Example entry

Category three - Best solution to an identified electrical issue

1: Describe the electrical issue and how it was identified.
Mark Smith, whilst surveying hundreds of vessels for electrical compliance, discovered that shore connections (specifically the connection box for ship to shore electricity supply), were not compliant to the Australian Standards. Further to this, the most critical safety factor is a very serious risk of electrical hazard including electrocution, due to current running through functional earth.

This specific issue was addressed and detailed in Mark's formal surveyor reports listing the non-compliance against the corresponding and relevant clause in the standard. The non-compliances needed to be addressed by the client before a satisfactory report could be issued and a Certificate of Survey issued. Not being able to obtain this certificate can impede business in the Domestic Commercial Industry impacting on their revenue.

To further explain, Mark uncovered that vessels were initially found to be compliant to AS/NZ3004.2 (specifically Australian/New Zealand Standard AS/NZ3004:2014 Electrical Installations – Marinas and boats – Boat installations), however the polarity monitoring test failed to meet AS/NZ3000. Furthermore AS/NZ3000 stipulates that for polarity testing, current is not allowed to normally run through the earthing conductor, which is exactly what was happening with a permanently connected polarity monitor.

Nothing Mark has seen during these surveys addressed the issues of:
- Current permanently running through the earthing conductor
- The interlocking system, and
- *The momentary polarity test.

Legislation references both standards, however consideration was not given to both with shore connections on the market or connections made in a piecemeal manner.

The outcome is that in most cases full compliance has not been met and the most critical safety factor for a vessel is Reversed Polarity which presents a very serious risk of electrocution. By having incorrect polarity, this exposes the vessel and the people on board to an electrical hazard.

Concerned that boat owners were unknowingly non-compliant and at risk of serious injury, Mark set out with the purpose to come up with a unique new design for a 'plug and play' shore connection box that would solve these issues.

2: Explain the solution that was developed to address this issue.
In 2018 Mark began the process of designing a circuit arrangement that met the requirements to check polarity by undertaking a momentary test, which by design would stop current normally running through the protective earth.

Additionally, the design of the circuit arrangement included an interlocked system. This allowed for the functionality of preventing power to be connected to the boat if polarity was incorrect. It also gave the person the ability of reversing the polarity without calling an electrician.

The circuit arrangement also was designed to be Fail Safe. This means that if power was lost or there was a problem with the device, the device fails to safe mode – it was de-energised. Additionally with the automatic testing function, if shore power was lost due to an outage, the device will automatically undertake the testing and re-connect to the shore power.

The design process took over three years of extensive research and development to develop circuit arrangements and prototypes prior to the actual manufacturing of the device.

More specifically, In order to achieve this over 15 developmental designs were developed and improved upon over a three year period. This included many hours designing circuit arrangements, performing calculations, building prototypes and testing.

To further explain the process, the following is an overview of the designing process, highlighting the critical steps in the evolution of ESHORE.

The first step was designing a circuit arrangement based on the idea of what was required - a momentary polarity test.

Mathematical calculations were then performed to check the effectiveness and validity of the arrangement as well as to determine the components required to build the first prototype. This first prototype was built based on a 24v control system and whilst functional, it did not meet the design requirements for the enclosure. The next prototype investigated the use of a

240v control system using in-line resistors enabling the use of solid state relays. In line with the above process, calculations were performed, components ordered and a new prototype was built. It was determined that this arrangement would meet design requirements and produce a momentary test.

The next evolution of the design process was to convert the design from a manual system to an automatic one which involved the above process but additionally involved designing the circuit arrangement making allowances for timing relays and latching contactors.

Finally the process involved marrying the above with the enclosure that would ultimately house the circuit arrangement. This enclosure needed to be fit for purpose in the marine industry. Functional testing on the completed prototype was then performed to determine the cyclic life of the device. The final step in the process was confirming that the device met all aspects of AS/NZ3004.2 and AS/NZ3000.

Mark spoke with Government and regulatory bodies, industry representatives, target market and his peers to discuss his solution prior to, and during the development of the device. At every stage, Mark received positive feedback on the need for a better solution and for his prototype device.

3: Outline how successful the solution was and how it improved electrical safety.
ESHORE is a brand new product that was officially launched to the Australian market at the Sanctuary Cove International Boat Show on the Gold Coast on 19-22 May 2022.

Mark's design process has enabled him to manufacture in Australia 3 devices to date:- 16amp single phase 32 amp single phase, and a *3 phase.

A soft launch of the product occurred on the 22nd April and a few products have been sold to the Domestic Commercial Vessel market, with one company installing the 3 phase device on 5 boats that are currently being built in Vietnam. All have received positive reviews on ease of installation and ease of operation. Testimonials are available.

As the product is new, there is little data as to more widespread effectiveness of the product, however the patented circuit design, and the end product meet the initial objective of creating and manufacturing a shore connection device that met all legislative requirements as well as was safe for the consumer. Additionally the response from the Boat Show has been positive with a Boat Builder in Perth recommending the device for all new builds

moving forward, several DCV businesses expressing interest in purchasing the device for their vessels, which is in motion, and a major Chandlery wanting to sell the device to the Australian and New Zealand market through their website, as well as another major Australian Chandler, who has been in the industry for a long time and is currently in negotiations regarding supply and pricing, commented that ESHORE is “a great product, massive market with education of boaties needed.”

Apart from safety and compliance it has also indirectly resolved the issue of electrolysis that can occur on vessels. With Mark's patented momentary Polarity Test eliminating current running continuously through the protective earth, it has thereby reduced the effects of electrolysis.

Mark is constantly looking at ways of improving the design and is currently working on a printed circuit board for the 16 amp device which is currently in the testing phase.

The hurdles that currently are being faced is with educating the recreational boat owners, as they are unaware of the changes they need to make and the potential dangers that exist with current devices.

The opportunities however extend beyond the Marine Industry, and can be applied to the RV market in both Australia and New Zealand (where it is actually legislated that polarity is required to be checked). Changing the volatges in the circuit arrangement of the device so that it can be compatible with connections in other countries also opens up many more possibilities.

There is no doubt that the product has addressed compliance and safety issues that exist currently, and with the patented momentary polarity test will reduce electrical hazards on board when the boat is plugged into shore power. It is the only product on the market that has a momentary polarity test, and this unique patented design makes it the only safest shore connection available.