



Chapter 8

SAFETY

ACMA Foundation Syllabus 3.10 and 9

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SAFETY

Radio Shack

The shack can be a dangerous place if careful consideration is not given to yourself and anyone visiting. Electrical safety is the prime consideration, but this chapter discusses several potential issues for your consideration.

Electricity

Electric Shock

The Human body can be damaged by current flowing through the skin and muscles. The muscle can spasm severely. If the heart muscle spasms severely, the heart is in the most dangerous condition is when the current is sufficiently high to cause the heart may go into ventricular fibrillation. Fibrillation is when the heart is not pumping normally, and the blood is no longer circulated. This can lead to death.

Safe Work Australia states that 76 Australians die from electric shock every year. Safe Work Australia also identifies the types of equipment that poses greater risk than others.

- Portable electrical equipment including plugs and sockets; electrical connections; the cable itself. All are especially vulnerable to damage.
- Extension leads, particularly those connected to equipment that is frequently moved, can suffer similar problems.

Our skin resistance will determine the amount of current which will flow through our body if we touch a live conductor. If the voltage is high enough, burns may also result.

As radio operators, we need to be cautious when dealing with 230 V AC mains equipment. If the equipment also is fitted with valves and transformers, the voltages may be in the thousands.

When working with mains equipment.

- Wear insulated shoes Not bare foot.
- Isolate the power.
- Ideally have a co-worker.
- Ensure the equipment is grounded.

Current level and affects.

- At 0.001 amps the sensation is discernible.
- At 0.01 amps pain is experienced
- Between 0.01 amps and 0.1 amps breathing will become difficult and severe shock will be experienced.
- From 0.1 to 1-amp severe burns can occur, breathing stops and death almost certainly can result.

Before the power plug

Mains Circuit Breakers

Older style houses may still be fitted with wire fuses or circuit breakers. If this is the case, a licenced electrician should be engaged to replace the fuses or Circuit Breakers (CB) with Residual Current Circuit Breaker (RCCB).



The significant difference is that Circuit Breaker (CB/MCB): Protects equipment by breaking the circuit during short circuits or overloads while RCCBs protects human life by detecting small current leakages to earth.



Fuses require an excess of the rated current to flow through the fuse wire before the fuse blows and are generally slower to react to excess current than a CB. A 30-mA current through your body is enough to cause cardiac arrest or irreversible damage to your body.

Example: A 10 A fuse requires more than 10A to flow through you before the fuse will blow.

An RCCB/RCD will save your life by ensuring that in case of a current leakage or an imbalance in current, which could result in electrocution, the current is cut off.

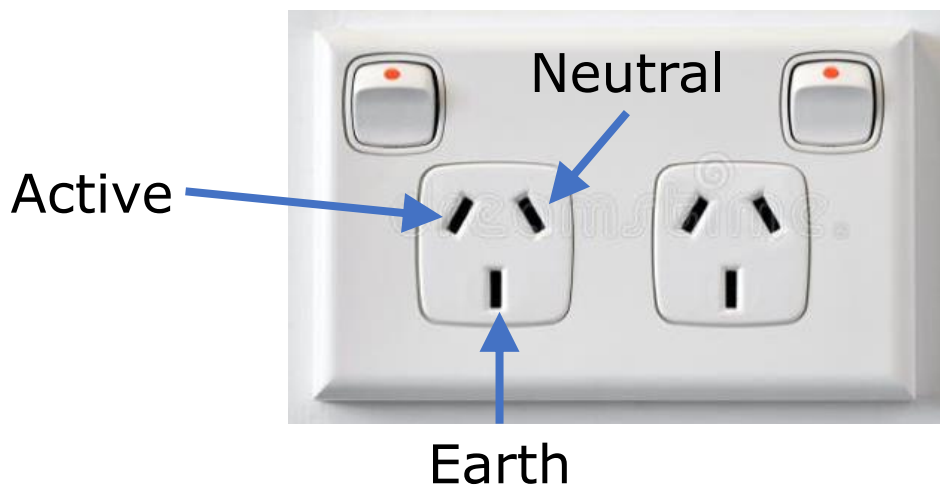
A CB will save your home from electrical fires by ensuring that the wires are not overheated and that there is no overload on the electric circuit.

I know they work well from personal experience.

Power Plug

Wiring behind the power plug should not be accessed.

Any work in that area must be completed by a licenced electrician and comply with the Australian/New Zealand Wiring Rules AS/NZS 3000:2018.



This General-Purpose Outlet (GPO) is rated at 10 amperes. A 15-ampere outlet, mostly seen for caravans, has a larger earth pin.

After the power plug

Wire Colours

Wire colours varied over the years but are internationally standard now.

Neutral coloured blue and is the return path for the circuit.

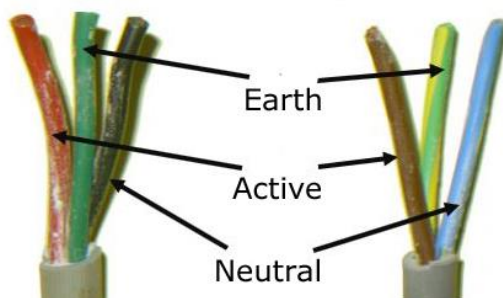
Earth coloured green with a yellow tracer.

Active coloured brown carries the current.

The earth wire must be connected to the metal case of any equipment. The earth provides protection if the equipment fails. The Earth pin is electrically connected to an Earth stake near your power box. Deliberately disconnecting the Earth and operating the equipment is an extremely dangerous practice.

Caution – Older equipment may have older wiring colours.

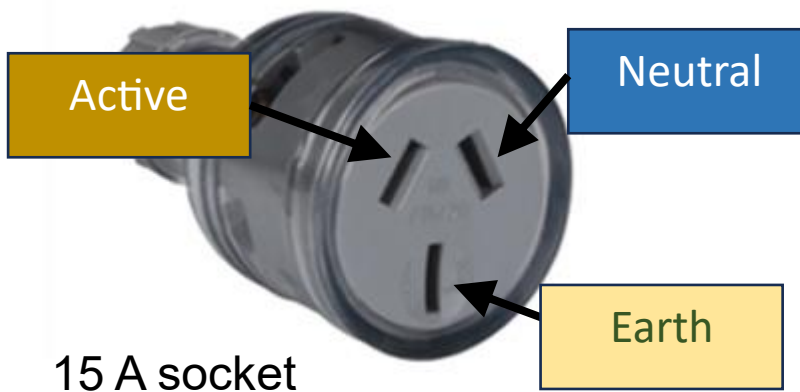
	Pre-1977	1977-2004	Current
Active wire	Red	Red	Brown
Neutral wire	Black	Black	Blue
Earth wire	Green	Green with yellow tracer	Green with yellow tracer



The Three Pin Plug and Socket

The standard three pin power plug used in Australia is also utilized in New Zealand, Fiji, Tonga, Solomon Islands, Cook Islands, Papua New Guinea, and several other Pacific Island countries.ⁱ

The Australian 3-pin plug (Type I, AS/NZS 3112) features two flat pins angled in an inverted 'V' shape with a longer vertical earth pin, used for 230-240V power.



Bare conductors

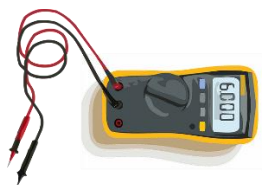
Keep body parts away from any bare conductors in equipment.

Voltage Testing

Using a multimeter set correctly to test the voltage on the wires will produce the following results.

- Between Active and Neutral, the reading is 230 V.
- Between Active and Earth, the reading is 230 V.
- Between Neutral and Earth, the reading should be 0 V.

A worthy practice is to perform a continuity check between the metal chassis of the equipment and the Earth pin. If there is no continuity, repair the Earth lead before proceeding.



Appliance testing

Often known as Portable Appliance Testing (PAT) or Test & Tag in Australia/New Zealand, is a routine safety inspection of electrical equipment to prevent hazards like electric shocks or fires.

The test involves a visual inspection for damage and an electrical testing (e.g., earthing, insulation) to confirm safety. The equipment is then tagged for compliance.

The primary goal of tagging is to ensure electrical appliances are safe for use and comply with health and safety regulations. This particularly applies in workplaces where equipment is shared.



Components

Capacitors

Capacitors look innocuous but can still retain a deadly charge. A charged capacitor which can supply sufficient current to kill. Discharge any unknown capacitors with an insulated screwdriver before handling.



Transformers

Transformers in some equipment can be step up to higher voltages. Valve equipment can require voltages around 600 v and current in the many amperes. Caution should be exercised around all active transformers.



Old TV Tubes

Old TV picture tubes are big capacitors and can hold a charge for an extended period. Also, old picture tubes are lined with phosphorus so exercise caution around broken tubes.



RF Hazard

Mobile or Portable antennas

Before erecting any antenna at a mobile or portable site, look up. Ensure the antenna will not contact any overhead power lines.

RF hazards

The high RF power levels in transmitters and amplifiers are a risk in themselves. Shielding of the high-power compartments helps to contain the RF energy and to prevent unwanted exposure to RF fields. Severe RF burns.

At Microwave frequencies, RF fields can become a hazard to eyesight as the concentrated energy can affect the eyes.

Lasers

Lasers are rated by hazard classification.

Class 1 lasers are not hazardous.

Class 2 lasers are normally not hazardous.

Class 3 lasers are hazardous where eyes are exposed.

Class 4 lasers are hazardous to eyes, and the direct beam is a fire hazard and serious skin hazard.



Equipment

Before opening any communications equipment for service or repair, unplug the device from the mains. Inspect the cable for any breaks or bare wires.

Once the case is open, some capacitors may still be holding their full charge. Caution is especially required if the equipment is valve operated as they may have many hundreds of volts in circuits around the valve.



Fuses

A fuse is designed to melt when the current exceeds the fuse ratings. This will open the circuit and stop the supply of electricity. Do not fit blown fuses with a fuse of a higher rating.



Lightning



Lightning is not friendly with antennas and radio equipment and can cause extensive damage. If lightning is predicted in our area, close the station, disconnect radios from antenna and earth all the antenna cables coming into the shack.

Lightning arrestors can be installed if lightning is a constant hazard.

Surges or spikes from a lightning strike can induce spikes in cabling and wiring. Insulation breakdown and damage can often be caused this way.

Chemicals and Gases

Hazardous chemicals

Items include:

- acids such as sulphuric acid in batteries
- alkalis such as caustic soda,
- Polychlorinated Biphenyls. (PCB) in transformer insulating oils,
- etchants such as ferric chloride
- ammonium persulphate,
- insulators such as
- beryllium oxide
- asbestos



Precaution should be taken when handling any chemical.

- Wear gloves.
- Wear eye protection.
- Wear breathing apparatus if needed.
- Have soap and water on hand in case of a spill.

Gases

Charging a lead-acid battery generates gases. Only charge lead acid batteries in open spaces or well-ventilated areas.

Battery Acid

Battery acid is a highly corrosive, clear, and odorless solution of 30–50% sulfuric acid mixed with water, typically used as the electrolyte in lead-acid batteries and requires protective gear.



Heights

How many time have we gone on the roof to fix an antenna and not thought about the risks.

Falls from heights are a leading cause of workplace fatalities and serious injuries in Australia, consistently accounting for about 13-15% of all worker fatalities annually. In 2024, 24 workers died from falls, making it the second highest cause of death behind vehicle incidents. Key industries include construction, agriculture, and manufacturing. Work Safe Australia

2-Meter Rule: Generally, fall protection systems are required if a person is working at a height of 2 meters or more, or within 2 meters of a fall edge.



Ladders

Ladder-related falls are a significant cause of injury and death, particularly among older individuals in Australia.

An average of over 30 Australians die each year from falling from a ladder and over 4,000 Australians are hospitalised annually due to ladder falls.

Men aged 60–64 are the most vulnerable group. Roughly 80% of those hospitalised are aged 45 or older.

Safety Guidelines

- **3-Point Contact:** Maintain three points of contact (two hands and one foot, or two feet and one hand).
- **4-to-1 Rule:** For extension ladders, the base should be 1 foot away from the wall for every 4 feet of height.
- **Inspection:** Always inspect ladders for defects (broken rungs, damaged feet) before use.
- **Setup:** Ensure the ladder is placed on a stable, level surface.

General

Security

The shack should be secured when not in use. This prevents theft of equipment and stops unqualified persons using your equipment.



Headphones

The volume in headphones, typically exceeding 85dB, can damage hearing.

Headphone use poses significant hazards like noise-induced hearing loss (NIHL) and decreased environmental awareness leading to traffic accidents. Another hazard is ear infections from over-use. To prevent damage, follow the 60/60 rule (60% volume for 60 minutes).



Go to Chapter 7 Questions.

Have fun and stay safe.
