses.
- 9599 series LED downlights with powerful 'Spot' or 'Spread' light distribution patterns without glare.

Lens, Optic Technology and Eye Safety

To take advantage of the ever increasing efficacy of the most advanced LEDs, efficient optic design is essential to capture and spread the available luminous flux emitted by the LED and to evenly illuminate areas.

With significant advances of LED brightness, eye safety considerations are increasingly important. It is essential for high power LEDs to be coupled with optic designs that protect the eye's retina from possible damage when viewed directly.

It is desirable for the entire lens area of a lamp to be evenly illuminated via an efficient optic rather than using a multiple of LEDs without any optic. Easily visible LEDs inside a luminaire without any optic or lens protection can cause a degree or even significant eye discomfort if viewed directly.

Costs

Quality LED interior and exterior lamps have shifted lighting systems from an incandescent globe based inside a

housing or reflector to complex engineered opto-electronic devices. These devices now incorporate advanced drive circuits, spike and over voltage protection, optics, lenses, plus the LED source itself.
As a result, the added features and benefits of effective LED lighting do carry higher costs compared to incandescent lamps. However, for many applications the substantial power savings, long term reliability and improved safety advantages are a convincing value proposition for astute owners and operators.

Lamp definitions

IMO COLREG definitions for navigation lighting

All Round Lamp
A light showing an unbroken arc over the horizon of 360 degrees.
All Round Lamps may output white light, red light or green light.

Side Lights
A green light on the starboard side (Starboard lamp) and a red light on the port side (Port lamp) each showing an unbroken light over an arc of the horizon of 112.5 degrees and fixed to show the light from right ahead to 22.5 degrees (2 points) abaft the beam.
On a vessel less than 20 metres in length sidelights may be combined.

Stern Lamp
A white light placed as close as practicable to the stern showing an unbroken light over an arc of the horizon of 135 degrees and so fixed to show the light from right aft for 67.5 degrees (6 points) on both sides of the vessel.

Towing Lamp
A yellow light placed in a vertical position above the stern lamp showing an unbroken light over an arc of the horizon of 135 degrees and so fixed to show the light from right aft for 67.5 degrees (6 points) on both sides of the vessel.

Masthead Lamp
A white light placed over the fore and aft centre line of the vessel showing an unbroken light over an arc of the horizon of 225 degrees and fixed to show the light from right ahead to 22.5 degrees (2 points) abaft the beam on both sides of the vessel.

Tri Colour Lamp
On a sailing vessel less than 20 metres in length under sail, the sidelights and stern light may be combined into one lamp positioned on top of the mast. When the sailing vessel is under power, the Tri Colour lamp must be switched off and the navigation lamp rules for power driven vessels apply.

International Standards

Hella marine navigation lamps comply with the International Regulations for Prevention of Collisions at Sea (IMO COLREG 72).

This IMO compliance, together with supplementary national requirements, is listed with each navigation lamp series throughout the catalogue.

Main approval types:

IMO COL REG 72

Complies with IMO (International Maritime Organization) requirements under the International Regulations for the Prevention of Collisions at Sea. (IMO COLREG 72) IMO COLREG 72 forms the international basis for legal navigation lighting on vessels.

BSH

Approved by the German BSH (Bundesamt für Seeschifffahrt und Hydrographie) and carry BSH type approval numbers.
BSH was formerly called DHI (Deutsches Hydrographisches Institut).

RINA

Approved by the Italian RINA (Registro Italiano Navale) authority.
Approved lamps carry a RINA type approval number.

USCG

Complies with USCG (United States Coast Guard) requirements.
Lamps carry a marking for minimum visible distance in nautical miles,
Eg USCG 2 NM.

ABYC A-16

Complies with ABYC (American Boat and Yacht Council) Navigation Lamp Standard A-16.

Approved under the Marine Equipment Directive (MED) 96/98/EC last modified by directive 208/67/EC for use throughout Europe in all EC member states for both pleasure and commercial vessels.

Vessel Requirements

Lamps requirements by vessel length.

For vessels less than 50 metres in length overall, IMO COLREG 72 describes the following minimum visible distances for navigation lamps. Distances are in Nautical Miles.
Supplementary national approvals may also apply.

Vessels 0-12 metres / 0-40 feet in length:

White, Red, Green All Round lamps, 2 miles
Masthead lamp, 2 miles
Port and Starboard lamps, 1 mile
Stern lamp, 2 miles
Tri Colour lamp, 2 miles. (Sailing vessels under sail only)

Vessels 12-20 metres / 40-65 feet in length:

White, Red, Green All Round lamps, 2 miles
Masthead lamp, 3 miles
Port and Starboard lamps, 2 miles
Stern lamp, 2 miles
Tri Colour lamp, 2 miles. (Sailing vessels under sail only)

Vessels 20-50 metres / 65-150 feet in length:

White, Red, Green All Round lamps, 2 miles
Masthead lamp, 5 miles
Port and Starboard lamps, 2 miles
Stern lamp, 2 miles

IMO COLREG 72 Lights and Visibility - Powerboats

IMO COLREG requirements for navigation lighting on powerboats less than 50m LOA (Length Overall).
Note - Sailboats under motor adopt the rules for Powerboats.

Powerboats up to 7m. Max 7 knots

1 All Round White lamp

Powerboats up to 12m where Masthead and Stern lamps cannot be mounted

1 All Round White lamp
1 Port lamp
1 Starboard lamp

Powerboats up to 12m where Masthead and Stern lamps cannot be mounted

1 All Round White lamp
1 Bi-Colour lamp

Powerboats up to 20m

1 Masthead lamp
1 Port lamp
1 Starboard lamp
1 Stern lamp

Powerboats up to 20m

1 Masthead lamp
1 Bi-Colour lamp
1 Stern lamp

A vessel less than 50m engaged in

Powerboats up to 50m

1 Masthead lamp
1 Port lamp
1 Starboard lamp
1 Stern lamp

A vessel less than 50m engaged in

	trawling	fishing, other than trawling
		
	1 All Round Green lamp 1 All Round White lamp mounted above one another	1 All Round Red lamp 1 All Round White lamp mounted above one another
Powerboats towing with a tow length of less than 200m	A vessel engaged in diving operations	A vessel engaged in pilotage duty
		
In addition to Port, Starboard and Stern lamps 1 Towing lamp mounted above the stern lamp 2 Masthead lamps in a vertical line (When the tow length exceeds 200m, three Masthead lamps in a vertical line)	1 All Round Red lamp 1 All Round White lamp 1 All Round Red lamp mounted above one another	In addition to Port, Starboard, Masthead and Stern lamps 1 All Round White lamp 1 All Round Red lamp mounted above one another

IP Ratings

IP stands for Ingress Protection; the IP degrees of protection are determined by DIN 40050 part 9.

This standard exists to specify the exact protection of electrical equipment against penetration by solid foreign matter, including dust and water. The exact degree of protection is achieved by various tests.

e.g. The IP rating of the Sea Hawk floodlights is listed as IP6K9K.
This means dust tight and protected from high pressure steam cleaning.

IP 6K 9K

First numeral = Protection against ingress of solid foreign objects (table 1)
Second numeral = Protection against the ingress of water (table 2)

Table 1:
Protection against the ingress of solid foreign objects (including dust)

X..... not tested
0..... not protected
1..... solid foreign objects ≥ 50 mm
2..... solid foreign objects ≥ 12.5 mm
3..... solid foreign objects ≥ 2.5 mm
4..... solid foreign objects ≥ 1.0 mm
5 and 5K..... dust protected
6 and 6K..... dust tight

Table 2:
Protection against the ingress of water

X..... not tested
0..... not protected
1..... vertical dripping
2..... dripping (inclined 15°)
3..... spraying
4..... splashing
4K .....same with increased pressure
5..... jetting
6..... powerful jetting
6K ..... same at increased pressure
7..... temporary immersion
8..... continuous immersion
9K ..... high pressure/steam jet cleaning

Photometric Testing

NaviLED PRO series lamps have ultra precise horizontal and vertical cut-off angles to clearly indicate a vessel's movement and heading.
Every individual NaviLED PRO lamp is photometrically verified in production by a sophisticated goniometer to ensure compliance with the intensity and cut-off requirements of international navigation lamp standards. After passing photometric testing, a unique serial number is laser engraved onto the lens. This serial number is referenced to individual test reports which are electronically archived by Hella marine, ensuring international navigation lamp standards are consistently met.

Red Night Lighting

Night Vision - Why red light does not affect our night vision.

The human eye contains two types of receptors, the rods and the cones. Rods and cones have an increased sensitivity to frequency bands at different ends of the visual spectrum.

Rods are largely responsible for our day time and colour vision and have an increased sensitivity towards the red band of the visual spectrum.

Cones are responsible for our night vision capability and have an increased sensitivity towards the blue, shorter wavelength band of the visual spectrum.

For this reason red light will not affect the sensitivity of the cones and with that our night vision is not affected by the use of red light in the cabin.