



Welcome to the safe@work Electrical and Electronics Industry Module.

Have you read the General Module, completed the test and printed your safe@work General Award of Attainment?

The Electrical and Electronics Module should be done **AFTER** the General Module.

If it is some time since you have done the General Module you should read the Review Module. The test for this module includes some questions based on the Review Module.

There are common hazards in the electrical and electronics industry. It is important to learn about these hazards and how they can be controlled so that people at work are not exposed to risk.

The Electrical and Electronics Industry contains information on:

- Lock Out, Isolation and Tagging
- Carrying Out Electrical Work
- Residual Current Devices (RCDs)
- Hazardous Substances and Dangerous Goods, and
- Personal Protective Equipment and Clothing.

Within this industry, you may be involved in a range of work activities such as using measuring instruments, soldering, using hand, power and specialist tools and constructing circuits.

Key Point

Only licensed electrical workers can legally perform electrical work.

This includes new electrical installations and alterations, and repairs to existing installations. An unqualified person must not be employed or allowed to undertake electrical work.

Key Point

Apprentices and trainees must be supervised by a qualified electrical worker at all times.

Your employer must make sure you are properly trained and supervised, that you are instructed in safe work procedures, and that all equipment is in good working order.

It is important that you work in a safe manner, not only for your own safety but also for the safety of others.



Lock Out, Isolation and Tagging

Lock out, isolation and tagging procedures in a work place are designed to protect people and property from risks arising from machinery or equipment which has been taken 'out of service' for repair, maintenance or inspection. The significant hazard is often electricity in such cases.

Before any repair or other work is started, the machinery or equipment to be worked on must be disconnected from the electricity supply - unless other adequate precautions are taken to prevent electric shock.

Lock out

Lock out is the best way of preventing machinery or electrical current becoming operational during maintenance. A lock is attached to the machine switch so that it cannot be turned on.

The employee working with the machinery or equipment should hold the only key to the lock. A lock must only be removed from equipment or machinery by the person who attached it. Procedures must be put in place for the removal of the lock in case this person is not available - for example, if there has been a change of shift workers.

Isolation and tagging

Before you start work:

- switch off
- isolate circuits
- fix appropriate tags
- test that the electricity supply is isolated and
- always test your test instruments.

Danger tags

Personal "DANGER" tags are colour-coded red and black, and are used while equipment and machinery is being repaired or serviced.

A "DANGER" tag is a warning to all persons that the equipment or machinery is being worked on and must not be operated, as lives may be placed in danger.

Key Point

A circuit must not be energised while a "DANGER" tag is attached.

If turning on a switch or valve or operating any machinery or equipment you are working on will place you or someone else in danger you must fix your own "DANGER" tags. They must be tied on every main isolation switch or valve and you must make sure the switch is in the correct safe position before you start the job. When two or more employees are working on the same job they must each fix their own danger tag.



"DANGER" tags are for everyone's safety. Authorised workers must:

- sign and date the tag
- only fix and remove your own "DANGER" tags
- place tags at common isolation points
- tie the tag securely and
- remove the tag at the end of the shift or when the work is done.

Out of service tags

Yellow and black "OUT OF SERVICE" tags are used to warn people that machinery, appliances or equipment are damaged, unsafe or out of service for repairs, maintenance or inspection. They are used to prevent accidents and damage to the equipment or machinery.

Key Point

While an "OUT OF SERVICE" tag is fixed to machinery, appliances or equipment it must not be operated.

Workers who are required to fix "OUT OF SERVICE" tags must:

- be authorised to fix and remove them
- write their name and the reason on all tags
- place them in a prominent position
- place tags at common isolation points and
- leave tags on until the machinery or equipment is repaired, or the maintenance operation complete, and the item is safe to use.

Key Point

Any faulty equipment should be tagged "OUT OF SERVICE" so that it cannot be used until it is replaced or repaired.

The safe work procedures for the removal of "DANGER" and "OUT OF SERVICE" tags at your work place must be followed.

Talk to your employer or supervisor if you are unsure about tagging machinery and equipment correctly.

Carrying Out Electrical Work

Note: Students on work experience must not undertake any task which may place them at risk from electrical sources. This information is designed to give students an understanding of the hazard and some of its risk control measures.

Key Point

Your employer must make sure you are trained in safe work procedures.



Safety procedures for working with electricity might require:

Before starting work

- Plan and discuss the job
- Consider the hazards and think about what is to be done
- Confirm permission to isolate (use a permit system if relevant)
- Isolate the electrical equipment or circuit
- Fit a "DANGER - DO NOT OPERATE" tag
- Put up safety barriers when required
- Use the correct earthing equipment
- Cover and insulate live apparatus nearby
- Check test instruments, and
- Get authorisation to do the work.

Avoid working on live equipment whenever possible. You should not wear bracelets, rings, neck chains, exposed metal zips or watches while carrying out electrical work near live electrical equipment. If in doubt, ask your supervisor.

When working

- Use safety observers when required
- Never rely on your memory
- Connect the earth and neutral conductors first
- Check the isolation points before resuming work after a break
- Use approved safety belts
- Regularly check and clean the tools that you use
- Use insulated ladders, and
- Use non-conducting tape measures.

Key Point

Working safely includes considering the work procedure, the type of tools used and the type of clothing worn.

On completion of work

- Check that no tools are left on (or in) the job
- Remove your own earthing equipment
- Check that the work is complete and the equipment can be energised
- Notify all personnel involved that the equipment will be energised
- Hand in your work permit (if relevant)
- Remove "DANGER - DO NOT OPERATE" tags
- Energise power supply, and
- Remove and store all safety barriers.



Safety practices

- Know electric shock and resuscitation procedure
- Keep a first aid kit handy
- Check the first aid kit regularly
- Know where the fire extinguishers are located, and how to operate them
- Know the correct type of fire extinguisher for the various types of fire
- Keep your work place clean and orderly, and
- Report all electrical accidents.

Residual Current Devices

A Residual Current Device (RCD), or safety switch, is an electrical safety device designed to immediately switch off the power when electricity "leaking" to earth is detected at a level harmful to a person using electrical equipment. RCDs are designed to operate within 10 to 50 milliseconds. They also reduce the risk of fire by detecting leakage to earth in electrical wiring and equipment.

Note: Students on work experience must not operate powered tools or mobile plant. This information is designed to give students an understanding of the hazard and some of its risk control measures.

Key Point

An RCD offers a high level of personal protection from electric shock.

Workers who use portable electrical equipment, power tools and extension leads at work you must be protected against earth leakage by an RCD installed at a permanent switchboard or in a fixed socket outlet.

Residual Current Devices significantly reduce the severity of electric shock, but will not protect you against all electric shock. For example, contact with electricity causes electric current to flow through the body which will not be detected by the RCD unless there is also a current flow to earth.

Key Point

RCDs are an addition to safety measures, not a substitute for them and they must be regularly tested and maintained.

Hazardous Substances and Dangerous Goods

You may need to use rosin fluxes for metal soldering in the electrical and electronics industry.

Flux is a sticky liquid or paste used to react with and remove compounds from the surface of the connection, to improve the flow of the molten solder and to prevent oxidation during the heating cycle.



Rosin flux may cause health problems if fumes are inhaled or if flux gets on your skin. Fumes may cause irritation such as watery, prickly eyes, running or blocked nose, sore throat, coughing, wheezing, tight chest and breathlessness. Skin contact may cause itchy skin and dermatitis. Skin contact usually happens when employees get flux on their hands while applying it to metal surfaces before soldering.

Your employer must control the health risks associated with rosin flux by applying risk control steps in the following order of importance:

- **eliminating** soldering completely, by crimping or twisting electrical wire connections if possible
- **substituting** fluxes that do not contain rosin if possible, or using rosin core solder where the rosin is contained in a fine tube of solder, which is less likely to result in skin contact during hand soldering
- **extracting** rosin fumes by a local extraction exhaust system or a fume cabinet connected to an exhaust system
- **limiting the amount of time** an employee spends doing soldering work, and
- **providing personal protective equipment and clothing**, such as suitable gloves and protective clothing where there is risk of skin contact, and eye protection if there is risk of splash from liquid flux.

Personal Protective Equipment and Clothing

Your employer is required to provide personal protective equipment and clothing (PPE) when hazards in the work place cannot be eliminated, or to increase your level of protection. Your employer should make sure that PPE complies with the relevant Australian Standard.

You must be instructed and trained in the correct use and storage of the PPE provided by your employer, and you must use it according to your training and agreed safe work procedures.

Some of the items of PPE you may use in the electrical and electronics industry are given below.

Clothing provides protection from electric arcing/flash burns, flying objects and electric shock. Ideally, clothing should cover the body completely, and:

- be of appropriate material (either wool or cotton, but not synthetics)
- have non-conductive and concealed buttons
- have sleeves to wrist length, and
- have legs which reach to your footwear.

Safety helmets should be non-conductive. They provide protection from overhead wires, structures and falling objects.

Safety glasses provide protection from electrical arcing and flying objects.



Insulating gloves provide protection from electric shock. They should be worn when accidental contact with live conductors is possible, but they must never be the sole means of insulation.

When using gloves, note:

- rated gloves are designed for live work and are rated according to the level of voltage they are able to insulate against.
- rated gloves should be tested regularly to determine their effectiveness. non-rated gloves are for mechanical protection only.
- all gloves must be inspected before each use.

Safety footwear should be non-conductive. It provides protection from electric shock and falling objects.

Insulating mats should be used when working on live conductors or where accidental contact is possible. They must never be the only means of insulation.

Self-Assessment Questions

Now try the self-assessment questions. Before starting the questions, be sure to enter your name and the name of the school exactly as you want it to appear on your Award of Attainment. We ask you to provide these details so that you can be issued with the Award of Attainment.

There are 16 questions. If you get 12 or more correct you can print online a safe@work Award of Attainment. The Principal of your school will then sign the Award of Attainment and validate it with the school stamp.