

Application Focus: Lighting for Offshore Wind Farms



Raytec is a world leader in LED lighting for hazardous area environments and industrial applications. SPARTAN is our range of globally certified Ex LED luminaires, also available as heavy-duty industrial variants. SPARTAN luminaires deliver world-leading performance, reliability and durability. In this Application Focus, we explore the lighting requirements for offshore wind farms and identify some of the key features to consider when specifying luminaires for these types of environments.

Lighting Requirements for Offshore Wind Farms

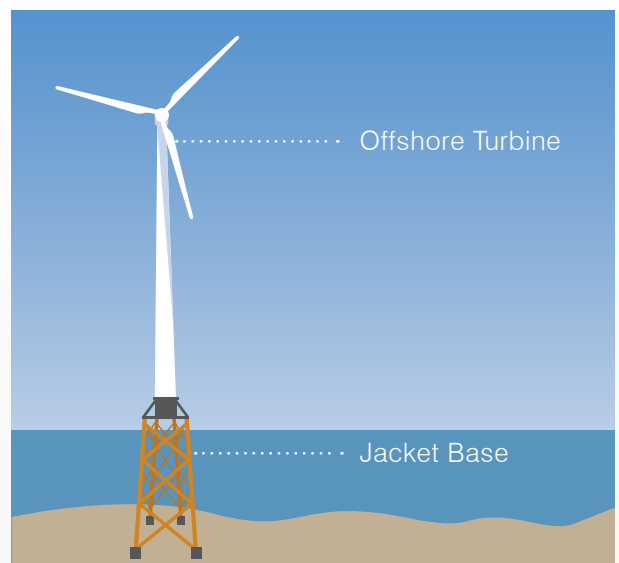
An offshore wind farm can be defined as a cluster of wind turbines constructed in a body of water. From here, the turbines harvest wind energy to generate electricity and benefit from the high wind speeds of their offshore location.

However, the nature of an offshore location provides a challenging environment when specifying lighting. Given the continuous exposure to marine conditions, such as high wind speeds and a saline environment, a high-quality and durable luminaire, capable of withstanding these elements, is critical.

Typical Areas Requiring Lighting Includes:

Jacket Base of the Turbine

The 'jacket base' is the supporting structure which the turbine sits on. The jacket sits above the waterline, as well as being anchored to the seabed, giving the turbine the foundation it needs to withstand the harsh marine environment and dynamic loads. Lighting is required to ensure safe working conditions when accessing and departing the turbine, via a crew transfer vessel, where the jacket structure is the main access point. Installing lighting here is also beneficial for routine maintenance and inspection of the area around the 'splash zone', where corrosion occurs due to the meeting of the waves and air.



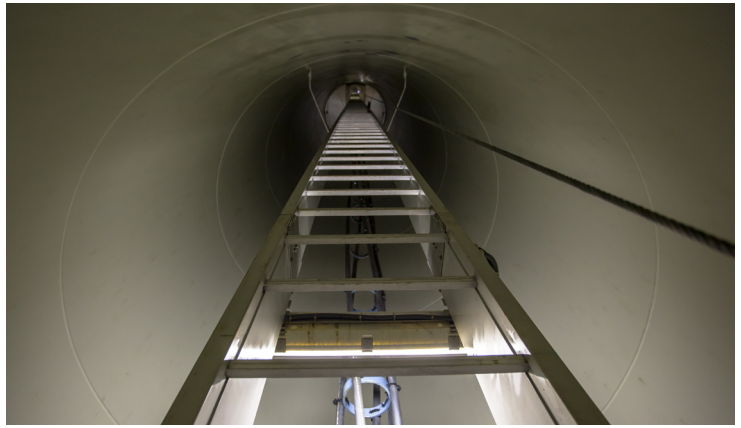
Interior of the Turbine

Lighting is required inside the turbine for the safety of workers when they perform routine maintenance procedures from within the tower. In many cases 'Emergency Lighting' is also needed to maintain safety in the event of a power outage.

Access Area Lighting

It is a necessity for heavy-duty industrial lighting to be installed at the crew access point to the turbine, when disembarking the crew transfer vessels. This area sits above the supportive structure and is accessed via a bridge from the crew transfer vessels. Therefore, safety requirements dictate that high-quality industrial lighting is needed to make sure these areas are well lit.

All of these areas require the use of a heavy-duty luminaire to withstand the challenges of the environment. The remainder of this article will explore the key features to consider when specifying a luminaire for an offshore wind farm.



Specifying Lighting for Offshore Wind Farms

Choosing LED

Firstly, selecting a luminaire which uses LED technology (rather than over conventional lighting, such as high-pressure sodium), should be considered essential when specifying for offshore wind farms.

Maintenance

Providing it uses effective thermal management, an LED luminaire can offer a lifetime of 100,000 + operating hours, without the need to re-lamp. This results in a significantly longer lifespan and lower lifecycle costs. Reducing the number of maintenance interventions in these remote, offshore locations, where access is difficult and costly, is vital.

Energy Costs

Keeping costs to a minimum is a common goal amongst offshore wind applications. LEDs run more efficiently than conventional lighting, reducing energy costs, but the real benefit comes from an LED luminaire's ability to instantly restrike. Instant restrike allows the lights to be easily switched on and off when they're not being used. In contrast, due to the warm-up time of a conventional lamp (such as High-Pressure Sodium) they would likely be left switched on 24/7 to avoid costly and impractical delays during maintenance.

Quality of Light

Light quality is also improved, with LED's capable of providing improved CRI and higher colour temperatures than conventional lighting, drastically improving working conditions.

Easy Maintenance

Specifying an LED luminaire can help in reducing the frequency of maintenance required. However, the way a manufacturer has designed the luminaire can have a large impact on how easily maintenance can be carried out if it is required, and how long the site is left without light.

Making Access Easier

For offshore wind farms, where access for maintenance can be difficult, choosing an LED luminaire with a removeable power supply unit (PSU), that can be placed separately from the main unit, can help make access easier. For example, Raytec's SPARTAN High-Power Flood & High-Power Bay luminaires, allow the PSU module to be removed from the main body of the luminaire and be positioned in an easy to access location. This makes access to serviceable parts far easier.

Let us contemplate this in the scenario of an offshore wind application. As mentioned earlier, lighting is required inside the interior of the turbine, stretching from the bottom to the top. Each luminaire can be accessed via a stair or lift system within the turbine column. However, when routine or emergency maintenance is required, having the PSU located at ground level would mean this could be conducted with more efficiency. Having this functionality reduces the time taken to carry out maintenance, and its associated cost. By reducing the time and frequency which maintenance workers spend working at height, health and safety compliance is also positively impacted.

Reducing Downtime

Minimising downtime is crucial to the financial viability of wind farms. If the lighting fails, certain scheduled maintenance procedures can't take place due to the health and safety risks to the workers. This could have a detrimental impact on the 'up-time' of the turbine itself. So, having a lighting solution that allows maintenance to be quick and easy - bringing the turbine back into service as soon as possible - can be a massive selling point for manufacturers, developers and investors, as this improves the overall financial viability of the site.

Durability: Withstand Harsh Environments

There are many environmental issues companies need to be aware of when installing hardware for an offshore wind application. These will be discussed in further detail below:

Sea Water (Saline Environments)

A saline environment (exposure to sea water spray and salt water saturated air) can cause a higher risk of corrosion compared to inland applications. Saltwater spray aggressively corrodes the metal. Once evaporated, saltwater can also leave a thin film of salt on the hardware - interfering with the performance of the luminaire by reducing light intensity.

Any luminaire installed in these offshore locations needs to withstand these aggressive conditions. At Raytec, our SPARTAN range is designed with offshore use in-mind. Made with marine-grade aluminium and stainless-steel fixings, while being ABS-approved to marine standards, our luminaires are ideal for any marine application.

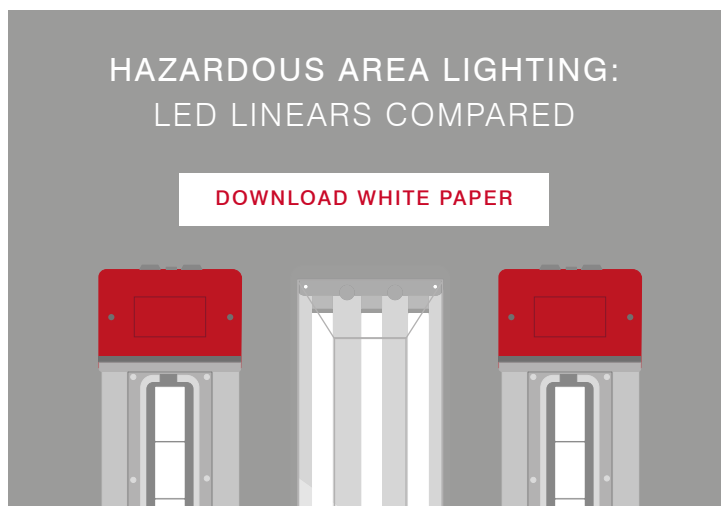


Modular Design



Top Tip for Specifying....

Specify a luminaire made from marine grade aluminium or stainless steel as this provides a more robust solution under aggressive environmental conditions. Also look for a luminaire which uses a smaller front gasket, reducing the risk of water ingress into the unit. To find out more about this topic, read our most recent white paper 'Hazardous Area Lighting: LED Linears Compared' where we highlight the design differences of Ex Linears on the market.



High Wind Speeds / Rain-Drop bombardment

High wind speeds and other weather conditions such as sleet, hail and heavy rains are a regular occurrence for offshore applications. A luminaire with a high IP rating is essential to prevent water ingress which could damage internal components of the unit.

Fixing centres and brackets of luminaires also need to be durable enough to withstand the extra wind forces. If this is not the case, then over time the lighting bracket could wear and snap causing the unit to be lost at sea.

Top Tip for Specifying...

Specify a luminaire with an appropriate IP rating, and check exactly which tests the luminaire has been exposed to. SPARTAN luminaires have been approved to both IP66 and IP67 standards – so they can withstand powerful water jets (IP66) as well as temporary immersion (IP67).

Sun and UV Exposure

Prolonged exposure to the sun, or UV (ultraviolet) rays, is common for offshore locations. In the case of an offshore wind turbine, the turbine is in a vast, open space, with nothing to shadow the turbine. When lighting is installed in external areas, such as the 'jacket base', this continuous exposure to UV may cause issues for some luminaires, depending on the materials it's constructed from. For example, luminaires made from GRP (glass reinforced plastic) can degrade and become brittle when exposed to UV over long periods, causing issues around maintenance and structural integrity of the housing.

Emergency Lighting

Offshore wind sites are high-risk environments and rely on the use of emergency lighting to ensure the safety of maintenance workers on-site at that specific time.

Turbines have a tendency to cut out. This can be down to several reasons, such as the wind speed being too high, water entering the wiring system, a voltage or current surge, or overheating. In these circumstances the turbine is turned off, the fault assessed, repaired, and restarted. This can sometimes be done remotely, but in many cases, it is necessary for people to enter the turbine to manually check the issue. Emergency backup lighting is therefore a necessity to maintain the safety of anyone on site, providing back-up illumination in the event of a power outage. This protects maintenance workers and can be essential in getting the turbine running again. Emergency lighting may also be needed to evacuate people from site if issues are unable to be resolved.



Duration & Output

To ensure an emergency luminaire will provide back-up illumination for the required length of time, it is important to check the emergency duration when specifying. Consideration should also be given to the level of light output the luminaire provides whilst operating in emergency mode. This is usually expressed as a percentage of the luminaire's output in normal operation, and it is common for output to drop significantly when in emergency mode.

Most of Raytec's SPARTAN emergency luminaires provide 25% light output for 3 hours as standard but can also offer up to 100% output for a shorter duration if required. The duration and intensity of output are often specific to individual applications, so this flexibility can be an important benefit.

Automated Testing

Some manufacturers are now providing emergency luminaires which increase safety and reliability of emergency systems. Raytec's SPARTAN Intelligent Emergency luminaires provide a self-testing function which automatically cycles the emergency battery, to maintain its health and to measure its capacity. This ensures the luminaire is operating at its optimum and reduces the requirement for manual intervention. Inspection of emergency luminaires is also made easier, with a tri-colour LED indicator which communicates when the unit is going through a testing procedure and highlighting the health of the luminaire.

Other Considerations

Lighting Design

Lighting design is an essential part of specifying lighting for an offshore wind application. With numerous turbines across one site, achieving the correct light levels on-site will improve safety and efficiency across the turbine. For specifiers going through the initial design process, a lighting design will provide peace of mind that the final solution will achieve the required, on-site lighting goal, with no surprises at the point of commissioning.

Raytec's completely free lighting design service, provides you with the 3D visual representation of the final lighting solution, with detailed lux levels and a true indication of lighting performance. Our lighting design experts will give you dedicated one-to-one support to ensure that the optimum solution is achieved, in-line with your requirements.