Department of Education, Training and Employment

Guide to Managing Electrical Safety in Education Queensland Schools

Part 3: Maintaining Electrical Safety

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Queensland Government

Table of contents

Part 3:

MAINTAINING ELECTRICAL SAFETY

Workplace electrical incidents often arise from:

- Use of faulty electrical equipment, including overloading and continued use of plugs, cords and power boards with obvious evidence of damage.
- A lack of maintenance of electrical equipment
- Electrical work performed by an unlicensed person
- Contact with overhead wires

3. MAINTAINING ELECTRICAL SAFETY

3.1 What is Testing and Tagging of Electrical Equipment?

The label (tag) attached to the item specifies the next test date.

The *Electrical Safety Regulation 2013* prescribes ways to ensure electrical safety. This includes the use of testing and tagging and/or safety switches.

"In-service testing and tagging" as the name suggests, involves a competent person (section 3.3) testing the electrical equipment to detect damage, wear or other conditions that may make it unsafe. The person must then label (tag) the item if it complies with the test specifications.

It is important to remember that testing and tagging can be rendered ineffective if any part of the electrical item is damaged after the tagging is completed. Implementing a testing and tagging regime is one method that the legislation offers as a way to ensure electrical safety.

Testing and tagging assesses the integrity of the item at the time of testing – it does not provide any 'extra' protection beyond that of the item's inbuilt safety features.

3.2 What is a Safety Switch?

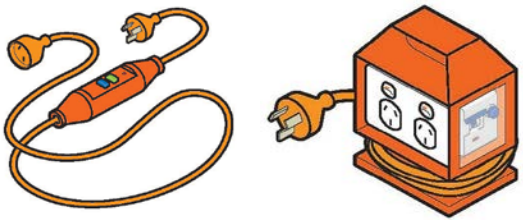
Safety switches are also known as:

- Residual Current Devices (RCD),
- Earth Leakage Circuit Breakers (ELCB) or
- Earth Leakage Devices (ELD)

Safety switches are easily identifiable by the 'T' TEST button (circled).

A range of devices are available:

- Fixed - permanently installed on electrical switch boards or on power points
- Portable - connected to the relevant piece of equipment;
- In-line - another portable option and are incorporated into a device similar to an extension lead.



Examples of portable safety switches- a portable RCD fitted 'in line' to power cable (l) and a portable RCD protected power board (r). Image: Code of Practice Managing electrical risks in the workplace 2012. Safe Work Australia

Safety switches monitor and compare the current flow in both active and neutral circuits of an electrical item. An imbalance of current flow indicates that some of the current is not returning via the neutral wire but is leaking to earth – possibly via a person. When this occurs the unit detects the imbalance and automatically cuts the electrical supply to discontinue the flow of electricity in less than one thirtieth ($^{1}/_{30}$) of a heartbeat. This is sometimes referred to as the safety switch "tripping".

Safety switches cannot protect a person if they contact both active and neutral conductors together. In this circumstance the current may not flow to earth and the safety switch would not detect an imbalance and therefore not 'trip' (cut off the electricity).

Complete protection under all circumstances is not possible from safety switches or any other devices. Proper care and maintenance of electrical equipment is always required.

The installation of a safety switch **reduces the number of items that need to be tested and tagged** in schools as many items of electrical equipment can be protected by either testing and tagging or connection to a safety switch. For example, in an average primary school it is likely that the only specified electrical equipment that would need testing and tagging AND connection to a safety switch would be electrical

equipment used by the Schools Officer. Items in classrooms, library and office would be adequately protected by the safety switch.

What's so good about safety switches?

- Safety switches are designed to disconnect the power in less time than a heartbeat; thus possibly preventing a tragedy.
- Safety switches protect against shocks from current passing through the body to earth which is the most frequent cause of electrocution.
- A functioning safety switch provides an added level of ongoing protection.
- Testing and tagging checks the integrity of the item at the time of testing only. This can be rendered invalid if the item is damaged between checks.
- If electrical equipment is introduced into the school that is not electrically safe, a safety switch provides a level of protection and will assist with identifying faulty equipment.
- The installation of safety switches provides ongoing savings due to reduced need for testing and tagging.

3.2.1 Why do I have to test a safety switch?

Nothing is failsafe. Safety switches must be checked regularly because, just like a smoke detector or any other safety device, it cannot protect you if it is not operating properly.

➔ All **fixed** and **portable** safety switches must be tested immediately after they are installed or connected

➔ There are **two types** of tests for your safety switch.

1. The "user test" is completed by someone at your school. The user test is achieved by regularly testing your safety switch using the TEST button.

AND

2. Testing of the safety switch by a competent person. This is a time/current test performed by a competent person – it is necessary that an appropriately trained and equipped person performs this test (e.g. electrician).

🕐 **For frequency of each 'test' please refer to Part 1 or 2 of this document.**

3.2.2 How do I perform the regular "user" testing of my safety switch using the TEST button?

1. Note: some electrical equipment may malfunction (e.g. lose data, start or stop unexpectedly) if the power supply is interrupted. Consider this equipment when planning your tests e.g. you may need to "shut down" computers before pushing the TEST button.
2. Press the inbuilt TEST button – this simulates a problem in the system.
3. This should automatically "engage", "trip" or "operate" the safety switch and cause it to flick to the OFF position.
4. Then simply press the RESET button.
5. If pressing the TEST button does not cause the safety switch to flick to OFF then call an electrician immediately to have it checked. Seek advice from the electrician on the use of the electrical items in the interim and note the advice. Higher risk items such as power tools in industrial technology should not be used until the switch is operating properly.
6. Record the date of the test on a register.

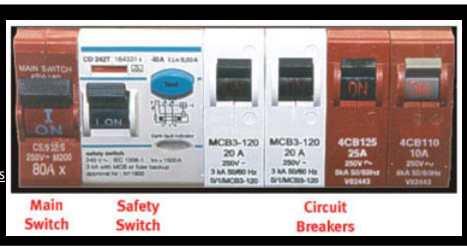
3.2.3 What do we do if the safety switch trips during normal activities?

1. If a safety switch trips and disconnects power, it may be due to a faulty appliance. You may have been using a faulty appliance or your electrical wiring may have become faulty.
2. Reset the safety switch by pressing the RESET button.

3. If it trips again, unplug the last appliance used. If everything works okay, label that item as faulty and arrange to have the item checked by an electrician.
4. If the safety switch continues to trip, disconnect all appliances on the circuit and plug them in, one at a time, until you locate the faulty one.
5. Avoid touching the appliances while carrying out this process.
6. Contact your electrician if problems persist.

Safety switches are often confused with circuit breakers. Circuit breakers and fuses protect against overload faults and high current short circuits. These do not replace safety switches. Safety switches protect people – circuit breakers protect equipment.

Image source: http://www.justice.qld.gov.au/fair-and-safe-work/electrical-safety/homeowners-and-consumers/safety-switches



3.2.4 Who pays for testing and tagging and the installation of safety switches?

Testing and tagging of specified electrical equipment including portable safety switches (School Funded)

Schools are responsible for engaging and funding contractors (or competent person) to complete testing and tagging of specified electrical equipment. There is no obligation for schools to engage BAS (formerly Q Build) to perform these functions.

Schools should be mindful that competent persons who only "test and tag" may be restricted in the types of electrical work they can perform and may not be able to complete repairs that may be needed to make the electrical equipment safe.

Testing of fixed electrical equipment including fixed safety switches (Centrally funded)

Testing of fixed electrical equipment is covered under the 'Service Maintenance Allocation' and is centrally funded by the department. This work is performed by BAS.

3.3 Competent person

The *Electrical Safety Regulation 2013* defines a competent person as someone who has acquired, through **training, qualifications, experience** or a combination of these, the knowledge and skill enabling the person to inspect and test electrical equipment. By choosing to complete testing and tagging "in-house" the school (and in turn the Department) takes on these responsibilities.

The principal (as the manager of the workplace) is:

- responsible for determining that the person who carries out inspection, testing and tagging of electrical equipment has the required competencies; and
- accountable for the ongoing actions of the 'competent person.

In the event of an electrical incident the following information may be requested from the school:

- documentation that the testing and tagging process was completed correctly;
- documentation or verification that the person fulfils the requirements of a competent person for testing and tagging;
- information as to how this competency is maintained over time (refresher course, consistent use of the equipment, time allocation, confidence and competence in using the equipment).

Consequently, it is preferable to out-source this work to an appropriately qualified tradesperson. The licensed electrical contractor (electrician) takes on the role of the "competent person" and is responsible for ensuring the work completed is electrically safe.

A record of the work is to be retained by the school, providing evidence that the test and tag regime and visual checks are completed. If an electrical incident occurs, the principal can verify that testing and tagging was completed by a competent person by referring back to the contractor invoices/documents. In addition, appropriate actions such as repair or disablement can also be achieved. The skills to effectively achieve this may not be able to be acquired during a short course.

Course information

The competencies required to inspect, test and tag electrical equipment are stated in Australian Standard AS/NZS 3760 *In-service safety inspection and testing of electrical equipment*. These competencies as well as course information are listed on the Electrical Safety Office website at: https://www.worksafe.qld.gov.au/licensing-and-registrations/electrical-training/test-and-tag-course.

This link includes information on the course - 'UEENEEP026* Conduct In-service Safety Testing of electrical cord connected equipment' and Registered Training Organisations (RTO) that deliver the course.

3.4 New Equipment

In Australia, when the equipment is new, the supplier is deemed responsible for the initial electrical safety of the new equipment. New equipment need not be inspected or tested, however it must be included in the regime of testing and tagging (or used with a safety switch) as per other electrical equipment. This will ensure it is protected according to the type of work for which it is used and captured with the next 'round' of testing and tagging if appropriate.

3.5 Repaired Equipment

Repairers of electrical equipment have a duty to ensure the repaired electrical equipment is electrically safe. This includes ensuring the repaired electrical equipment is tested and examined to verify it is electrically safe.

Repairers are not required to attach a 'test tag' to the repaired electrical equipment before returning it to the customer, however, the repairer is required to provide the customer with a 'certificate of testing and safety'. Any record containing the required information is acceptable as a 'certificate' and most electrical contractors include the information on the invoice or receipt. A copy of this invoice, receipt or document is to be kept by the workplace as verification of the safe management of the equipment (Ref: *Electrical Safety Act 2002, s37 and Electrical Safety Regulation 2013, s 26).*

3.6 Three phase equipment / Hard wired equipment

Examples of equipment that use three phase power in schools include lathes, milling machines, shapers, compressors, kilns and some large air conditioning systems.

The power available from a domestic power outlet in Australia is normally 240V A.C. The electricity available from these outlets is called *single phase power*. This is a single voltage that alternates in polarity between positive and negative, hence the term 'A.C.' meaning *Alternating Current***.** Figure 1 shows a typical A.C. voltage passing through the positive and negative stages of one cycle, which takes one-fiftieth of a second to complete.

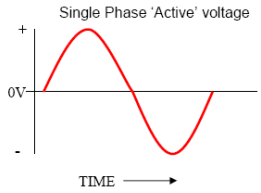


Figure 1: Single phase A.C.

Most small domestic appliances use single phase power because it is easy to work with and requires only two wires, active and neutral, (plus a protective earth wire) to deliver energy to a load. However, there are some limitations to single phase power. As the voltage passes through a 'zero' point *twice* for each cycle, there are points in time when no energy is available to drive loads. This can be a problem for heavy and industrial loads which use a lot of power. Another problem is that single phase electric motors do not know which way to rotate when they start, unless special wiring methods or motor-start devices are used.

Three Phase Power is *three* simultaneous AC signals, spaced one-third of a cycle apart in a single 50 Hz cycle (see figure 2). For industrial applications three phase motors are more reliable, less expensive, run more efficiently and last many years longer than their single phase counterparts.

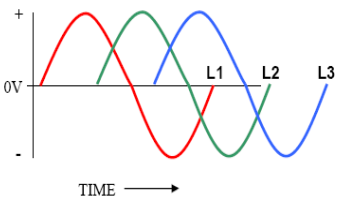


Figure 2: 3 phase power A.C.

These items are not 'specified electrical equipment' and are not covered under the requirements of the *Electrical Safety Regulation 2013.* However, it is important to ensure these items are used safely and the risk of electric shock is prevented or minimised.

Ensure that:

- the equipment is secured properly to the floor to prevent any damage to wiring or cabling due to slow movement or vibration of the equipment
- items are visually checked regularly for firm connections, damage to panels or wiring etc.
- regular checks by an electrician are also recommended.

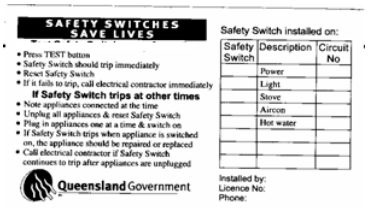
Although unusual, three phase, including hard wired equipment (no plug), can be connected to safety switches.

3.7 Record Keeping

Records are essential to review how your systems are working and to monitor compliance with departmental and legislative requirements.

If an electrical incident occurs, records will be checked to determine if these requirements were fulfilled. Without records it will be difficult to demonstrate that systems were in place to ensure compliance. Internal Auditors may also ask to check these records. The *Australian/New Zealand Standard* 3760 states that documentation must be kept for seven years.

There is a range of ways that you can create and maintain records – spreadsheets, electronic registers etc. Inclusion of the following information will support a range of functions in addition to your health and safety system including asset management, replacement programs, scheduling of testing and maintenance and budget planning.



Example: testing register on sticker in a switch board

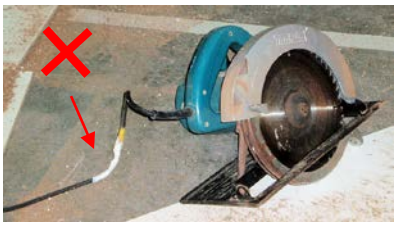
1. Register of all electrical equipment
2. Specified electrical equipment
   - Identify and include frequency of testing and tagging dates (if required)
3. Safety switches e.g.:
   - Record push button tests of safety switch (e.g. initial and date)
   - Record tests by competent person (e.g. date and contractor)
   - The record can be as simple as a card in the switch board with date, name and signature
   - As best practice – a record of the location of all safety switches and circuits they cover
4. Repair or maintenance work e.g.:
   - A log where staff can identify repair work required for electrical equipment
   - Service or maintenance work for specific items – an example form is available at: http://education.qld.gov.au/health/docs/safety/hazards/emr/generic-equipment-maintenance-register-emr.doc
5. Risk assessments related to the use of electrical equipment.
6. Record, notify and investigate electrical incidents to prevent reoccurrence.

- Refer any person who receives an electric shock to medical attention, even if they say they feel fine.
- Notify all electric shock incidents to WHSQ on 1300 369 915; even if you don't think there is an 'injury'.
- Record all electrical incidents - see the Health and Safety Incident Recording, Notification and Management Guideline for specific information.

3.8 How does electricity cause injury and electric shock?

Electricity is predictable in that it will:

1. move in a circuit;
2. travel a path of least resistance; and
3. head for the ground.



Electricity will not discriminate on how it achieves these three actions, that is, it will pass through a person to flow to the earth if that is the easiest path of travel. A safe path to ground for electricity is away from your body and confined within whatever piece of electrical equipment you're using. However, if an appliance is faulty the electric current may try to find another path (e.g. through a person) to get to ground.

Aside from injuries sustained due to electrical current flowing through the body, other injuries can result such as falls from ladders, contact with moving machinery or injuries to other people.

Electric shock has the potential to cause fatal injury. The term 'electrocution' implies death due to the action of electric current. Electric current passing through the body can cause:

- Muscle spasms
- Inhibition of the respiratory centre of the brain
- Heart fibrillation (disturbance to heart beat)
- Tissue burns and nerve damage
- Confusion or memory loss

Muscle spasm can prevent people from releasing their grasp on electrically "live" parts and prevent breathing or shouting for help. This can cause the person to panic which in turn induces sweating. A variable that affects current flow through the body is the individual's "electrical resistance". Almost all of the body's resistance is in the skin and sweating further reduces the person's inherent resistance. *(Greater resistance = increased difficulty for electricity to pass through the body)*.

Ventricular fibrillation is considered the main form of death by electric shock. Essentially, it is a condition of the heart caused by the disturbance of the heart's own internal impulses. The heart rhythm fluctuates and cannot effectively pump blood to sustain life.

Isolate the person from the electric current (i.e. turn the power off if possible, remove the person from danger) and **then provide** first aid. Always seek further medical assistance either;

- Immediately, by calling the ambulance or
- As soon as possible, by attendance at a doctor even if the person has received a mild shock or only a suspected shock. This is because disturbance to the heart beat may not be readily detected by the person or during first aid.

More information

Creating Healthier Workplaces - Electrical Safety
http://education.qld.gov.au/health/safety/hazards/electrical.html

Health and Safety Incident Recording, Notification and Management
http://ppr.det.qld.gov.au/corp/hr/workplace/Pages/Health-and-Safety-Incident-Recording,-Notification-and-Management.aspx

Other safety tips can be found at:
https://www.worksafe.qld.gov.au/electricalsafety