# Electrical Safety Report (Solution of Prevention)

(Authored by Clem Capdevila, Electrical Contractor and Entrepreneur in Brisbane)

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Electrical shocks, fire and death by electricity occurs every year and will continue without a "solution of prevention" that can identify a risk prior to a fatal electrical event.

There is a current, urgent necessity for an action plan to predict and prevent electrical shocks and deaths, as well as fires caused by electricity, in all electrical installations building infrastructures throughout Queensland.

[redacted]

The "solution of prevention" (eliminating the risk of electric shock and fire) presented in this paper will identify why current systems are unable to provide a "solution of prevention" , how with some additional adjustments to the existing electrical infrastructure, a "solution of prevention" to eliminate electrical risks to persons and property can be achieved, which is the core purpose of the Queensland Electrical Safety Act 2002,

***(a) Preventing persons from being killed or injured by electricity; and***

***(b) Preventing property from being destroyed or damaged by electricity.***

The existing ASNZS3000:2018 wiring rules and Electrical Industry Infrastructure require a "solution of prevention" in order to achieve the principal aim of the Electrical Safety Act 2002.

**Why is the current Electrical Industry Infrastructure unable to implement a ''solution of prevention?**

**There are 5 main reasons-**

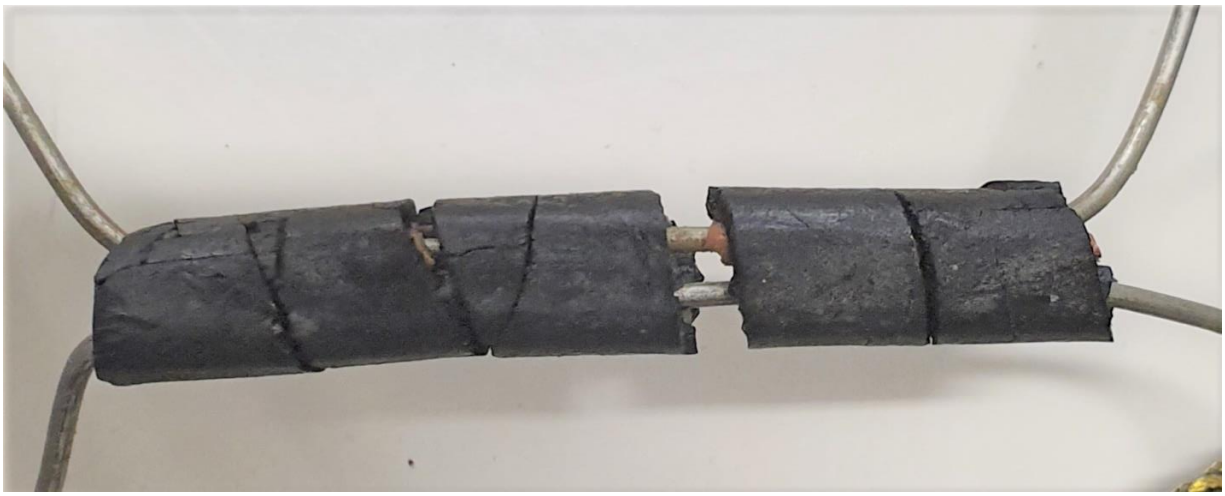
**Reason 1: How we test set by Electrical Industry Standards**

There are problems within the ASNZS3000:2018 wiring rules verification testing that prevents a "solution of prevention". This is mainly because most testing is performed de-energised with a Direct Current (DC), whilst building infrastructures use energised Alternate Current (AC). An electrical cable responds differently with energised Direct Current to Alternate Current. In order to see what a cable is doing when in service, it must be tested energised in order to read real values, readings that can predict a risk of electric shock and fire.

The current ASNZS3000:2018 wiring rules have 6 steps of verification listed (a) to (f), that must be performed when completing an electrical installation. Insulation resistance step (b) is tested "de-energised" meaning the power is turned off. Insulation testing cables de-energised is via an induced Direct Current (DC) voltage on only 2 conductors within an electrical power cable at a time. The testing value is measured in Mega Ohms to measure the level of resistance a copper conductor can handle surrounded by an insulation barrier. The purpose of the insulation resistance test is to identify an insulation breakdown to prevent the cause of electric shock and fire.

De-energised Insulation resistance testing cannot read resistive values on the neutral and earth cable under an energised state. As AC current pulsates against the insulation of the conductor walls, it can induce small to large amounts of voltage from the active cable conductor, through micro cracks to the earth and neutral cable conductors, resulting in high resistive values that will prevent a circuit breaker and

safety switch from tripping. This can cause electric shock and fire, only detectable the power is on (energised). Detected early, the risk can be eliminated preventing an electric shock or fire.



**Picture above:** This cable passed an insulation resistance test, because in order to pass the cable had to withstand 500V DC and not cause a short circuit. However, this cable could cause electric shock and fire.

The author has 4 years' experience in testing steps a, b, c, e & f with the power turned on (energised) and found that it is the only way to see what a cable is really doing, is when it is energised with Alternate Current. Reading values under an energised state on all 3 conductors allows a true picture a cables electrical property. Like a crocodile, you can tickle it whilst it sleeps and keep your arm, tickle it when it is awake, you will lose more than just an arm. An electrical cable is the same, it responds differently de-energised (livened with DC) to energised AC.

**Reason 2. Deteriorating electrical components**

The electrical installations in all building infrastructures will deteriorate over time and can cause electrical fire and electric shocks. With the current testing requirements, there are no test procedures that can determine the early stages of a deteriorating installation.

A typical power point electrical installation consists of 3 parts:

1. A circuit breaker with a safety switch
2. The electrical power cable
3. The power point

All parts in this circuit have the potential to negate the electrical safety of the circuit. This is caused by principles listed below:

- A safety switch ages if the spring inside is not tested regularly, which may cause delayed tripping times or may prevent the safety switch from tripping, raising the real risk of electrical shocks.
- An electrical cable typically has a life span of 30 to 50 years set by most manufacturers. A deteriorated cable can prevent a safety switch and circuit breaker from tripping, raising the real risk of electrical shocks and fire.
  **Electrical power cables in building infrastructures prior to the 1970's and, in some cases as early as the 1990's are at most risk.**

- A power point creates carbon build up over time (The material left after a spark from electricity), which will delay the safety switch tripping time from an appliance under fault, having to pass through the carbon build up to get to the safety switch, raising the risk of electrical shocks.

It is fundamental that all aspects of the above circuit are tested and working correctly for the circuit to be electrically safe.

It is important to note here that with existing testing requirements on the above example circuit, only the cable would be tested **de-energised** in steps (a) to (e) of the verification wiring rules and the safety switch in step (f), would only need to be tested by pressing the test button on the switch.

Leaving possible high resistive values on the electrical cables when energised which are not tested. The spring might be tripping the circuit from the switch board, but how does it trip at the power point, or at the appliance after going through the cable and passing through the power points possible carbon build up, resulting in an electrical dangerous installation.

An electrical power cable can power an appliance whilst possessing high resistive values on the earth and neutral conductors, that will prevent the circuit breaker or safety switch to trip under a fault. Resulting in a risk of electric shock and fire.

There is no system in place at present to check the entire circuits in order to detect and eliminate all the dangers that may be present in the components in the installation listed above.

However, in order to achieve a “solution of prevention” the current testing requirements must be modified in order to compulsory check all electrical installations of the entire building infrastructure.

**Reason 3: The existing testing requirements set by Electrical Industry Standards**

Under the existing electrical industry standards, a complete test is only required at the initial time of installation, and on just the circuit worked on for an electrical installation. Meaning that the home you live in has no requirement to be tested again after it was initially built.

If new electrical works are conducted, only those new electrical works need to be tested.

Leaving the building infrastructure at risk of fire and shocks as it ages and the electrical installation begins and continues to deteriorate, resulting in electrical shocks and fires.

The author has evidence that risks of electric shocks and fire may still be present in your home after an electrician has performed additional electrical works, due the current requirements of the ASNZS3000:2018 wiring rules and industry regulations and standards.

There needs to be a requirement to test the entire home or property in order to comply with the purpose of the Queensland Electrical Safety Act 2002. Without this change the Queensland people will continue to be subject to electrical shock and fire risks.

[redacted]

**Reason 4. Efforts from the Queensland Government in contributions towards Electrical Safety:**

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**The Queensland Government has an Act that protects it citizens and set requirements to ensure electrical safety**

1. Electrical Safety Act 2002 – Purpose of the Act includes:

(a)preventing persons from being killed or injured by

electricity; and

(b)preventing property from being destroyed or damaged by electricity

2. The Queensland Government created an advertisement campaign with the aim to educate the public.

In June 2016, the Queensland Government launched a TV and radio advertisement campaign with the message ***'1 safety switch may not be enough – call your electrician to see if your home is safe'.***

The author has noted that the general public believes that they are electrically safe by one or more reasons as follows:

1. The last electrician didn't say anything about not been safe

2. The meter reader didn't say anything

3. Energex changed the overhead line and didn't say anything

4. The Government didn't send me anything

5. I have 1 safety switch and I thought that it protects the entire home

**Reason 5: Outcome from the Queensland Government and Electrical Industries contribution towards Electrical Safety:**

Below is a picture of a switchboard at a holiday rental apartment in Yeppoon, Queensland in 2019. The owner believed the property was electrically safe and an electrician had inspected the property.


**Picture above:** Note only the power points are protected by the safety switch. If the safety switch is working properly ***and*** the cable is working within safe parameters ***and*** the power points are free from

carbon, then the safety switch will prevent electric shock causing death from appliances plugged into power points only. The remaining electrical circuits including the stove, air conditioner, fridge and lights have no safety switches. This poses the risk of electric shock from metal fittings and fire from exposed active conductors onto a flammable source and could result in an unsafe electrical circuit.

Both the Queensland Government and Electrical Industry failed to make this property free from electrical shocks. The landlord also conducted a business without ensuring electrical safety, unaware of the implications due to a lack of information provided in the current system.

**The "solution of prevention" by the author:**

The Author has developed an **Electrical Safety Check List** listed below:

**Electrical Safety Check List** - A complete testing procedure and minimal works required to provide real electrical safety to the entire property, identifying and incorporating a "solution of prevention" to any electrical hazards that may result in electrical shocks and property fires prior to an occurrence.

1. **Test:** Existing verification testing procedures set by ASNZS3000:2018 wiring rules
   **Result:** Prove that there is no chance of short circuit, correct polarity and continuity of earths to allow switches and circuit breakers to potentially work effectively before energising the power supply
2. **Test:** Live 240V digital resistive value testing of electrical power cables on all circuits (incorporates all verification rule requirements)
   **Result:** Identify resistive values under load to monitor safe working parameters to prevent electric shock and fire
3. **Test:** Digital power point testing at all power points throughout the property inside and out
   **Result:** Identify trip times to prevent electric shock reaching the heart to prevent death from electricity
4. **Test:** Voltage and continuity testing at all metal fittings throughout the property inside and out
   **Result:** Identify if earthed, and if earth is connected to MEN, and if there is any voltage on the metal fitting, to prevent electric shock when in contact with metal fittings. All small voltages lead to greater voltages as the circuit continues to deteriorate.
5. **Procedure:** Protecting all circuits with safety switches
   **Result:** Allowing live metal fitting to de-energise when in contact preventing electrical shocks and fire
6. **Procedure:** Earthing all circuits with no earth so a safety switch can work correctly (in homes up to 1980's lighting circuits may have no earth)
   **Result:** Apply earth to un-earthed circuits for safety switches to work and prevent electric shock and fire
7. **Procedure:** Protecting all double insulated cables exposed at arm's reach throughout the property inside and out
   **Result:** Preventing penetration of cable and causing electric shock and fire
8. **Procedure:** Repairing damaged corrugated & solid conduit work throughout the property inside and out
   **Result:** Preventing exposed cabling and cable in direct sunlight, increasing the rated of deterioration towards high resistive values, with contact resulting in electrical shocks and fire

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The **Electrical Safety Check List** must be conducted over the entire property in order to ensure real electrical safety in the prevention against electric shocks and fires. The authors Electrical Safety Check List with some additional legislative changes can provide a "solution of prevention" and make a reality the core principle of the Queensland Electrical Safety Act 2002 for all citizens of Queensland not just the authors customers.

**How can we work together as an industry to achieve the main core in the Queensland Electrical Safety Act 2002**

*(a) Preventing persons from being killed or injured by electricity; and*

*(b) Preventing property from being destroyed or damaged by electricity.*

**The proposed requirements in 4 parts**

**Part 1: Amendment to existing legislation.** Political leaders need to institute changes in legislation to apply the infrastructure necessary.

Changes that are needed to ensure electrical safety include:

1. Electrical Safety Check List (as described above) must be conducted on all existing electrical installations on all properties throughout Queensland.
2. The Electrical Safety Check List must be conducted periodically in all areas domestic, commercial, industrial, and public spaces.
3. The certificate of safety and compliance must be for the entire property, not just the circuit worked on.
4. If a circuit fails testing, then it must be rectified or de-energised for safety by the electrician conducting the test.
5. It must be compulsory that all owners have no choice, for all electrical installations to be tested for electrical safety.
6. All existing installation must be retested with the Electrical Safety Check List

**A precedent example is Pool fencing**

Pool fencing laws are for all owners of pools regardless, as a homeowner cannot decide to whether a family member or visitor can fall into their pool or not. The same must be for electrical safety.

If it could be done for pools, it can be done for Electrical Safety.

**Part 2: Training**

1. Courses for existing electricians – Electrical Safety Check List training and certification
2. Additional subjects in electrical apprenticeships. - Add the Electrical Safety Check List

**Part 3: Enforcement** – Electrical Safety Office

1. Enforce testing on the entire property not just the circuit worked on.

2. Check electricians are accredited with Electrical Safety Check List.

3. Enforce compliance for homeowners.

**Part 4: Public Awareness.**

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An awareness of electrical safety must be provided to the public, ensuring support and participation in the amendments to electrical safety changes.

It is important to have parts 1,2 and 3 in place before the public is made aware, so that the electrical industry can provide a ready solution.

**Current electrical training, electricians, electrical contractors and the Queensland Government do not have a "solution of prevention". If this change isn't applied, now and in the future, there will be more cases of electrical shocks and fire. A "solution of prevention" needs to start today.**

**Closing Statement by the author:**

The information provided in this document proves that the existing infrastructure that manages and controls our electrical industry, will continue to be unable to provide a solution of prevention and continue to see a real risk of fire and electrical shock in our homes, workplaces and public spaces as all electrical installations continue to deteriorate.

A solution of prevention as requested by the Queensland Electrical Safety Commissioner, Greg Skyring, has been provided in this document. It is now time to act and make our Queensland Electrical Safety Act 2002 a reality so Queenslanders can be confident that they are safe in their homes, properties, workplace and public spaces.

**What you can do next:** If you feel you can contribute in any way, please contact Clem Capdevila via email clem@es1.com.au or via post to PO Box 1223 Oxley Qld 4075

**The Author**

Clemente (Clem) Capdevila

Electrician – Electrical Contractor – Entrepreneur

- Innovation Patent application 2008 ESPRESS - Semi Self-propelled Power Station (lapsed)
- **Electrical Safety Check List 2015-2019 – Preventative solution**
- Provisional Patent application 2017 – Electrical Safe Cable – Electrically Safe Cable (drawings filled by other country)
- Provisional Patent application 2018 – Electrical Safe Protective Barriers – Electrically Safe Barriers (active)