

LED Compartment Lighting Suite for Collins-Class Submarines

Technology Solution: ASC – Australia’s largest specialised defence shipbuilding organisation – was engaged to upgrade the 6 Collins-Class submarines operated by the Royal Australian Navy.

“To meet the customers production schedule Oxley established specialist manufacturing and product testing cells designed to meet the customer requirements.”

Oxley secured an initial contract to replace the existing fluorescent compartment lighting in a single Collins Class diesel electric submarine with an LED lighting solution. Oxley designed, manufactured, and comprehensively tested a total of 326 luminaires which were installed on the submarine. They proved to satisfy all of the boat’s lighting requirements in terms of compact design, brightness and safety and as a result Oxley was awarded the 2 year contract for the remaining 5 boats, including spares holding and setting to work.

As part of the contract ASC required a solution to replace fluorescent tubes with a suite of LED compartment luminaires which were able to meet the comprehensive specification for submarine use.

LED lights designed and manufactured to exacting military standards are ideally suited to submarine operation. They offer long operational life of up to 50,000 hours, advanced shock survival, low physical profile, power saving and advanced illumination characteristics which reduce fatigue and multi-mode operation from a single unit. Fluorescent tube lights have proved less reliable and difficult to store and dispose of safely, this is a particular issue on a submarine where personnel are within a contained environment (as breakage of fluorescent tubes and subsequent release of mercury can be a health issue).

Critical elements to be addressed when designing the LED lights included the fire risk posed by materials, the finite space available, managing the heat generated by the units and providing improved power efficiency. It was important to consider both recessed and surface mounted lights when developing the design to enable consolidation of the existing 16 lighting units in to 4 form factors, with 8 functionality types. This reduced the quantity of on-board and dockside spares required; saving the client weight, space and money.

The new lights were a bespoke design for the Collins Class project - but employ much of the Oxley technology proven in the harshest of military environments. They also delivered significant reductions in power demand– a vital consideration for diesel electric submarines where power is a finite resource. The luminaires could not waste energy in heat generation and the power factor of the lights had to be as high as possible, this had to be achieved without the use of aluminium electrolytic capacitors, which are large in size and have poor reliability. To achieve this Oxley developed a complex, software controlled, active PFC switched mode power supply design which constantly monitors the input and output power to achieve a typical power factor of 0.92.

The 12 light variants supplied include units with red or white LED output, and flushed or recessed mountings. They offer the option for an integrated battery back-up to operate in the event of total power failure, other specifications include explosion proofing, and operation with and without local control. Operating temperatures range from 10°C to 55°C and all of the units are sealed to a minimum of IP54. All lights were designed to surpass a high (2.5kV) voltage spike bespoke to this submarine and the unusual power input of 115 V 90° AC phase provided additional design complexities. The units operate from an isolated 2 phase 115V 60Hz supply in accordance with DOD-STD-1399.

