Mr. Mark Smith
Director
SET Maritime & Electrical
PO Box 374
Coorparoo, Qld, 4151
[redacted]

14th August 2023

The Honourable Grace Grace MP,
Minister for Education
Minister for Industrial Relations
Minister for Racing
1 William Street
BRISBANE QLD 4000

Re: **2021 Review of Queensland's Electrical Safety Act 2002**

Dear Minister,

Thank you for the opportunity to provide feedback on the Review of the Electrical Safety Act 2002 and personally I commend the statement by the Queensland Governments preliminary response to the Final Report, that electrical safety is a key priority. The 83 recommendations within this report will be a major step forward in managing these risks for emerging technologies of electrical components and systems, to improve electrical safety.

With the increasing popularity for the installation of renewable technologies for energy generation, transmission, distribution, and energy storage for maritime installations for extra low voltage (ELV) and low voltage (LV) and unfortunately this area in not as well understood or regulated for compliance, as it should be.

Topic1: Electrical Safety Considerations of New and Emerging Technologies.

Questions seeking feedback.

1. ***How are you, your organisation or your stakeholders affected by the problems identified and to what extent?***

   Response:

   As a Marine Electrical Surveyor (Inspector) for over 10 years, and developer of the compliant and award-winning Shore Connection and Reverse Polarity Testing Device - ESHORE, I have come to realise that there is a large degree of apathy towards understanding and complying with marine electrical standards.

What I find within the Recreational Craft (RC), (and DCV) market is that there is a reluctance by marine industry stakeholders to look past AS/NZS 3000 series or follow the guidance with AS/NZS 3004.2 for marine installations. The prime example is the use of lithium battery systems in vessels.

They are many concerns that go with the installation of lithium batteries on vessels and 2 examples of areas that are being misunderstood are:

a) Lithium batteries are being sold in Queensland in the marine industry as a direct replacement for Lead Acid batteries. Lithium battery installations require specific charging settings, monitoring and switching systems. A summary of the major points related to safety are:
    i. CHARGING
    Lead acid battery chargers typically deliver a constant voltage charge, where lithium battery chargers deliver a constant current and voltage charge.
    This means that if a charger that is suited for lead acid batteries is used for charging lithium, it can cause overcharging in these batteries. This may result in an exothermic reaction within the lithium battery referred to as a thermal runaway. Once this reaction starts, the combination of fuel and oxygen causes a self-generating fire and will only stop once the supply is exhausted.
    ii. BATTERY MANAGEMENT SYSTEM
    This is an extremely important safety system for Lithium batteries, as BMS systems will disconnect loads if the voltage gets too low and disconnect chargers if the voltage gets too high (overcharging). This requirement for a BMS is also specifically identified in AS/NZS 3004.2:2014 which states "***shall be fitted to all maritime craft***".
b) Inverters are a popular must have on RC, as these can provide 230 Volt AC from a battery bank and does away with the running of a generator. For marine applications inverters on RC are deemed a power source (as per AS/NZS 3004.2) requiring that the multiple earth neutral (MEN) be located at the power source. Cheaper inverters on the market are not generally suited to marine applications, as they don't have a MEN, which is an important connection to ensure the correct operation of residual current devices (RCD).
    For inverters that do have an internal MEN, there is another important safety point requiring the link between the earth and neutral be switched on in marine installations. This becomes apparent when the RC is connected to shore power at a marina, as now there are 2 MEN links in the distribution network; one on the RC and the other located at the Marina's main switchboard. This will lead to unwanted tripping of RCDs.

2. ***Do you agree with the assessment of the problem identified, and are there any other elements to the issue that you think have not been captured? If yes, what are they and can you provide examples of these issues?***

Response:

The assessment of the problem identified are well thought through and is looking to address the issue of ELV and LV. However, the element of maritime electrical installations, has not been fully explored. The limited area raised for comment is under the heading of 'Recreational vehicle and vessel audits' (pg. 87 of the Report - Review of the Electrical Safety Act 2002), referring to the need for consultation with the national regulator, the Australian Maritime Safety Authority

(AMSA). Unfortunately, this is not the case for recreational craft (RC) registered as a Queensland regulated ships which comes under the jurisdiction of the Department of Transport and Main Roads and MSQ.

Additionally, further areas of concern that can be added to the 2 examples above are the arrangement for shore connection arrangements for vessels berthed at marinas and wharfs. These are:

a) Flexible cables for shore lead connections to the conform with the following (not limited to):
    i. To be at least a heavy-duty flexible extension lead (A Bunnings white extension lead is not compliant);
    ii. The shore connection lead to be fitted with IP56 (min) plug and socket;
    iii. The lead to be tested and tagged every 12 months, and;
    iv. That there is protection against reversal of polarity.

3. ***What practical impact in the form of benefits would the options proposed in the Discussion Paper have on you, your organisation, the workforce or the community? Please provide examples where possible, including for new and emerging technologies and ELV equipment.***

Response:

A positive outcome would be to improve the standard of electrical safety to marine vessel to protect life, the environment and lastly the asset.

For road vehicles, where there is release of electrical energy from batteries or cabling causing a possible fire, the operator can stop the vehicle and can exit with passenger (if applicable) to a safe distance. For a vessel at sea this is not an option and the safety appliance to keep you alive is to remain on vessel itself, as once you enter the water, your chance of survival diminishes exponentially the longer you stay in the water.

With DCV vessels, survival at sea is a required course to have completed for commercial crew, which even then only in some cases helps This is not the case for RC. There is an adage by seafarers that you always step up into a safety appliance and never step down into a safety appliance.

4. ***What practical impact in the form of costs, would the options proposed in the Discussion Paper have on you, your organisation, the workforce or the community? Please provide examples where possible, including for new and emerging technologies and ELV equipment. What is your preferred option for the various ELV discussed and why will it be best for you, your organisation and your stakeholders?***

Response:

The practical impact to improve the level of electrical safety, will be in the form of costs for additional Government awareness, education, licencing programs, and new training modules for technicians working with new and emerging technologies.

However, the area to ensure these regulations are being implemented, is to add rigour around the metrics collected on compliance for operational data for a Performance-Based regulation to be effective. This is a critical step.

5. ***What is your preferred option for the various ELV discussed and why will it be best for you, your organisation and your stakeholders?***

   Response:

   Option 2: Proposes a legislative change, to introducing a licensing requirement for those working on electric vehicles and vessels.

   Option 3: Awareness and education campaign, increasing Government communication on safety when working on electric vehicles and vessels.

   The benefit myself and other Marine Electrical Surveyors is the clearer the legislation and reference to standards are, the easier it is to pass these requirements onto the end user, that this to protect them and their asset.

6. ***If you prefer Option 1 (status quo), how would the potential electrical safety risks of newer ELV technologies be minimised or eliminated?***

   Response:

   This is not an option that will provide the outcome of improved electrical safety.

7. ***Do you have suggestions for other options to address the problems identified? Please provide examples (including costs where appropriate) of your suggested options, including how it would ensure the workforce are electrically safe and conduct electrically safe work for community safety.***

   Response:

   I believe this is a good initial step to improving electrical safety and capture the new and emerging technologies.
   However, the landscape of these technologies is rapidly evolving, and to ensure workforce are electrically safe and conduct electrically safe work for the safety of the community, an option for reviewing the Queensland's Electrical Safety Act would be better served as well as conducting regular 10-year reviews to keep pace of advancements in technology.

8. **Are you aware of evidence of the dangers of particular forms/categories of ELV equipment? If so, what evidence is available?**

   Response:

   The example previously provided above (Q: 1) identifies the ELV equipment of lithium battery and inverters for ELV installations has greatly increased. Also, the consideration for safety regarding ELV installations are how they are now interfacing with LV installations.

9. **Should certain ELV equipment be included in the scope of the Act's regulatory reach that are not currently covered?**

   Response:

Yes, as the potential of risk has increased due to the energy storage capacity and therefore the potential of a resulting fire increases. A typical lithium-ion battery storing 260-270 watt-hours of electricity per kilogram of battery, is significantly different to the current lead acid battery storing 50-100 watt-hours of electricity per kilogram of battery. The temptation is to fit more lithium batteries to provided longer operation hours (Amp hours), keeping your LV appliances working overnight without depleting the stored energy. However, with this increase of stored energy, (Electrical power), comes the potential of greater energy release producing tragic results due to thermal runaway. The results are equally as disastrous with a RV at a remote camp site.

10. ***What approach to including ELV equipment within the scope of the ES framework should be adopted in Queensland?***

Response:

There is already an ES framework in place for Restricted licenses for those performing electrical work incidental to a trade or calling, for example:

- Refrigeration and air conditioning technicians.
- Instrumentation and process control technicians.
- Plumbers working on hot water systems.
- Gas fitters working on gas appliances.
- Electronics technicians.
- Mechanical fitters disconnecting/reconnecting electric motors.

This Framework should be expanded to capture work involved with ELV systems that use alternative energy storage systems, (not lead-acid batteries) and ELV installation that interface with LV installations.

11. ***Should a measure of energy density/capacity be adopted? If so, which measure and what amount (e.g., how many watts per hour)?***

Response:

Yes, and I would suggest that the measurement of energy density be adopted, as a battery's capacity does not tell you the amount of energy it has stored. To determine the amount of energy the battery stores the voltage must be known, as the higher voltage the more energy for capacity is given, shown in the following formula: -

Energy (Watt-hours) = Capacity (amp-hours) x Voltage (volts)

The simplest way would be to have 2 categories:

i. Battery with a storage capacity below 200 watt-hours of electricity per kilogram of battery to remain unregulated.
ii. Battery with a storage capacity of above 200 watt-hours of electricity per kilogram of battery to be regulated.

12. ***Are you aware of evidence of the dangers of particular forms/categories of ELV equipment? If so, what evidence is available?***

Response:

The above example provided information around particular types of electrical dangers that are associated with the installation of new technology in ELV equipment. This fact was recently highlighted while attending SCIBS as an exhibitor, where during my time there, I had the opportunity to look at other exhibitors. A local Queensland company caught my attention, with their display of Lithium- Ion batteries and engaged in a discussion on their product. The batteries were being offered as a direct replacement for lead-acid batteries. There was some knowledge of charging requirements, but what was most surprising was that the batteries were being offered without a BMS.

Topic 2: Changing Landscape of Electricity and the Workforce

1. ***How are you, your organisation, the workforce and the community affected by the issues posed by the changing landscape of electrical work? To what extent?***

   Response:

   The changing landscape has always been a constant struggle as I/we find ourselves taking on the role of educator and enforcer and subsequently debating with people about the fact that their interpretations of standards/rules are incorrect. Electricians working in the maritime industry, DCV operators and private boat owners do not keep up to date as much as they should with changes that are happening and now with the dangers of new and emerging ELV technologies. There is a high degree of apathy to marine electrical standards and compliance to AS/NZS 3004.2 and I believe this will not change until MSQ commence collecting and analysing data on compliance and operational data for Performance-Based regulation, to be effective.
   In the past 18 months, I have tried to 2 occasions to engage with Minister of Transport and Main Roads on this matter and each time this engagement had been referred onto MSQ. The response where less than encouraging. The reply letter received from the General Manager of MSQ was less then convincing of that electrical safety is a key priority. It was he that said, and I quote:

   "The legislation is performance-based rather than prescriptive and as such does not mandate the way in which owners and operators meet their general safety obligations."
   Having referenced what performance-based legislation is and as part of the principles of a regulator's best practice for performance-based outcomes, this requires someone to look at the metrics collected on compliance and operational data to gauge if the legislation is being effective.

   To follow up on metrics that would be required, I have recently made a request to Licensing & Advisory Services (WHS#206745) for information related to monitor performance-based legislation on 4 key areas. The response by the Office of Electrical Safety (OES) was by phone and the OES are in Blue under each key area:

1. The number of referrals that MSQ made to the Electrical Safety Office to conduct compliance inspections on Queensland-registered vessels.
   In the past 12 months MSQ has made no referrals.
2. The number of inspections that the Electrical Safety Office conducted regarding compliance of Queensland-registered vessels.
   OES does not routinely conduct compliance inspections on Queensland-registered vessels.
3. How many certificates of testing and compliance have been submitted to the Electrical Safety Office for the electrical installation works of Queensland-registered vessels.
   The issuing certificates of compliance is provided to the customer on completion of electrical works and these are not forwarded to the Regulator.
4. How many marinas have been inspected for electrical compliance.
   OES has never conducted inspections of marina electrical installations.

It should be noted that WorkSafe Qld does have policies with relation to compliance and enforcement for electrical safety and are prominently found on their website. Having checked the MSQ website, a policy for compliance and enforcement of Queensland-registered vessels could not be found.
Although MSQ release bulletins on a regular basis, the topic of marine electrics has been written about on only two occasions over the past five years.

I have had a follow up conversation with [redacted] of Maritime Safety Queensland (MSQ) Compliance Unit, and a meeting was held on 7 March 2023 MSQ officers, unfortunately the was no representative from the Office Electrical Safety.
To date I have had no real feedback on the issues that I have raised.

NOTE:
Please find attached all correspondence between the Minister, MSQ and myself for your reference.

2. ***How many workers have been impacted by the identified hazards or are exposed to such hazards and might be exposed in the future? Which workers/ businesses/ households are impacted by the problem?***

Response:

There is very little data on maritime incidents involving electrical hazards as it tends to be a hidden area that few people report. Antidotally, while as an exhibitor at SCIBS and discussing electrical hazards with member of the general public, it become apparent that receiving an electric shock is a normal occurrence on your boat or when connecting the boat to shore power.

3. ***Which are the key industries in which these tasks take place and how large are they?***

Response:

Recent statistics obtained from Boating Industry Australia (BIA), for the year ending 30 June 2021:

- the Australian marine industry had a turnover of $8.835 billion.
- more than 2,100 active boating industry businesses

- more than 920,000 registered boats
- and approximately 18,500 new boats registered during the year in Queensland.

4. ***Do you agree with the assessment of the issues identified with the changing nature of electrical work, are there any other elements to the issue that you think have not been captured? If possible, please share examples of your experience with these issues.***

   Response:

   I believe that the review has captured the changing nature of electrical work in broad terms and agree with the proposal that has identified changes to legislation for Government communication and engagement to be increased.
   There will be a need to undertake a review for the specific area of Queensland registered ship, however the framework of updating the Electrical Safety Act is the required first step.

5. ***What practical impacts – including costs and benefits – would each option have on you, your organisation, the workforce and the community? Please share examples of impacts and experiences of impacts, where possible.***

   Response:

   The practical impacts would be a reduction of risk to the workforce and community for these new and emerging technologies.

6. ***In relation to the following three risks considered, which of the four options do you think is best and why?***
   a) ***Fixing, mounting and locating of renewable energy generation and storage technology (such as solar PV panels)***
   b) ***Mechanical cable protection work,***
   c) ***Laying, cutting or sealing underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source.***

   Response:

   Of the 3 risk assessments, a) is relevant to the maritime industry, in relation to the fixing, mounting, and locating of renewable energy generation. There are some differences that need to occur for marine installations that differ from shore installations. Examples of installations that vary from the Standard are as follows:

   i. The PV panel installation of the roof is required to have a 10000 V isolating switch to be fitted adjacent to the panels. This is not always practical on a vessel however it is located as near as possible to the PV panel.
   ii. The use of stainless steel for securing earth bonding cable to aluminium structures. In the Maritime Industry this relates to electrolysis, because aluminium and 316 stainless steel are far apart on the galvanic scale. When in contact with each other, the potential for corrosion is extremely high, with the aluminium being more anodic. The subsequent corrosion can lead to poor continuity bonding.

The other matters raised within this section are outside my area of experience and knowledge.

7. ***Do you have suggestions for other options to address the issues identified? Please provide examples (including costs) on the impacts of your suggested options, including how it would ensure the workforce is electrically safe and conduct electrically safe work.***

   The other matters raised within this section are outside my area of experience and knowledge.

8. ***The Review identified risks with the locating mounting and fixing of energy generation and storage electrical equipment. Do you agree that the risks identified are limited to this equipment? If not, what do you consider the scope of these risks to be?***

   Response:

   I would have to agree with the risks identified in relation to the location mounting and fixing of PV module. As once exposed to sunlight, the circuit is alive, and with that the risk of electric shock increases. The issue of poor handling practice of cables during the mounting and fixing of PV modules and the crushing or insulation damage further exacerbates this risk.

9. ***The Review identified risks from the laying, cutting or sealing of underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source (section 18(2)(j) of the Act). Other exclusions for electricity entities also exist in section 18(2) of the Act. Has the decentralisation of energy generation had a similar impact on the risk profile of these exclusions? Please provide examples where possible.***

   Response:

   The matter raised within this section are outside of my area of experience and knowledge.

Topic 3: Electrical Safety and Electric Vehicles

1. ***How are you, your organisation, the workforce or community affected by the problems identified and to what extent?***

   Response:

   The review of this sections looks specifically at the electrical safety risks presented by electric vehicles (EV) and gaps within the existing education, training, and licencing of workers. These same gaps are also a present within the RC and RV markets. While EV operate on 400Vdc, the majority of marine installation and RV market typical use battery bank arrangement of 12, 24 or 48Vdc and are categorised as ELV system. Under the NSCV the use of ELV battery storage is captured and requires electrical plan approval for systems identified as complex. This covers the area of lithium batteries, charging, stowage and BMS, which are all referenced in the standard AS/NZS 3004.2. This is not the case for RC and as mentioned above in Topic1 -1 i) lithium

batteries are being fitted with incorrect charging systems and no BMS fitted. Also, from my own visits to RV shows and looking at different installation systems; from this very narrow sample of the RV market, it would strongly suggest to me that same gaps that are present in the EV market are of the same concern of that of the RV market.

2. ***Do you agree with the assessment of the problem identified, and are there additional risks presented by electric vehicles that have not been identified? If yes, what are they and can you provide examples of these issues?***

   Response:

   For the DCV the most practical choice is the Plug-in Hybrid Electric Vehicles (PHEVs) with energy being provide by a combination of fuel and battery. The use of alternative fuel for maritime is still in the early stages of development. The use of liquefied natural gas (LNG), liquefied biogas (LBG), hydrogen, ammonia, methanol, ethanol and hydrotreated vegetable oil (HVO) are being considered. With these alternatives are currently being assessed by classification society like DNV.

   I am currently not aware a hazard identification and risk assessment (HIRA) haven been undertaken at for the DCV. A believe that a systematic approach to assess hazards and their associated risks would provide the techniques to manage these risks.

3. ***What practical impact, including the costs and benefits, would the options proposed in the Discussion paper have on you, your organisation, the workforce or the community? Please provide examples where possible.***

   Response:

   The practical impacts would be a reduction of risk to the workforce and community for these new and emerging technologies.

4. ***What is your preferred option and why would it be best for you, your organisation and your stakeholders?***

   Response:

   Option 2: Proposes a legislative change, to introducing a licensing requirement for those working on electric vehicles and vessels.

   Option 3: Awareness and education campaign, increasing Government communication on safety when working on electric vehicles and vessels.

   The benefit me and other Marine Electrical Surveyors is the clearer the legislation and reference to standards are. The easier to pass these requirements onto the end user that this to protect them and their asset.

5. ***If a licensing framework was introduced:***
   a) ***Should any specific type of vehicle be excluded for the requirement (e.g., motorcycles, cars, buses, trucks)? If so, what are they and why?***

Response:

My initial response is to say NO, as the use of lithium batteries is now being used in all forms of transport devises by industry and the public. These battery systems now are not only prevalent on our roads and homes, but are used in Airports (public and secure areas), Hospitals (patient movements), Warehouses, etc.
With an increase of use, we are seeing an ever-increasing number of incidences that we are reading about or seeing on TV of fires that involve in products that use of lithium battery technology.

b) Is a restricted licence (specified training) or full licence (full apprenticeship) suitable? If so, why?

Response:

The introduction of a restricted licence for ELV is warranted, mention above with relation to in just one aspect of lithium battery systems and their use. The charging and monitoring of these batteries have specific requirements and these are not being addressed at the point of sale or installation.
This is prevalent in the older technology of AGM or Absorbent Glass Mat batteries are advanced type of maintenance-free lead-acid batteries. These are what are referred to as a gel type battery and have maximum charging rate of 14.1Vdc. If over charge these batteries with first bulge, leading to casing rupturing and then the possible release of electrical energy from the short-circuiting battery plates.
This requirement of DCV is in place and requires that an Accredited Marine Electrical Surveyor must approve the Electrical Schematic and Wiring Diagram for installation that are deemed to be a complex system by AMSA.

c) Should the licence type be determined based on the type of vehicle? If so, what would you suggest and why?

Response:

Accreditation training for a restricted licence should be for the basic of working safely with vehicle electrical installation. For specific training requirements for the differing types EV, would from the Manufacture and Industry stakeholder to ensure that specific training is provided.
On a personally level, I would like to see a difference of license type for shore based and marine based electrical systems.

d) What types of work or occupations should be excluded from a licensing requirement? Or alternatively, what types of work or occupations should have specific licensing requirements (e.g., on-road works, general maintenance and check-ups, and/or removal and disposal)?

Response:

No comment

e) ***Are there any elements under the Act which should not apply? Which sections and why?***

All elements identified under the Act which should apply.

f) ***Are there situations in which a disconnect and connect restricted licence for performing work on non-propulsion components of a vehicle would be appropriate?***

Response:

I would suggest that for situation where the disconnect and connect of the electrical supply can be undertaken by the activation of a double isolation pole switch to isolate the power supply to work on non-propulsion components of a vehicle would not require a restricted licence for performing this task.
However, if it is required that cabling to be disconnected to isolate the power supply to work on non-propulsion components of a vehicle, it would be appropriate that this task should be performed by a person holding a restricted licence.

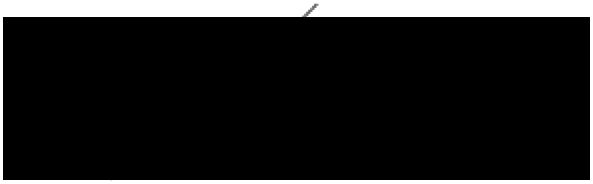
6. ***Do you have suggestions for other options to address the problems identified? Please provide examples (including costs where appropriate) of your suggested options, including how it would ensure the workforce are electrically safe and conduct electrically safe work for community safety.***

Response:

No Comment

Once again thank you for the opportunity to provide feedback on this important review and if you have any questions. Please do not hesitate to contact me and I trust this information is of assistance.

Yours sincerely



Mark Smith CEng, CMarEng, FIMarEST, BAppSc(MarEng)

Enc. Correspondence with the Minister for Transport and Main Roads and MSQ

- Email to the Hon Mark Bailey MP, Minister for Transport and Main Roads
- Response from General Manager (Maritime Safety Queensland)
- Letter to The Hon Mark Bailey MP, Minister for Transport and Main Roads
- Response from General Manager (Maritime Safety Queensland)

SET Maritime and Electrical Capability Statement
CV for Mark Smith

Mark Smith

From: Mark Smith
Sent: Thursday, 1 September 2022 7:26 AM
To: transportandmainroads@ministerial.qld.gov.au
Cc: [redacted]
Subject: Subject: Request for meeting with The Hon Mark Bailey MP, Minister for Transport and Main Roads
Attachments: Supporting information.docx; 1.MIB---Electrical-Systems.pdf

Dear Minister,

I am writing to request a meeting with you to **discuss compliance breaches and serious safety concerns relating to electrical connections for both marine vessels (DCV and Recreational) and caravans**.

The purpose of the meeting is to discuss that installations have been identified where **people have received electric shocks** due to incorrect polarity of consumer mains or submains. Shore installations are regulated by Work Safe - Electrical Safety Office and marine installations are regulated by MSQ?.

MSQ has been contacted for comment and informed that they do not have the technical expertise to verify if compliance is met on commercial and recreational ships/vessels/boats/craft. No education programs have been rolled out, nor inspections conducted of marine electrical installation to see if compliance is being met. It was suggested I contact Work Safe - Electrical Safety Office, to see if their inspector? conducted electrical compliance for QLD registered commercial and recreational ships/vessels/boats /craft for compliance.

I would like to share with you some further information about the impacts of non-compliance with the standards and concerns regarding serious safety risks. Please find attached supporting information.

I would like to understand your views on this issue, and to understand what can be done to raise awareness about this, and what needs to happen for much needed change to occur.

Can your office please contact me to arrange a suitable time for a meeting?

I plan to attend with a member of my team, [redacted].

Yours faithfully,

Mark Smith CEng, CMarEng, FIMarEST, BAppSc(MarEng)
Principal Surveyor
Accredited Marine Surveyor: AMSA – 3242-6148 4
Qld EC Lic. 73995
Authorised Maritime NZ Surveyor – SRV242

SET Maritime & Electrical

PO Box 374
Coorparoo, Qld 4151

[redacted]
WEB: http://setmaritime.com.au

ATTACHMENT: SUPPORTING INFORMATION

ABOUT MARK SMITH

Mark Smith is the owner of SET Maritime & Electrical and is a **qualified Chartered Marine Engineer** and an **AMSA Accredited Marine Surveyor**, and an **Electrical Contractor**.

Mark is a **member of the Australasian Institute of Marine Surveyors** and **Fellow of the Institute of Marine Engineering, Science and Technology (IMarEST)**.

Throughout his career spanning 40 years, Mark has worked in numerous areas of the Oil and Gas Industry, working with Bluewater, Offshore, and Floating Production Storage and Offloading (FPSO) units, with exposure to main propulsion systems including medium/slow speed diesels (including diesel electric), steam and gas turbine engines.

More recently Mark's work has taken him into the Domestic Commercial Vessel (DCV) industry where he specialises in electrical compliance for Plan Approval and Surveys of vessels. Over this time Mark has gathered extensive knowledge in relevant legislation and standards.

This breadth of experience has allowed Mark to develop a unique and highly sought-after skill set, not to mention an extensive knowledge base to draw upon.

THE ISSUE

Whilst surveying hundreds of vessels for electrical compliance, Mark discovered that their 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 concern is a **very serious risk of electrical hazard including electrocution**, due to current running through functional earth.

This specific issue was addressed 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 compliance issued. Not being able to obtain this certificate can impede business for the Domestic Commercial Industry impacting on revenue for the business.

To further explain, Mark uncovered that vessels were initially found to be compliant to AS3004.2 (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 had 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.

MARINE INDUSTRY OVERVIEW

According to the Australian Government, Department of Industry Science Energy and Resources, the Australian Marine Industry includes:

- shipbuilding and repair
- boatbuilding and repair
- marine equipment manufacturing
- marina operations

The Boating Industry Association posted a national snapshot of the marine industry for the year ending 30 June 2021 highlighting the following key figures:

- The marine industry had a turnover of $8.835 billion (up 11% YOY)
- Direct employment was 27,630 with many thousands more in associated businesses (up 9% YOY)
- There are more than 2,100 active boating industry businesses (up 5% YOY)
- There were more than 920,000 registered boats and countless non-powered watercraft during the year
- More than 2.5 million Australians held a boat licence
- There were approximately 18,500 new boats registered during the year.

The Australian Skills and Industry Committee reported that Australia is the fifth largest user of shipping services in the world, and 80% of Australia's imports and exports by value are carried by sea.

SPECIFIC TO MARINE

Work Safe published electrical licensing disciplinary action, listing Reverse Polarity as below:

- September 2019
- September 2020
- April 2021
- October 2021
- March 2021
- April 2022
- February 2022

Work Safe Newsletter dated December 2021 has highlighted the issue:

Several installations have been identified where either people at the property, or at another property, have received electric shocks due to incorrect polarity of consumer mains or submains.

https://www.worksafe.qld.gov.au/news-and-events/newsletters/esafe-newsletters/esafe-editions/esafe-electrical/2021-bulletins/december-2021/testing-for-correct-polarity

The above are all related to Shore Installation and Marine installations are regulated by MSQ. However, MSQ does not have the technical expertise to verify if compliance is met on commercial and recreational Ships/Vessels/boats/craft.

(Information received from - [redacted] *)*

AS/NZS 3004.2:2014 - Electrical installations-Marinas and boats; Part 2: Boat installations details SHORE CONNECTION ARRANGEMENTS and how protection against reversal of polarity in the supply lead is achieved.

Marine Information Bulletin (MIB) – Dept. Transport & Main Roads (see attached Marine Information Bulletin - Electrical-Systems)

A MIB was first issued in 2017 regarding all Qld Registered commercial and recreational Ships/Vessels/boats/craft are to comply with AS/NZS 3004.2:2014 - Electrical installations-Marinas and boats; Part 2: Boat installations. This MIB was updated in 2021

MSQ has been contacted for comment and informed that there has been no rolled out an education program nor inspections conducted of marine electrical installation to see if compliance is being met.

QLD electrical safety regulator Work Safe - Electrical Safety Office, has been contacted for comment and informed that their inspectors do not conduct inspection of Qld Registered commercial and recreational Ships/Vessels/boats /craft for compliance.

SPECIFIC TO CARAVANS

AS/NZS 3001:2008 - Electrical installations-Transportable structures and vehicles including their site supplies (RV)

These mobile recreational vehicles are the same as maritime craft, in that each time a connection is made at a new site, it is conceded to be a new connection and polarity is to be verified.

NZ have the following additional requirements with relation to Polarity (APPENDIX C of the above Standard):

C5 TESTING OF SITE SUPPLIES

- C5.1 Polarity of socket-outlets - Socket-outlets shall have the correct polarity.
- C5.2 Polarity of protective devices
- C5.2.1 Active conductor operation - Protective devices shall operate in the active conductor.

C7 TESTING OF CONNECTABLE INSTALLATIONS

- C7.1 Polarity of socket-outlets - Socket-outlets shall be verified as having the correct polarity.

- C7.3 Polarity of the supply lead - Supply lead conductors shall have the correct polarity.
- C7.4 Polarity of appliance couplers - Appliance coupler conductors shall be of the correct polarity.

Protection against reversal of polarity in the supply lead for RV installation similar to those of Maritime installation should be considered.

WHAT MARK HAS DONE ABOUT IT

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, called ESHORE.

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 design 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 AS3004.2 and AS3000.

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.

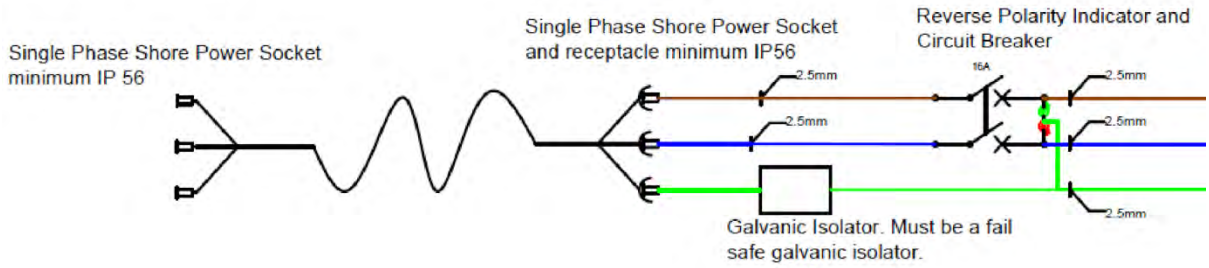
PRODUCT TECHNICAL INFORMATION

Over the last six years, during his many hours surveying vessels for electrical compliance Mark discovered that shore connections were not compliant to the Australian Standards 3004 and 3000. He found that vessels were initially found to be compliant to AS3004.2 however the polarity monitoring test failed to meet AS3000.

Legislation references both standards however consideration was not given to both.

Furthermore, AS3000 stipulates that for polarity testing, current is not allowed to normally run through the earthing conductor.

Diagram for permanently connected polarity monitor which is not complaint



Unlike the housing industry, there are many variables that can affect polarity. The sources of which can come from the extension lead used to connect as well as the actual shore connection. These variables can result in incorrect polarity which presents the electrical hazard.

To further explain, polarity in electrical terms refers to the active and neutral conductors within a AC circuit, Electrical polarity (Active and negative) is the direction of power supply in an electrical circuit. . In an alternating current (AC) circuit the two poles alternate between negative and positive and the direction of the current (electron flow) reverses cyclically.

In the context of electrical installations in the marine industry, a polarity test is used to confirm the correct connection of the active and neutral conductors. Similarly, it’s important to confirm that switches are located in the active conductor, not the neutral conductor.

The purpose of a polarity test is to ensure that all single pole devices (fuses, switches, and circuit breakers) are connected in the active conductor only. We cannot simply trust that it has been connected up the right way. Since ac installations consist of an Active and a Neutral conductor, it is extremely important that these conductors are connected the right way around, within all electrical devices and components To ensure this, a polarity test is done when connecting a new power supply to the boat, e.g. shore connection power from marina to marina.. This simple test is just as important as all the others, and many serious

injuries and electrocutions could have been prevented if only polarity checks had been carried out. Furthermore, according to the standards, the polarity test must be momentary only. This is the patented circuit arrangement Mark has developed.

This test will verify that polarity is correct. If polarity is not correctly terminated, there may be a risk of electric shock.

Reverse Polarity is when the conductors have been terminated incorrectly. While the circuit is still completed, this can create a dangerous situation.

Electrical outlets with reverse polarity can be dangerous to you and your devices and can remain energized even when turned off. Devices plugged into an outlet with reversed polarity may appear to work as usual but are unsafe and can shock you.

To better describe the issue of polarity and reverse polarity

Fig 1.

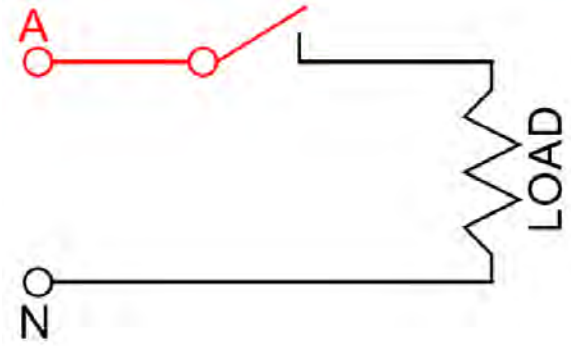
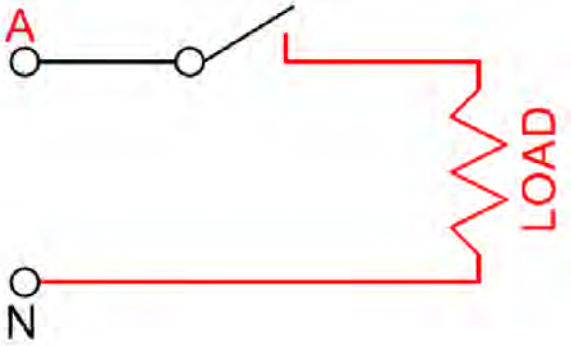


Fig 2.



For single phase shore connections to be safe and compliant, the verification of correct polarity is paramount. Correct polarity is illustrated in Figure 1. The reversal of polarity (Figure 2.), is when the neutral conductor is terminated to where the active conductor is supposed to be. This may seem like a minor problem, as all electrical devices will still operate, and in the event of a short for example will still be live even after turning the “switch” off. Because of this, all switching is in the neutral conductor.

To elaborate further, Figure 1 shows correct polarity, and with the switch open, there is no potential between the load and the earth. Figure 2 shows that incorrect polarity, and with the switch open, there is potential between the load and the earth. Allowing for an increased risk of electrocution, short circuit and/or fire.

Polarity Testing

To prevent reversal of polarity for shore to boat electrical supply as detailed in AS/NZS 3004.2, the following functionalities as listed below, need to be in place to ensure the correct operation of safety devices, and protect the personnel from electrocution and damage to the electrical installation: -

1. A circuit breaker operating in all live conductors of the supply, including neutral, and is fitted adjacent to the shore supply inlet on the vessel.
2. A test device, connected on the supply side of the vessel's shore supply circuit breaker to check and visually indicate the polarity of the shore supply in relation to the vessel's system*.

3. An interlocking circuit to ensure the shore power cannot be connected unless the polarity is correct *.
4. An indication to show when the shore supply is energised.
5. Appropriate switchgear to facilitate the reversal of polarity.

* Except where shore power is supplied to the boat by an on-board isolating transformer or converter with a polarized output.

The Standard also stipulates that instructions for connections of shore power are to be posted at the connection point.

The testing of Polarity is the foundational requirement that all shore connection devices need to address. The AS/NZS 3017:2007 Electrical Installation - Verification Guideline for energised systems, detail testing voltage potential between the active and earthing conductor, with no potential between the neutral and earthing conductor. This is normally achieved by using a multimeter and is a momentary test.

For Vessel shore connections this testing regime requires it to be part of a permanent installation and the need for a Functional Earth. Within AS/NZS 3000:2018 Wiring Rule, 1.4.66 Functional earthing (FE), it states that:

"An earthing arrangement provided to ensure correct operation of electrical equipment or to permit reliable and proper functioning of electrical installations."

Further details are provided in 5.2.2 Functional Earthing (FE), where it states that:

"Equipment may be required to be connected to the earthing system for purposes of correct operation rather than the safety conditions associated with protective earthing. In such cases, functional earthing conductors are not required to be selected and installed to withstand fault currents or to be identified in the same manner as a protective earthing conductor."

Examples for FE use.

- connections fitted to certain types of RCDs
- conductors connecting cathodic protection systems
- radio interference suppression
- clean earth

Therefore, a vessel where a permanent Polarity testing arrangement is required, the use of a functional earth is required. However, this test needs to be a momentary test, as Protective earthing conductors shall not normally carry current, so cannot be a permanent connection; (AS/NZS 3000:2018 - Clause 8.3.8.1).

Marine Information Bulletin

Queensland regulated ships – electrical standards and licences

Updated 30 June 2021

Purpose

This Marine Information Bulletin covers the standards applying to electrical installations on Queensland regulated ships and work that must be performed by appropriately licensed electrical workers. Boat owners are reminded that they must engage the services of an electrical contractor for any mains voltage (230V or 240V) work on their boats.

Definitions

Electrical contractor licence: A licence issued by the Electrical Safety Office authorising a person to conduct a business or undertaking that includes the performance of electrical work.

Electrical work licence: A licence issued by the Electrical Safety Office authorising an individual to perform electrical work. An **electrical mechanic licence** authorises the holder to perform all electrical work and an **electrical fitter licence** authorises the holder to perform all electrical equipment work.

Electrical work: Work at voltages above extra-low voltage, work on cathodic protection systems and work at extra-low voltage in hazardous locations. Electrical work includes testing and supervising electrical work.

Voltages: **Extra low voltage** (ELV) means voltage of 50 Volts or less alternating current (AC) RMS or 120 Volts or less ripple-free direct current (DC). **Low voltage** (LV) means voltage greater than extra low voltage but not more than 1000 Volts AC RMS or 1500 Volts ripple-free DC.

Questions

What are my responsibilities regarding the electrical installation on my boat?

Under the *Transport Operations (Marine Safety) Act 1994* owners and other persons involved with boats have a general safety obligation regarding the condition of boats, including the condition of a boat's electrical installation.

Low voltage electrical installations and electrical equipment on boats in Queensland must comply with the requirements of the *Electrical Safety Act 2002* (ESA).

The ESA provides that only licensed electricians may perform electrical work. A licensed electrician must ensure that electrical work is in accordance with **Australian/New Zealand Standard 3000** known as the **wiring rules** (AS/NZS 3000).

How can I meet my responsibilities regarding the electrical installation on boats?

Complying with the electrical standards and ensuring that electrical work on boats is performed by a licensed electrician is a way for owners and other persons involved with boat's electrical systems to meet their general safety obligations.

What standards apply to electrical installations on boats?

The electrician you employ must ensure that the low voltage installation complies with the wiring rules.

Provisions in AS/NZS 3000: 2007 apply to marinas and boats registered in Queensland–*7.8.2.4 Electrical installations in marinas and recreational boats* shall comply with AS/NZS 3004. Note 2 of clause 7.8.2.4, refers to *National Standard for Commercial Vessels – Part C Construction – Subsection 5B Electrical Edition 2* (NSCV Part C 5B).

AS/NZS 3004: 2014 Electrical installations – Marinas and recreational boats – Part 2: Recreational boat installations specifies requirements for the design, construction and installation of electrical systems in boats registered in Queensland that have a length of up to 50 metres and are designed for use on inland waters or at sea.

Another related standard is the NSCV C 5B, published by the National Marine Safety Committee in 2005. This is a commercial vessel standard that is also suited to electrical installations on boats registered in Queensland. This standard provides additional requirements and variations to AS/NZS 3000 necessary to reflect the requirements of the marine industry and the particular environment on boats, while satisfying the fundamental safety requirements of section 1 of AS/NZS 3000.

Will the electrical installation on an imported boat comply?

Imported boats complying with IEC/ISO standards, classification society rules or other known standards will comply with the fundamental safety requirements of section 1 of AS/NZS 3000. Compliance with section 1 of AS/NZS 3000 is mandatory and if there are issues of conflict between these other standards and AS/NZS 3000 (for example, cable colour codes in low voltage installations of American built boats), if not resolved under AS/NZS 3000: 3.8 will require resolution on a case by case basis by Maritime Safety Queensland in consultation with the Electrical Safety Office before acceptance for compliance.

Any person selling an imported boat, including an import agent, must ensure that the electrical equipment on board complies with Queensland legislation.

Household and similar type electrical equipment which includes such items as circuit breakers, switches, safety switches, refrigerators and microwave ovens must be registered on the Electrical Equipment Safety System register. See www.eess.gov.au.

What about maintenance and repairs to the electrical installation on a boat?

Maintenance and repairs to low voltage electrical installations on boats is electrical work and may only be performed by a licensed electrician.

Further information

Marine safety legislation is available on the Maritime Safety Queensland website at www.msq.qld.gov.au.

Copies of the *Electrical Safety Act 2002,* the *Electrical Safety Regulation 2013*, *Codes of Practice* and other publications regarding obligations for electrical safety are available as downloads from the Electrical Safety Office website (www.worksafe.qld.gov.au/your-industry/electrical) or call 1300 650 662.

Australian Standards are available from SAI Global Ltd. SAI Global can be contacted by phone on 13 12 42, by email at mailto:sales@sai-global.com and their website is www.saiglobal.com.

For further information contact your local Maritime Safety Queensland office:

Airlie Beach	4841 4500
Bundaberg	4132 6600
Cairns	4052 7400
Gladstone	4971 5200
Hervey Bay	4194 9600
Mackay	4944 3700
Mooloolaba	5373 2310
Brisbane	3632 7500
Gold Coast	5585 1810
Townsville	4421 8100

Other Marine Information Bulletins about the safe operation of boats are on Maritime Safety Queensland's website at www.msq.qld.gov.au

Mr. Mark Smith
Director
SET Maritime & Electrical
PO Box 374
Coorparoo, Qld, 4151
[redacted]

The Honourable Mark Bailey MP,
Minister For Transport and Main Roads
GPO Box 2644
BRISBANE QLD 4001

January 5, 2023

Dear Minister,

I refer to [redacted] letter sent on 12 October 2022 and thank him for his kind words regarding the recent awards won and the product, ESHORE. It's great to see that these awards have highlighted the safety concerns and compliance issues for marine electrical shore connections and installations.

The purpose of my original request for a meeting was in relation to these maritime electrical safety and compliance issues. There are serious concerns surrounding compliance and safety, and the complacency that seems to exist around this. I view this meeting as a necessary and important part of progressing this matter further, as well as to discuss the numerous practical strategies I can advise on, and that can be implemented swiftly to ensure safety and compliance.

Regarding [redacted] letter and with reference to performance-based legislation, and as such not being mandated. Metrics would still need to be collected on compliance and operational data for Performance-Based regulation to be effective, and as part of the principles of a regulator's best practice for performance-based outcomes, the collection of operational and compliance data for review, is a critical step. There is no point having regulations if no one checks if they are being complied with, and given what I have been able to ascertain, there is no checking that the legislated regulations are being complied with and there is a reliance that owners are properly maintaining their boats. **This lack of care is creating unnecessary risk of serious injury and death**.

My 45-year career in the marine industry has been extensive and has enabled me to gain an Electrical Contractor's license, become an AMSA Accredited Marine Surveyor, a Chartered Marine Engineer, as well become a member of the Australasian Institute of Marine Surveyors, and Fellow of the Institute of Marine Engineering, Science and Technology (IMarEST). In these roles I have relied upon historical and current data as well as vessel surveys to achieve performance-based outcomes.

Furthermore, in my current role as a Domestic Commercial Vessels (DCV) Marine Surveyor, I would find it incredibly useful to rely on such data, however enquiries to both Marine Safety Queensland (MSQ) and the Electrical Safety Office (ESO) reveal in the past no such data exists. Furthermore, ESO has informed me, that no inspections have been undertaken on any recreational or commercial vessels. This was also reinforced by [redacted], who has advised that there is no one currently employed by MSQ who has the technical knowledge of marine electrics.

To follow up on metrics that would be required, I have recently made a request to Licensing & Advisory Services (WHS#206745) for information related to monitor performance-based legislation on the following areas:

1. The number of referrals that MSQ made to the Electrical Safety Office to conduct compliance inspections on Queensland-registered vessels
2. The number of inspections that the Electrical Safety Office conducted with regard to compliance of Queensland-registered vessels
3. How many certificates of testing and compliance that have been submitted to the Electrical Safety Office for the electrical installation works of Queensland-registered vessels
4. How many marinas have been inspected for electrical compliance

I have recently had a response from the ESO (by phone), who could only respond to point 3 above, that the issuing certificates of compliance is provided to the customer on completion of electrical works. This is not forwarded to the Regulator, although it is a requirement in other jurisdictions. During this phone conversation, it was discussed that in the past 12 months MSQ has made no referrals and does not routinely conduct compliance inspections on Queensland-registered vessels. They also did not recall whether the ESO has ever conducted inspections of marina electrical installations.

It should be noted that WorkSafe Qld does have policies with relation to compliance and enforcement for electrical safety are prominently found on their website. Having checked the MSQ website, **a policy for compliance and enforcement of Queensland-registered vessels could not be found**.

Although MSQ release bulletins on a regular basis, the topic of marine electrics has been written about **on only two occasions over the past five years**.

Recent statistics obtained from Boating Industry Australia (BIA), for the year ending 30 June 2021:

- the Australian marine industry had a turnover of $8.835 billion
- more than 2,100 active boating industry businesses
- more than 920,000 registered boats
- and approximately 18,500 new boats registered during the year in Queensland.
- And over 2.5 million Australians held a boat licence.

It would seem prudent and proactive to make this area a priority, with 18,500 new boats registered in Queensland in the past year. As certificates of compliance are not required to be sent to the Regulator, MSQ would not have knowledge of how many of these boats have electrical installations fitted. This is further supported when registering a Recreational Boat, the form that is required only notes that the Owner must meet obligations under the Petroleum and Gas (Safety) Regulation 2018 and the Electrical Safety Act 2002.

Upon a recent visit to a Marina in Brisbane, a walkaround revealed that approximately: -

- **90% of shore connection leads were not tested and tagged as required by legislation**
- **85% of connections had incorrect IP rating for fittings (plug and sockets)**
- **50% had cables that were in various stages of deterioration**

When you look at the published data from hearings conducted by the Electrical Licensing Committee over the past 12 months, disciplinary action has been taken against 73 licence holders with none of these having a connection with the industry.

Following the list of disciplinary actions displayed on the Worksafe Qld website is a message from the Commissioner for Electrical Safety and Chair of the Electrical Licensing Committee, Keith McKenzie, stating the following:-

"Most hearings that the Electrical Licencing Committee presides over involve electrical testing, including:

- ***the lack of knowledge on how to test***
- ***understanding of test required***
- ***understanding of test results and recording of those results.***
- ***failure to test at all.***

Testing the installation includes:

- ***whether it is a new or existing installation***
- ***addition or modification to a circuit***
- ***installation of a new piece of equipment.***

The testing is not only mandatory (s.23 of the Electrical Safety Regulation 2013) but will determine that the electrical work undertaken is electrically safe."

Maritime Electrical Contractor License holders hold the same licence type that are held by those that have been disciplined by the Electrical Licensing Committee, and it is hard to draw the conclusion that there have not been any electrical incidences in the maritime industry.

In summary, the purpose of this meeting is to your draw attention to serious and potentially deadly compliance and safety issues of marine electrical connections, and the repercussions of current complacency in the industry.

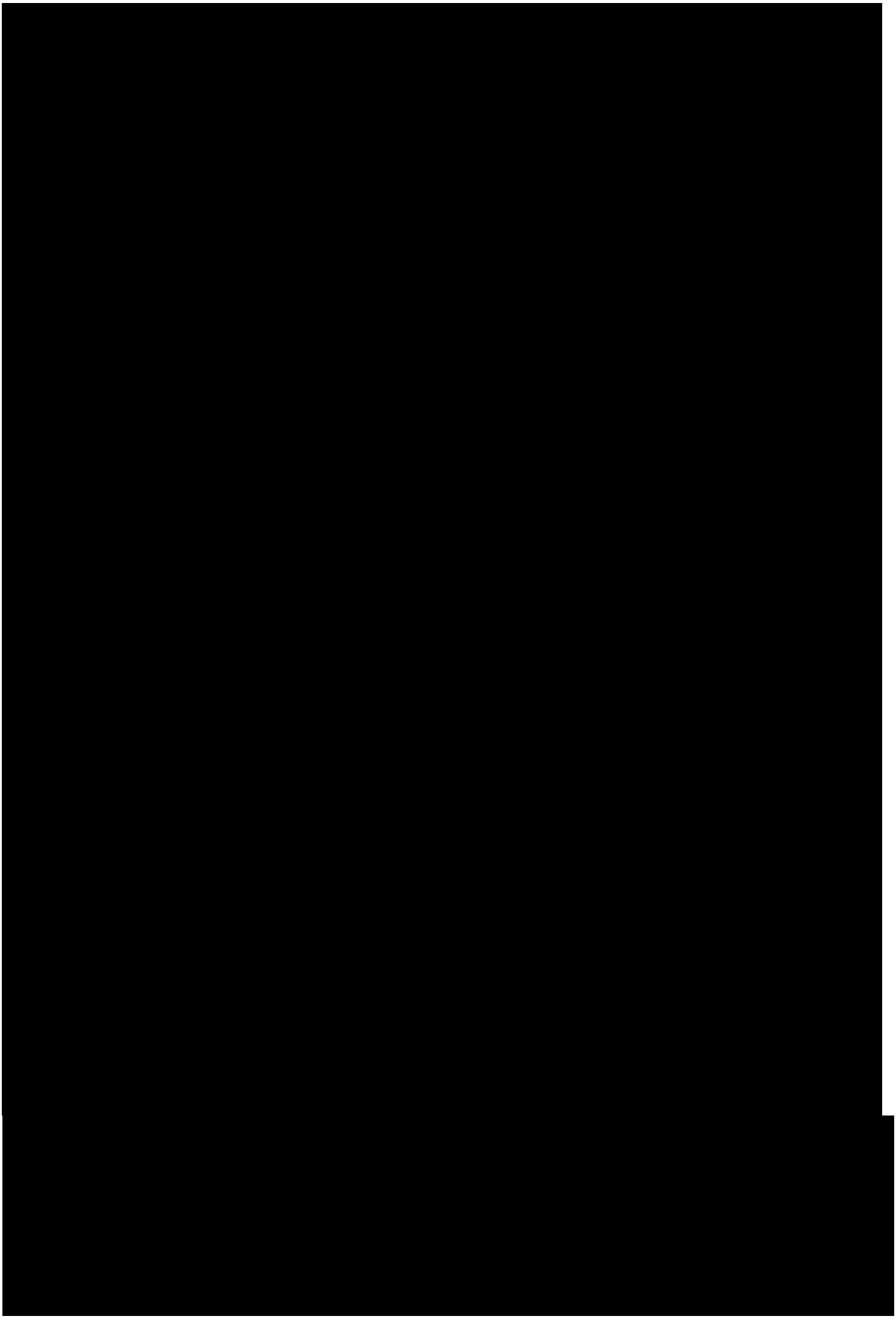
I believe a conversation with yourself and/or the relevant parties where we can discuss the issues and potential solutions will go a long way towards addressing these concerns.

Thank you in advance for your consideration of this important matter.

Yours sincerely

Mark Smith CEng, CMarEng, FIMarEST, BAppSc(MarEng)

Enc. Letter Mr. Dillon 12 October 2022



[redacted]

CAPABILITY STATEMENT

Email: [redacted]
Web: http://setmaritime.com.au
PO Box 374, Coorparoo, 4151
Mobile: [redacted]
Office: [redacted]

Business Overview

SET Maritime & Electrical is headed up by Mark Smith who is a highly regarded AMSA Accredited Marine Surveyor, Marine Engineer, and Electrical Contractor. After a seagoing career that spanned 21 years in Blue Water and the Oil & Gas industry, Mark then moved to a shore position as Technical Manager for GO Offshore for 5 years. Then in 2011 started his own Maritime Surveying and Consultancy Company, with a focus on Maritime Safety.

Core Competencies

SET can offer a unique skill set that can meet the varied requirements of Companies, Operators and Owners in the marine industry in areas of:

- DCV – Electrical installation design, approval, and survey for ELV, LV and HV.
- SME - Incidents involving hull and machinery, and the relevant onboard safety procedures.
- SMS – Writing and implementing to meet Part A of the ISM Code.
- FMEA – Undertaking Failure Mode and Effects Analysis for DP Vessels (Electrical & Mechanical System).
- DP – Reviewing systems, revising, and designing electrical systems for redundancy.

Professional Profile

- Engineer Class 1: Motor & Steamship
- Bachelor Applied Science (Marine Engineering)
- Associate Diploma Engineering (Marine)
- Electrical Contractor (QTP / QBP)
- Chartered Marine Engineer and Fellow IMarEST
- Charted Engineer - The Engineering Council (UK)
- Member Australasian Institute of Marine Surveyors

Current & Past Projects

- Electrical Propulsion & Power System Package for a 70m Catamaran Ferry.
- Hybrid Electrical System for Feed Barges within the Fish Farming Industry.
- Electric Propulsion Semi-Submersible Barge, remotely operated for Women's World Cup (Conceptional)
- Houseboat Hybrid Electrical System

Research & Development

- With Mark's extensive background, he developed a unique shore connection device that undertakes a momentary test for polarity which is very different to current devices that are permanently connected to the PE. This device meets the exacting requirements of:
  - AS/NZS 3004.4:2014
  - ABYC - E-11 AC & DC Electrical Systems
  - AS/NZS 3000:2018
- Mark is also currently working with an Industry Leader in independent electric power systems to improve Maritime Safety.

Industry Awards

The Polarity Device has been awarded by the following:

Worksafe Queensland Awards (2022)
- Best Solution for an Identified Electrical Issue

Australian Business Awards (2022)
- Product Inovation

Stevie Awards - Asia Pacific (2023)
- GOLD - Innovation in Consumer Products & Services
- BRONZE - Achievement in Product Innovation

Health Safety & Environment

With Mark at the helm and his experience in the oil and gas industry, and Offshore vessel management SET has the experience to undertake risk assessments, for:

- Hazard identification and risk assessment (HIRA)
- Management of Change (MOC)
- Pre-Startup Safety Review (PSSR)
- Critical Activity Mode of Operation (CAMO)
- Activity Specific Operating Guidelines (ASOG)
- Safe Work Method Statement (SWMS)
- Job Safety Analysis (JSA)

Skills Diversity

SETs diverse history of Maritime education, training, and competency., enables clients to be provided with an opinion that is based and supported on compliance on associated structure, ventilation and systems that can affect electrical installations:

- Structural design (Access/Ventilation/Protection)
- Mechanical/Electrical Systems (Access/Ventilation)
- Fluid pumping & piping systems
- Fire protection and extinguishing
- Emergency monitoring systems (Fire/Bilge/Earthing)

Curriculum Vitae - Mark R. Smith

Details

Name: Mark R. Smith CEng, CMarEng, FIMarEST, BAppSc(MarEng

Address: [redacted]

Office Telephone:

Mobile:

Satellite Phone:

Email:

Career Summary

The past 6 years of my career as an accredited Marine Surveyor (AMSA), I have been engaged in DCV survey attendances requiring verification of compliance to the NSCV Standard, and hold the following accreditation categories:

a) Initial Survey – Plan Approval **Electrical only*
d) Initial Survey – Electrical (Extra Low Voltage)
e) Initial Survey – Electrical (Low Voltage)
f) Initial Survey – Electrical (High Voltage)
g) Initial Survey – Construction or Alteration (Hull/Deck/Superstructure) **Steel and Aluminium only*
h) Initial Survey – Construction or Alteration (Machinery/equipment/Commissioning)
i) Initial survey—construction or alteration—loadline conditions and markings
j) Initial survey – construction or alteration (Equipment)
k) Initial survey—construction or alteration (Commissioning)
l) Periodical Survey
m) Periodical Survey – Electrical
n) Periodical Survey – Loadline
o) Survey of Safety Equipment
p) Survey of Communication Equipment

Primarily my role has been involved in the design and approval of electrical plans for Extra Low (ELV), Low (LV) and High HV) voltages systems. Some of these electrical designs, have included propulsion systems and the use of alternative powers supplies such as the installation of PV arrays and lithium-Ion batteries.

Additionally, as I hold categories for initial surveys for construction, and having been involved with new build teams for the construction of 8 new build vessels, it enables the team to reduce attendances, by scheduling surveys for construction, machinery, equipment and commissioning, when attendance for electrical survey is required.

The other aspect of my business has been as a Freelance Consultant/Surveyor for the past 11 years, undertaking attendances for Maritime Engineering Surveys covering Hull and Machinery, P and I, Marine Cargo, Nautical Surveys, MWS, Salvage (Engineer), Dynamic Positioning Surveys and Consultancy, Flag State Inspector, Casualty (Underwriter) reporting, pre-purchase inspections and Subject Matter Expert (SME) testimony.

To underpin the above, I am a highly skilled professional Marine Engineer with extensive knowledge and experience in the maritime field built upon the sound base of the trade skills learnt as a Fitter and Machinist and Electrician.

These fundamental skills have been honed from my tenures as a Seagoing Chief Engineer (Motor and Steam) and Technical Manager. From these varied roles a comprehensive knowledge, understanding and experience has been gained in vessel's critical systems regarding mechanical, electrical, and hull structural strength, the areas of frontline and scheduled maintenance (including Dockings), the commissioning of mechanical and electrical systems.

Career Summary

July 2011 to Present

Position: Freelance Consultant/Surveyor
Company: SET Maritime
Achievements:

- Construction Initial Surveyors to the NSCV Standard;
- Electrical design approval to the NSCV Standard (ELV; LV & HV);
- OVID Inspection of vessel that are registered under the NSCV Standard;
- Awassi Express – Provide a technical opinion on the operations undertaken by the Country Fire Authority of Victoria in relation to the onboard silo fire;
- As the Underwriter's Representative, I identified failings of the Maintenance and Integrity systems during an incident investigation of vessel's plant and machinery that contributed to the incidents, and;
- Delivering DP Annual Trials (meeting client assurance standards) and undertaking FMEA gap analysis – develop proving trails from the analysis.

November 2008 to July 2011

Position: Technical Manager
Company: GO MARINE Group (Offshore and Inshore)
Achievements:
- Rapid response in shore support for Offshore/Inshore vessels breakdowns – Limiting off-charter exposure,
- Project Manager of New Build Programs (Vessel ≥ 45m)
- Development implementation and monitoring of CMMS – Ensuring that maintenance is planned, scheduled and monitored;
- Preparing scopes of work (including repairs and modifications to Structural repair for docking/slipping for offshore/inshore vessels;
- Development and implementation of a Safety Case for the facility;
- Development and implementation of maintenance policies and management – Company meeting ISM, ISO and Client audits, and;
- Identification of major OEM failures on ship systems resulting in improved support from suppliers and better internal awareness of technical issues.

January 2007 to October 2008

Position: Chief Engineer / Maintenance Supervisor
Company: Aibel Australia Pty Ltd
Achievements:
- Successfully supervised project, from the conversion and construction of an oil tanker to a FPSO and done within the scope of delivery window to produce first oil meeting market expectation.

October 2003 to December 2006

Position: Maintenance Technician/Second Engineer
Lead Technician / Relief Chief Engineer
Company: Woodside (WA)
Achievements:
- Direct input and on-site supervision to the 2005 annual shutdown.

December 1999 to October 2003

Position: Maintenance Technician / Relief Marine and Electrical Engineer
Companies: Newfield (WA)
Mermaid Marine Management (WA)
Mermaid Sound Port and Marine Services (WA)
Achievements:
- Increased my personal knowledge across diverse company Safety Management and Quality Systems.

August 2001 to February 2002

Position: Project Engineer
Company: Gavin Mair Marine Design (WA)
Achievements:
- Designed vessels engineering systems of new buildings to Classification Society regulations and owner specifications.

July 2001 to August 2001

Position: Maintenance Supervisor
Company: Power Station and Marine Services (WA)
Achievements:
- Supervising the overhaul/repair of marine diesel engines to manufactures and classification society requirements.

May 1999 to June 2001

Position: Project Manager
Company: Metrowest Electrical and Communications (WA)
Achievements:
- Telecommunications – Quotations and installation of GSM roof top and ground sites for Optus, Telstra and OneTel.

1983 to 1999 Marine Engineering Positions (summary)

Company: Empress Cruise Lines Pty Ltd (Malaysia)
Service: Passenger Ship
Position: Staff Chief Engineer
Period: 1.5 years

Company: Rachid Fares (Fremantle)
Service: Live Stock Carrier
Position: Technical Superintendent
Period: 2.5 years

Company: Australian Offshore Services (Victoria)
Service: Offshore Supply Vessels (AHTS, ORSV and FPSOs)
Position: Chief and First Engineer
Period: 6 Years (3 years as Chief Engineer)

Company: Western Australian Shipping Line (WA)
Service: Container/Bulk Carriers
Position: Forth, Third, Second and First Engineer
Period: 6 Years

Qualifications

Associate Diploma Engineering (Marine) (issued 1992 by Challenger Collage., Western Australia)

Batchelor of Applied Science (Mar. Eng.) (Awarded 2019 by University of Tasmania)

Certificates of Competence

- Engineer Class 1: Motorship, STCW 95 (issued 1993 by AMSA)
- Engineer Class 1: Steamship, STCW 95 (issued 2006 by AMSA)

Additional Certificates, Endorsements and Courses

- Electrical Contractors Licence (Qld No: 73995)
- DP Basic Operators Certification
- Tap Root Course – Incident Analysis (2010)
- Auditor/Lead Auditor for Quality Management Systems (issued Ferriby Marine)

Trade Certificates

- Fitter and Machinist
- Electrical 'A' grade licence (WA and Qld)

Professional Bodies

- Chartered Marine Engineer and Fellow of the Institute of Marine Engineers Science and Technology (CMarEng, FIMarEST)
- Charted Engineer registered with The Engineering Council [UK] (CEng)
- Member of the Australasian Institute of Marine Surveyors