Learning resource

Demonstrate and apply knowledge of electrical fittings and components and their installation

Level 3 | Credits 6

Te Pūkenga

Contents

Electrical fittings

Electrical fittings are a very important aspect of electrical work and electrical safety.

The Electricity Act 1992 defines what electrical fittings are, as follows:

Electricity Act 1992

Part 1 Preliminary provisions

2 Interpretation

fittings means everything used, or designed or intended for use, in or in connection with the generation, conversion, transformation, conveyance, or use of electricity.

Reprint
as at 12 November 2018

Electricity Act 1992

Public Act	1992 No 122
Date of assent	17 December 1992
Commencement	see section 1

Some examples of common fittings are:

- Switches.
- Socket outlets.
- Light fittings.
- Ceiling roses.
- Permanent connection units.
- Flexible cords connected to any permanent connection unit, ceiling rose, or cord grip lamp-holder.


Photo by Graeme Jeffrey

Note: 'Accessories' is a term often used in the electrical industry and in the Wiring Rules. The term is rarely used in the Electricity Regulations and Electricity Act which uses the term 'fitting'.

Selecting the right fitting

Photo by Graeme Jeffrey

Electrical fittings are changing all the time - with changes in technology. As a designer of an installation, you are going to need to be able to make selections of appropriate fittings for the situation.

The choice of fittings is often influenced by five main factors:

- Current limits
- Voltage limits
- IP ratings
- Unsuitability of certain switches for purposes of circuit isolation
- The position of switches in circuits.

Other factors might be, the manufacturer or the style and cost. Let's see how each factor affects the selection of fittings.

Current limits

Fittings should be correctly rated and able to safely handle the load current.

AS/NZS 3000 4.1.2 requires accessories to be able to prevent danger from electric shock, fire, high temperature or physical injury during reasonable expected overloads, faults or external influences.

What this means is that a fitting should be able to carry the required current under normal and short-term fault conditions without over heating or shorting out.

When you are determining the required current-carrying capacity, you need to take into account any reasonable foreseeable changes in external influences such as the installation of thermal insulation in ceiling spaces and walls.

Photo by Graeme Jeffrey

Voltage limits

Fittings should be selected so that they have a voltage rating equal to or higher than the voltage the fittings will operate at.

IP ratings

Fittings need to be able to withstand any environmental conditions that can be reasonably expected for where they are installed.

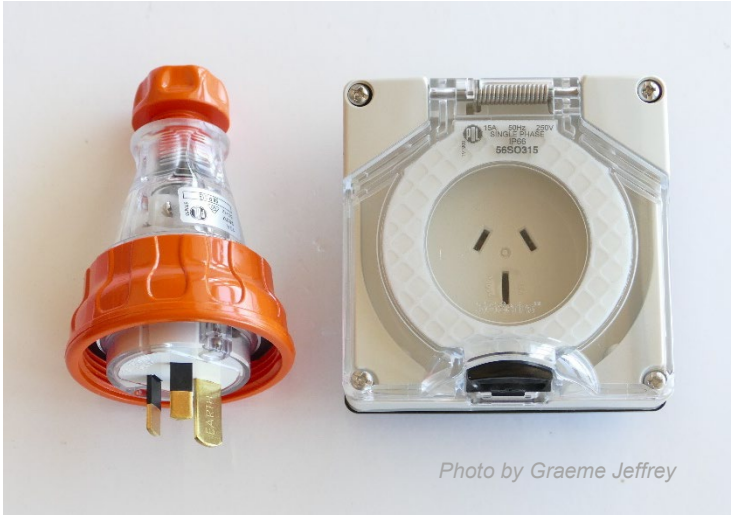
This may be weather, sunshine, water spray, heat, salt etc, especially if they are to be installed outdoors.

AS/NZS 3000 6.2 and 6.3 cover the installation of electrical fittings in damp areas.

Electrical fittings for installation in damp areas are specially designed to prevent moisture from entering the fittings and creating a hazard. They are weather protected, or hose proof, or watertight.

Damp area fittings are used in the following places:

- Outdoors where they are exposed to the weather.
- Bathrooms, laundries, washrooms.
- Cold-storage rooms.
- In, or near, water fountains.
- Areas that have to be hosed down.



Ingress Protection (IP) ratings indicate how resistant a device is to water and solids (dust/dirt).

The IP rating is an IEC standard (EN 60529) which outlines an international classification system for the sealing effectiveness of enclosures of electrical equipment. Sealing against foreign bodies (i.e. tools, dust, fingers) and moisture.

This classification system uses the letters "IP" followed by two or three digits.

An "x" is used for one of the digits if only one part of the classification applies; i.e. IPX4 which addresses moisture resistance only.

You can see an explanation of IP ratings in AS/NZS 3000 appendix G.

Fittings should be selected to ensure the IP rating of the equipment is equal to or higher than required.

Photo by Graeme Jeffrey


Photo by Graeme Jeffrey

Switches Vs Isolator switches

An ordinary switch does not meet the design criteria for an isolation switch. An isolator has a greater distance between the contacts when open and must be able to be locked in the off position.

Be careful, where the rules require an isolator switch, i.e. at a hot water heater, that the switch you install meets those requirements. Isolation the switches need to have the correct ratings and functions to enable safe isolation.

Position of switches in circuits

The position of switches in a circuit will determine the type of switch fitting that must be used. For example, intermediate switches for lighting circuits where more than two switches are required.

Only switches with interlocked contacts can be used to switch the neutral as well as the phase, otherwise all switches are to be installed in the phase conductor.

Mounting and support requirements for fittings and components

AS/NZS 3000 3.9 deals with mounting and the support requirements for fittings and components. It requires that wiring systems be installed in a way that they will be reliable over their lifetime and, be installed to accepted principles of good workmanship.

AS/NZS 3000 3.9 also provides other details.

Acceptable types of wiring systems

AS/NZS 3000 3.9 provides examples of acceptable types of wiring systems and methods for the installation of cables, as in table 3.1.

Effect of external influences

Any methods used must consider and make allowances for the effect of external influences on the wiring system.

A wiring system must protect against mechanical damage, environmental and other external influences by enclosure or other means. AS/NZS 3000 3.3 provides details of the various influences and situations that must be considered and the criteria that must be met.

Support and fixing

Wiring systems must provide adequate strength of support, suspension, and fixings, for example, when used above suspended ceilings.

Physical contact

Wiring systems must protect against physical contact with live parts by durable insulation materials or by placing live parts out of reach.

Reliability and continuity

Wiring systems used must provide reliability and electrical continuity of connections, joints and terminations.

Mutual detrimental effects between services

The systems used must avoid any detrimental effects arising from the installation and use of other wiring systems.

This includes things like, different electrical installations, different parts of the same electrical installation, or other installations like gas, water supply or telecommunications.

Fire prevention

All systems used must take precautions to minimize the spread of fire by the selection of appropriate materials and installation methods.


Photo by Graeme Jeffrey

Circulating / eddy currents, and electromagnetic interference

Systems used must take precautions to limit circulating / eddy currents. In the case of electrical installations containing sensitive electronic equipment, the installation system must minimise electromagnetic interference by selecting the appropriate cables and installation configurations.

Cable support systems

The three typical types of cable support systems are:

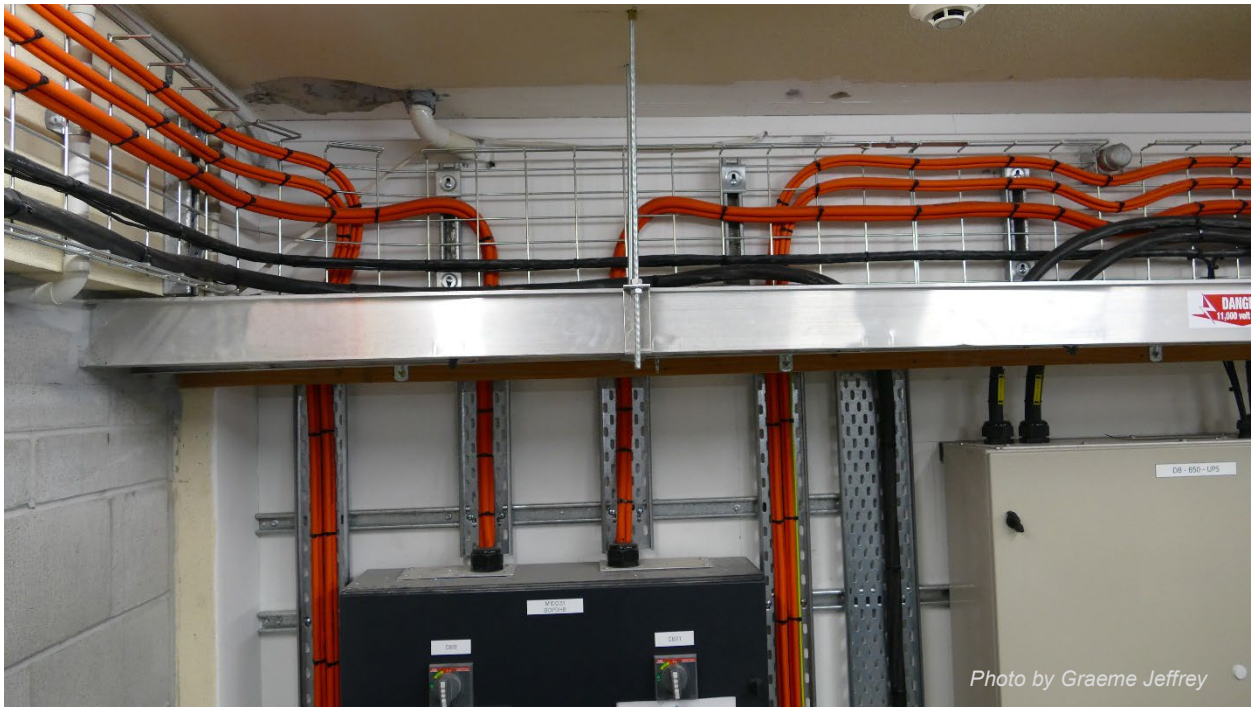
- Cable tray or ladder rack.
- Conduit or ducting.
- Catenary wire.

Cable tray or ladder rack

Cable tray systems are used to support insulated electrical cables and are commonly used in commercial and industrial construction.

They are especially useful in situations where changes to a wiring system are anticipated, since new cables can be installed by laying them in the tray, instead of pulling them through a pipe.

Cable trays are normally made of galvanised steel, stainless steel, aluminium, or glass-fibre reinforced plastic. When galvanised tray is cut to length in the field, usually the cut surface is painted with a zinc-rich compound to protect the metal from corrosion.



There are several types of cable trays that may be used in different applications.

A **solid-bottom** tray provides the maximum protection to cables, but requires cutting the tray or using fittings to allow cables to enter or exit the tray. A deep, solid enclosure for cables is called a cable channel or cable trough.

A **ventilated** tray has openings in the bottom of the tray, allowing some air circulation around the cables, water drainage, and allowing some dust to fall through the tray.

Small cables may exit the tray through the openings, which may be either slots or holes punched in the bottom.

A **ladder** tray has the cables supported by bars, similar to the rungs of a ladder.

Ladder and ventilated trays can have solid covers to protect cables from falling objects, dust, and water.

Tray covers for use outdoors or in dusty locations may have a peaked shape to shed debris including dust, ice or snow.

Lighter cable trays are more appropriate in situations where a great number of small cables are used, such as for telephone or computer network cables.

These trays may be made of wire mesh, called "cable basket", or be designed in the form of a single central spine (rail) with ribs to support the cable on either side.

Large power cables laid in the tray may require support blocks to maintain spacing between conductors, to prevent overheating of the wires.

Smaller cables may be laid unsecured in horizontal trays, or secured with cable ties to the bottom of vertically mounted trays.

Conduit or ducting

AS/NZS 3000 requires insulated, unsheathed cables to be enclosed in a wiring enclosure throughout their entire length.

Conduit or ducts are the wiring enclosures commonly used in this situation. A conduit is a small pipe used to run and protect electrical wiring in a building or structure. A duct is a larger pipe.

Electrical conduit may be made of metal, plastic or sometimes fibre or fired clay. Most conduits are rigid, but flexible conduit is used for some purposes.

Conduits include:

- Steel conduits or other metal tubing.
- Flexible metal conduit.
- Rigid plastic conduit.
- Corrugated plastic conduit.

Conduits should be supported at regular intervals to stop undue damage or sagging when mounted.


Photo by Graeme Jeffrey

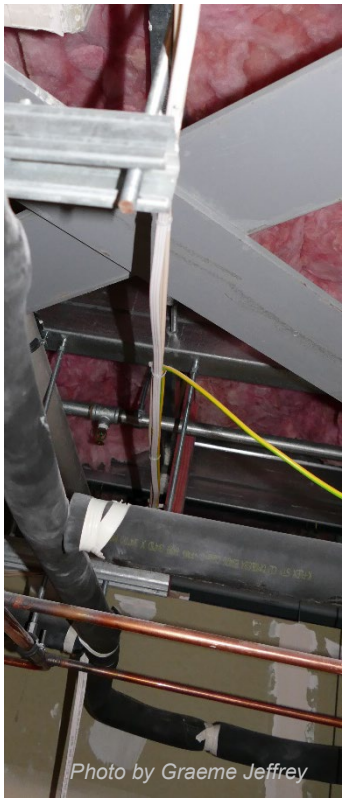


Photo by Graeme Jeffrey

Catenary wire

A catenary wire is a wire strung between two points to hang a cable on. It may be between power poles, from one building to another, or above a suspended ceiling.

The cable is held to the catenary wire with cable ties, straps or other ties.

Anchorages and cable supports need to be of adequate strength to support the load including the effects of mechanical stresses, e.g. due to wind/ice.

Catenary wires need to be mounted at sufficient height to prevent danger to persons or livestock, or to the cable being supported.

AS/NZS 3000 3.13 provides details about the cables that can be supported by catenary, requirements to be fulfilled by a catenary support and details of clearances.

Building materials, their strength for mounting and their fire rating

A typical building is usually made of several different building materials like bricks, timber, steel, concrete and/or wall material like plaster board. It is on these building materials that electrical fittings are mounted.


Photo by Graeme Jeffrey

It is important to know whether a particular type of building material has the strength to take the weight of the fittings being mounted.

Given below are the various types of common building materials, along with a five-star rating for strength of mounting and fire resistance. (Rating: 1 star = poor, 5 stars = excellent).

Concrete

Concrete is one of the most durable and common building materials. Structures made of concrete can have a long service life. Concrete is used more than any other manmade material in the world.

Concrete gains strength over time, and provides superior fire resistance compared with wooden construction.

Rating

Strength ★★★★★ Fire resistance ★★★★★

Brick

Bricks are comparable to concrete in terms of their strength and fire-resistance. Fired bricks are one of the longest-lasting and strongest building materials. They are however not as strong as concrete to mount to because of the danger of the brick cracking or loosening in the mortar.

Rating

Strength ★★★★ Fire resistance ★★★★★

Treated wood

Wood is treated using various methods like pressure, CCA, fire retardants to make the wood stronger and longer-lasting. The common treated wood used in buildings is very strong for mounting fittings. However, unless the timber has been specially treated by fire retardant chemicals, it is not very fire resistant.

Rating

Strength ★★★★★ Fire resistance ★★★

Gib ® plasterboard

Plasterboard or drywall is a paper lined panel made of gypsum. It is used to line interior walls and ceilings. It has low strength and can easily be cut. It is also not very fire resistant.

Rating

Strength ★★ Fire resistance ★★

Photo by Graeme Jeffrey

Polystyrene

Polystyrene is a polymer and is used in sheet form for building insulation. It is very light and can be easily damaged. It is also not fire resistant, in fact, it is easily destroyed by fire and gives off very toxic fumes when burning.

Rating

Strength ★ Fire resistance ★

Installing, terminating, and testing of cables

Installing, terminating, and testing of cables must meet the standards set by AS/NZS 3000 Section 3 - Selection and Installation of Wiring Systems, and Section 4 - Selection and Installation of Appliances and Accessories.

Cables supported by catenary wire

Installation

Cables supported by a catenary wire must meet the requirements of AS/NZS 3000 3.13, they must be stranded cables with double insulation or the equivalent of double insulation.

Cables and catenary supports installed outside must be suitable for exposure to direct sunlight and adequately protected from external influences.

Termination

When terminating cables supported by catenary wire, external influences that impact on the cables and catenary wire must be considered. For example, there must be adequate length at the termination of the cable to allow for movement in the wind.

Testing

Cables must be tested to AS/NZS 3000. Visual checks should also be done to ensure that during normal use the cables will not be under stress or being damaged.

Pendant-type socket outlets

Installation

Since pendant type sockets are usually suspended from the ceiling or wall and bear the weight of the fitting at the end, adequate mechanical protection must be installed to prevent strain on the cables.

Termination

Care should be taken when terminating cables for pendant type socket outlets to avoid mechanical stress on the connections during normal use.

Testing

Testing must be carried out to AS/NZS 3000. Included in the testing are tests to ensure that the switch operates in all active conductors.

Trailing cables

Installation

Trailing cables are usually found in lifts, mines and quarries and are made of vulcanized rubber, butyl rubber, silicon rubber or thermoplastic (synthetic rubber).

Trailing cables are usually heavy and therefore adequate mechanical protection must be installed to prevent strain, damage, or wear to the cables during normal use.

Photo by Graeme Jeffrey

Termination

Cables must be terminated by appropriate means to ensure that the terminations are not damaged or loosened during normal use.

Testing

Cables should be visually checked at regular intervals to ensure that during normal use the cables are not under stress, showing signs of wear and tear or being damaged.

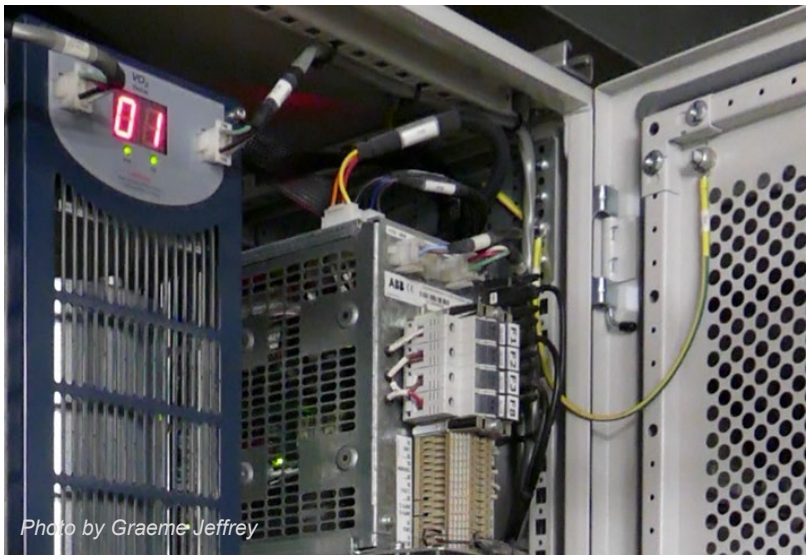
Earthing of electrical equipment

Earthing

AS/NZS 3000 5.4 states that electrical equipment with exposed conductive parts must be earthed.

It also says that earthing is not required where the wiring of the electrical equipment is protected by one of the following:

- The use of double insulation.
- By electrical separation.
- By SELV or PELV systems.



Methods of earthing

AS/NZS 3000 5.4.1.3 covers methods of earthing electrical equipment. Protective earthing conductors are not required where conductive parts are used.

According to AS/NZS 3000 5.4.1.3, electrical equipment required to be earthed is to be connected using:

- Protective earthing conductors that can be in the form of cables, cords, busbars or similar forms of current carrying material.
- Another earthing medium, such as conductive parts of cables, wiring enclosures, switchboard framework or the like.

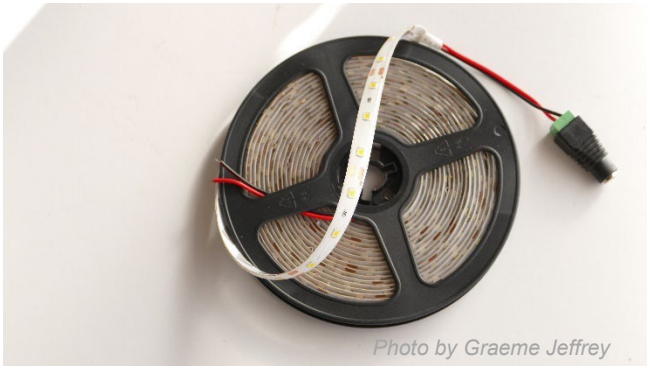
AS/NZS 3000 5.5 and its sub-clauses provide details for earthing arrangements.

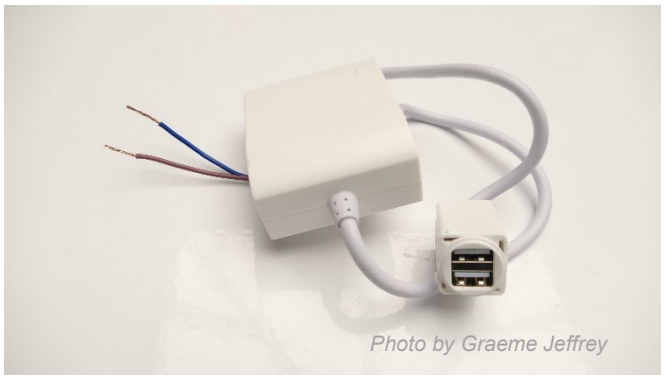
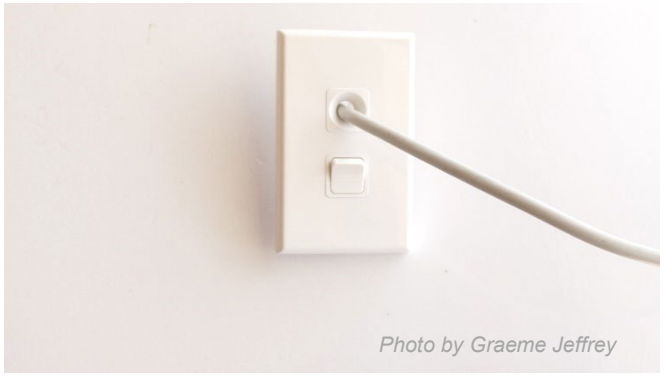
Electrical accessories

As an electrical worker you need to have a knowledge of various electrical accessories and what they are used for.

At this stage, you are required to recognise and correctly name various common electrical accessories and their uses.

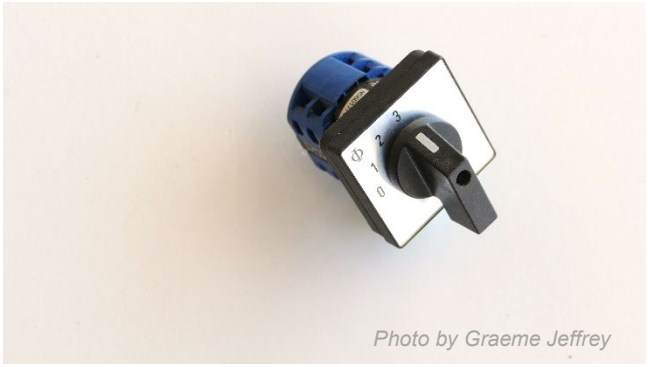
The main sources of information about an accessory are the manufacturers' catalogues, brochures, leaflets, and data sheets.

Picture	Name / Function / Use
 Photo by Graeme Jeffrey	**Double socket outlet -** To allow appliances to be connected to an installation. Standard domestic sockets are rated at 10A per socket, but they also come in a variety of other current ratings.
 Photo by Graeme Jeffrey	**LED light strip –** Used for lighting, they are often used to artisticly light areas for visual effects.
 Photo by Graeme Jeffrey	**Intermediate switch –** used when more than 2 switches are required to operate a lighting circuit.

Picture	Name / Function / Use
 Photo by Graeme Jeffrey	**USB socket -** to provide a means of connection to USB devices for charging.
 Photo by Graeme Jeffrey	**Fluorescent light starter -** part of a fluorescent light, it has a metal or plastic canister containing a switching device with a two-terminal plug connection. The starter helps the fluorescent lamp strike - it is used for causing fluorescent lamps to start glowing by initiating the discharge.
 Photo by Graeme Jeffrey	**Permanent connection unit (PCU) -** provides a connection point for fixed wired equipment. The PCU consists of a termination arrangement for the flexible cord with cord grip and switch, and termination for fixed wiring. It is used for permanent connection of electrical equipment like heated towel rails, bathroom heaters, semi-portable appliances, and appliances such as water heaters that need a suitable connection to the fixed wiring.

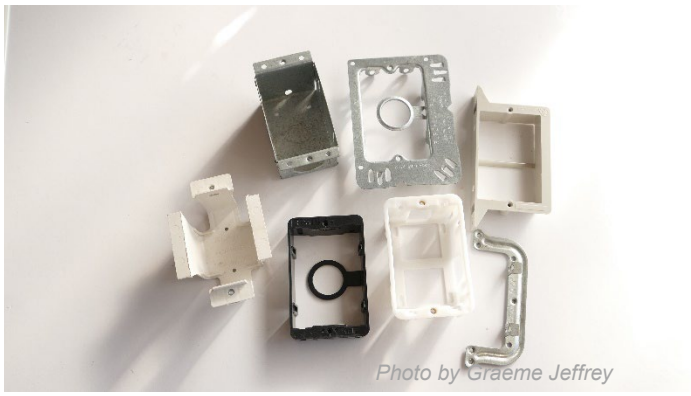
Picture	Name / Function / Use
 *Photo by Graeme Jeffrey*	**Thermostat -** Controlling the water temperature in hot water cylinders. They switch off when the water is up to temperature, and on again when the temperature drops.
 *Photo by Graeme Jeffrey*	**Plugs -** The 3-pin flat pin plug is the most common plug. It is used to connect supply to portable single phase electrical appliances. The tap-on plug version has the facility to accept another plug plugged into the back of the first.
 *Photo by Graeme Jeffrey*	**Three phase waterproof plug and socket -** For use in wet areas needing protection against moisture. They are available in different styles, current ratings and IP ratings.
 *Photo by Graeme Jeffrey*	**Cord extension socket, or cord connector -** this is a socket used on a flex and accepts a 3-pin flat pin plug. It is used to make extension cords.

Picture	Name / Function / Use
 *Photo by Graeme Jeffrey*	**Appliance connector Standard type –** The standard type plugs accept round pins. They are: ◤ Reversible ◤ Used in cord sets for appliances like jugs and kettles.
 *Photo by Graeme Jeffrey*	**Appliance connector International or DIN type -** The international or DIN type plugs accept flat pins. They are: ◤ Non-reversible ◤ Used in cord sets for power supplies to computers, printers, and other office equipment. ◤ Now also commonly used for jugs and kettles instead of the standard type.
 *Photo by Graeme Jeffrey*	**Toggle switch -** Toggle switches tend to have a switch “handle” that sticks out a long way. Old light switches had a predominant toggle handle and were phased out when the ‘flash new” flush rocker style switch took over the market. The switching mechanism has a “finger” that pushes open the sprung contact and the mechanisms tend to be bulky. Panel mount toggle switches are available for mounting on panels and some appliances or control equipment. They are used for: ◤ Switches in control circuitry ◤ Switches for appliances

Picture	Name / Function / Use
	**Rocker switch -** The rocker switch was a revolution in its day, it quickly took over the market from the toggle switch and is still in wide use today. The small switch mechanism has a sprung switching “dolly” which rocks one way or the other depending on the position of the control switch mechanism. The front user switch mechanism is quite flat and does not move much. Rocker switches are widely used for general switching applications such as switching lights, heating, and power outlets.
	**Rotary switch –** These are used where multiple switching is required and if more switch contacts are needed, they can often be added to the switch. The switch handle rotates to the desired position. It is more easily sealed from moisture than other types of switches so is suitable where water proofing is needed.
	**Push button -** Push buttons have contacts that either close or open when the button is depressed against spring pressure. They are used to control contactors switching motors, groups of lights, and similar loads especially in industrial settings. Domestic versions are available to operate things like bells, buzzers in doorbell circuits and garage door opener circuits.

Picture	Name / Function / Use
 Photo by Graeme Jeffrey	**Pull cord -** The switch is operated by pulling the cord. A pull turns the switch on, and the following pull turns it off. They are used in: ◤ Situations where the operator is likely to have wet hands ◤ Bathroom heater units ◤ Light switches ◤ Nurse-call systems in hospitals and homes for the elderly, where easy access is important.
 Photo by Graeme Jeffrey	**Time delay switch -** The air-valve controlled switch functions with a simple press to turn on. As the air leaks back into the mechanism, it slowly releases and the switch breaks after a time delay. Electronic versions are also available. The time is usually adjustable and sometimes they can be set for delay on or delay off. Time delay switches are used to: ◤ Turn lights on with a delay before the lights turn off again. This allows a user to turn the light on without having to go and turn them off again. ◤ Allow continuation of exhaust fan to remove steam, vapours, odours etc. after a room has been vacated. ◤ To prevent appliances or electrical equipment being left on for too long.

Picture	Name / Function / Use
 Photo by Graeme Jeffrey	**Timer switch -** Timer switches can be either fixed-wired or plug-in type. They are used for operating process controls, pumps, heating, lighting, ventilation and so on. They can be programmed to turn on or off at certain times of the day and for a set period of time. They can come as either analogue or digital timers.
 Photo by Graeme Jeffrey	**Passive infrared (PIR) sensor -** PIRs are usually used as security lights that start to operate at dusk and are activated by sensing infrared heat movement across the sensor. They are simple to install, very convenient and provide a deterrent to burglars. They are usually installed under the eaves of a building to give some protection from the elements.
	**Fluorescent lighting -** Fluorescent lighting is commonly used to provide lighting in workshops, offices and large rooms for economy and long life. As fluorescent tubes are physically long, they reduce shadows. They are available in a wide variety of lengths, sizes, numbers of tubes per luminaire and colour temperatures. LED versions are now more commonly used in new installations as they use even less power, are even more economical, have a very long life and have become cheaper to manufacture.

Picture	Name / Function / Use
	**Flush boxes -** Wall mounted electrical fittings are usually installed using either flush boxes or mounting blocks. Flush boxes mount onto the wall framing or lining. They provide a cavity for the wiring connections and a way of securing the fitting flush to the wall. **Note:** Common fittings come in standard sizes. Most standard fittings fit in a single gang flush box or mounting block. Older installations often had toggle switches and socket outlets that were the width of two single gang flush boxes and sometimes more. Double flush boxes and mounting blocks were wide enough to fit two gang (width) electrical fittings. As time has gone on, and with the introduction of very compact rocker switches, the term “gang” has morphed into describing the number of switches on a normal modern (single width) plate or grid. A double light switch is sometimes refered to as two gang, three switches as three gang etc.
	**Mounting blocks -** Where there is no wall cavity or a flush box is not suitable, mounting blocks can be used to mount electrical fittings on top of the surface. They come in a variety of thicknesses and some are designed to provide double insulation.

Picture	Name / Function / Use
 Photo by Graeme Jeffrey	**Junction boxes -** Junction boxes provide space, access and protection for the connections of cable conductors. When installing junction boxes, the protective outer sheathing of the cables must be taken right into the cover through close-fitting holes. There is to be no excessive pressure on the conductors or the connection AS/NZS 3000 3.7 covers electrical connections in general and 3.7.3 mentions junction boxes.
 Photo by Graeme Jeffrey	**Lamp holders -** The type of lamp holder used depends on the type of lamp cap. The two common types of lamp cap are: ◤ Plug-in or bayonet cap (BC) ◤ Screw-in or Edison screw (ES). The purpose of a lamp holder is to hold a lamp firmly, allow the lamp to be changed easily but still provide a good electrical connection.
 Photo by Graeme Jeffrey	**Bayonet Cap Lamp (BC) –** provides lighting with a push in and twist connection.

Picture	Name / Function / Use
 Photo by Graeme Jeffrey	**Edison screw lamp (ES) –** provides lighting with a screw in connection.
 Photo by Graeme Jeffrey	**Ceiling batten –** a lamp holder (batten holder) which is designed to be fixed directly to a ceiling or wall and connects directly to the fixed wiring.
 Photo by Graeme Jeffrey	**Cord-grip** - lamp holder designed to be connected to, and hung from, a flexible cord. The lamp holder has a grip clamp which grips onto the cord.
 Photo by Graeme Jeffrey	**Ceiling rose -** ceiling roses are used to connect the flexible wiring of suspended lamps to the fixed wiring. They are usually fixed directly to the ceiling and are used to provide a connection point to the installation for pendant lights etc.

Picture	Name / Function / Use
	**Connectors -** connectors are used to make fixed connections between two or more conductors and come in a big variety of styles and types. Some are insulated and some not. Insulated connectors with screwed terminals are usually used for connecting conductors together. Some connectors need to be small, i.e. to allow connections within a light fitting or mounting box. Common generally used types of connectors are single connectors and strip connectors.

Electrical appliances

Electrical appliances are a part of our lives. Table lamps, toasters, refrigerators, washing machines are to be found in almost every home.

The Electricity Act 1992 defines electrical appliances as follows:

> Electricity Act 1992
>
> Part 1 Preliminary provisions
>
> 2 Interpretation
>
> *electrical appliance* means any appliance that uses, or is designed or intended to use, electricity, whether or not it also uses, or is designed or intended to use, any other form of energy

Working in the electrical industry, it is important for you to have an understanding of electrical appliances.

Terms for electrical appliances

There are four areas we will have a brief look at to do with the operation of appliances. These are:

- The input specifications and ratings.
- Control and power circuits.
- Electrical protection for appliances.
- Appliance output.

An example of an appliance might be a 3kW Welder.

3kW welder

Input specifications and ratings

A 3kW welder requires a 15A socket and a 230V supply. The connection method needs to be rated correctly for the supply it is to be connected to.

Control and power circuits

User controls are provided to adjust the output of the welder and on/ off switch is used to operate the power circuits.

How protection is applied to the appliance

The appliance is earthed where required. Internal over current and temperature protection is provided in the welder.

Output

Converts low voltage input supply to extra low voltage but with higher current depending on the operator settings.

Let’s look at another example.

Cordless kettle and base

Input specifications and ratings

A 2400W kettle, requires a 10A socket and a 230V supply. The connection method needs to be rated correctly for the supply it is to be connected to.

Control and power circuits

An on/ off switch is used to operate the power circuit. A thermostat automatically turns the switch off when the required temperature is reached.

How protection is applied to the appliance

The appliance is a class I appliance and is earthed. The manufacturer may include an over temperature/current cut-out in the internal control circuit.

Output

Converts input supply current to heat using a heating element.

Install and connect

All installations must follow the Fundamental Principles laid down in Subsection 1.5 of the AS/NZS 3000 (also known as the ‘Wiring Rules’). These principles include:

- 1.5.1 Protection against dangers and damage
- 1.5.2 Control and isolation
- 1.5.3 Protection against electric shock
- 1.5.4 Basic protection (protection against direct contact)
- 1.5.5 Fault protection (Protection against indirect contact)
- 1.5.6 Additional protection by the use of RCDs
- 1.5.7 Basic and fault protection by use of extra-low voltage
- 1.5.8 Protection against thermal effects in normal service
- 1.5.9 Protection against overcurrent
- 1.5.10 Protection against earth fault currents
- 1.5.11 Protection against abnormal voltages
- 1.5.12 Protection against the spread of fire
- 1.5.13 Protection against injury from mechanical movement
- 1.5.14 Protection against external influences

You need to be sure that you are familiar with the requirements of these fundamental installation principles.

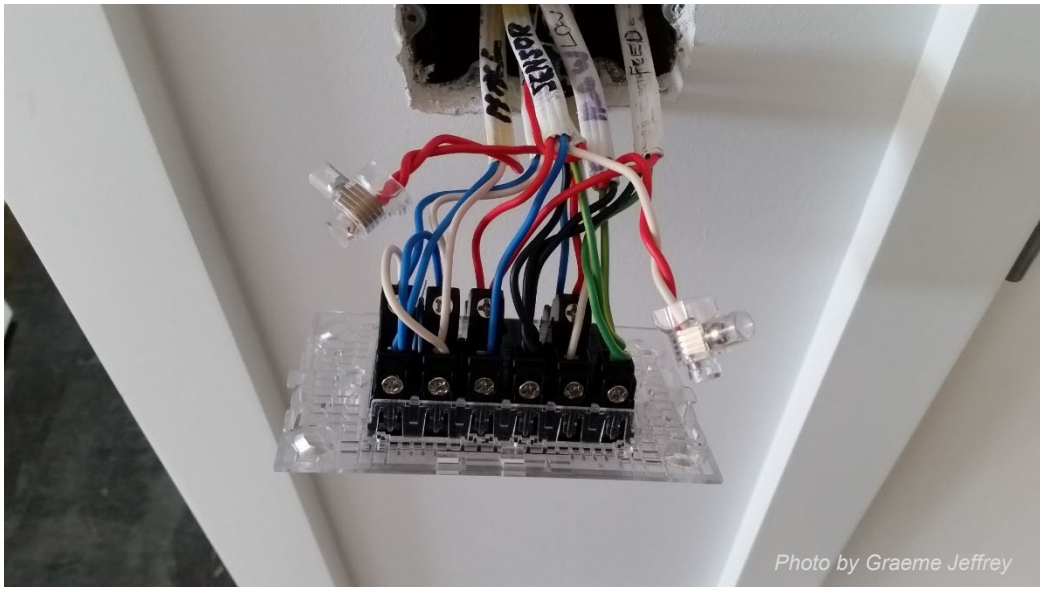
In addition to AS/NZS 3000 1.5, you must also be familiar with:

- AS/NZS 3000 1.7 Principles for selecting and installing electrical equipment.
- AS/NZS 3000 1.8 Verification (inspection and testing).
- AS/NZS 3000 1.9 Means of compliance.

Part 2 Section 2 of the Wiring Rules deals with Installation Practices, Section 3 with the Selection and Installation of Wiring Systems, and Section 4 with the Selection and Installation of Appliances and Accessories.

When installing electrical fittings, to make sure that the equipment is connected correctly and safely you will need to use:

- Manufacturers' specifications.
- Installation instructions.
- Declaration of conformity.



Testing of fittings, accessories, and appliances

Once the electrical fittings, accessories and appliances have been installed, you need to carry out the required tests.

You will also need to document the test results and complete the COC and ESC where necessary.

Te Pūkenga

earnlearn-tepukenga.ac.nz

0800 327 648 (0800 EARN IT)