



Electrical Workers Registration Board

Teaching Guidelines for Tradespersons Electrical Work Certificate

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Tradespersons Electrical Work Certificate Teaching Guidelines

Introduction

These guidelines have been prepared to assist Tutors in the development of suitable courses for teaching the Tradespersons' Electrical Work Certificate subjects to registered plumbers and registered gasfitters.

Although the examination standard is the same for all candidates, it is recognised that background knowledge at course commencement will vary from those with well-developed electrical skills, to those with an interest in electrical matters but with very little or no prior electrical experience.

For this reason the Electrical Workers Registration Board permits some variation to course duration in approved circumstances.

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1. Practical Tuition

Wherever possible, students must be given the opportunity to gain confidence in the recognition, handling and use of electrical equipment. Students must use meters and test equipment in particular as frequently as possible in order that they can competently use and rely on such aids for personal safety.

2. Safety

Special emphasis and reference must be given to the **testing requirements** of Regulation 37 of the Electricity Regulations 1997.

At all times the safety aspect must be emphasised in both classroom tuition and in carrying out practical exercises. Safety, not only for themselves, but also for others who may later depend on the standard of their workmanship.

3. Definitions

Unless the context otherwise requires, within these guidelines:

Act means the Electricity Act 1992

Code or ECP means New Zealand Electrical Code of Practice issued under Part IV of the Act.

Regulation means the Electricity Regulations 1997 and

Standard means, as the case maybe:

- a New Zealand Standard (NZS)
- a joint Australian/New Zealand Standard (AS/NZS)

Section means a section of the Electricity Act 1992

All other terms are as defined in the Electricity Act 1992, Electricity Regulations 1997 and AS/NZS 3000

4. Reference Texts

The Electricity Act 1992 and the Electricity Amendment Act 1997

The Electricity Regulations 1997, the Electricity Amendment Regulations 1999 and the Electricity Amendment Regulations 2002 that relate to electrical safety and electrical workers. (The Electricity Regulations Consolidation 2003 issued by the Board is an alternative)

AS 1939 supplement 1 – 1990

AS/NZS 2381.1:1999 Electrical equipment for explosive atmospheres – Selection, installation, and maintenance – General requirements

AS/NZS 3000/2000 Wiring Rules

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- AS/NZS 3004:2002 Electrical installations – Marinas and pleasure craft at low voltage
AS/NZS 3008.1.2:1998 Electrical installations – Selection of cables
NZS 3019 Int:2002 Electrical installations – In-service testing
AS/NZS 3760:2001 Inservice safety inspection and testing of electrical equipment

5. Examinable Material

Candidates must be advised that:

- (a) The contents of the practical assessment exercises are also examinable in the theory examination.
- (b) The content of the Electrical Service Technician "A" course is also examinable in the theory examination.

6. Levels Of Attainment

The letters "A", "B", "C", and "D" in the right-hand margin of each topic represents the "level of knowledge" that must be attained by each student as the result of time-tabled course tuition and private study. The letters represent the following:

- A Thorough knowledge
- B Good working knowledge
- C General knowledge
- D Basic understanding

7. Theory

7.1. Glossary of electrical terms

Understand and explain the following terms and the symbol where applicable: B

- | | |
|----------------------------------------------------------------|----------------------------|
| Voltage (Volt) | Current flow (Ampere). |
| Resistance (Ohm) | Power (Watt). |
| Insulation resistance | Continuity. |
| Phase conductor (Active, Line conductor) | |
| Neutral conductor | Earth continuity conductor |
| Bonding of metal liable to become live (equipotential bonding) | |
| Short circuit (between conductors and to Earth) | |
| Open circuit | Closed circuit |
| Earth | Earth situations |
| Exposed metalwork | Earthed metal |
| Double Insulated Appliance | |

7.2. Basic knowledge and understanding of electrical circuits

1. Describe the components of an electric circuit, i.e.: B
 - Source (battery, generator, a.c. mains, etc.).
 - Conductors (positive, negative, Phase, Neutral, Earth).
 - Insulation (to contain the conductors within defined limits)
 - Control (switches, thermostats, solenoid valves, sensors, relays).
 - Circuit Protection (fuses, circuit breakers, etc.).
 - Metering (ripple control relays).
 - Load (current using devices such as motors, igniters, elements).

2. Using circuit diagrams show the correct connections for a voltmeter, an ohmmeter or an ammeter. Using circuit diagrams show the correct connections for a voltmeter, an ohmmeter or an ammeter. B

7.3. Electricity supply

1. General
Describe the essential differences between alternating current and direct current supplies. C

2. The Multiple Earthed Neutral (MEN) System of Supply
 - (a) State the essential details of the system, (Basic treatment only) B
 - earthing of neutral conductor at the distribution transformer, at main switchboard on every consumer's premises, and at many intermediate points.
 - (b) Explain the principal purpose of the MEN system, e.g.: B
 - low neutral/earth parallel return circuit resistance to the distribution transformer.
 - ensures high fault current flow resulting in rapid and positive operation of circuit protection devices.
 - (c) Explain the essential differences between the MEN switchboard connection to the supply at the consumer's premises and the distribution and linked busbar switchboard used to supply sub circuits. C

3. Single Phase Supply
 - (a) State the essential details. A
 - one live conductor.
 - one neutral conductor.
 - one earth conductor.
 - (b) State the nominal voltages that exist between each of the conductors in low voltage installations. A

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7.4. Electrical safety of personnel

1. Candidates are to be made aware of their obligations under the Health and Safety in Employment Act 1992 A
2. State the factors that contribute to safety in the workplace, e.g.: A
 - the wearing of suitable clothing for the job.
 - ensuring working conditions are safe.
 - the correct use of machine tools.
 - the promotion of good workshop behaviour.
3. Explain the purpose and uses of (including diagrams): A
 - The isolating transformer.
 - Residual current devices (RCDs).
4. Understand the danger represented by exposed live parts and conductors with respect to: A
 - components or conductors operating at different potentials.
 - earth potential.
 - connecting any electrical appliance or apparatus that may become an electrical hazard.
 - the need to suitably label any such electrical appliance and remove it from the work area if possible.
 - the need to ensure that all covers, screens and guards provided with electrical appliances are in good order and are firmly fixed in their correct positions at the completion of any work carried out on the appliance.
 - disconnect the supply before working on electrical equipment.
 - the need to always test work before connecting it to the supply.
5. State which types of fire extinguisher are suitable for use on electrical fires and understand that the power supply to the burning equipment should be turned "off" before attempting to extinguish the fire. A
6. State why it is usually necessary to earth the exposed metalwork of electrical appliances to reduce the electric shock hazard. A
7. Explain how a metal clad electrical appliance is connected to earth and why it is necessary to ensure the lowest possible resistance for the earth continuity conductor, and understand: A
 - the need for clean, tight earthing connections with no cut or loose strands of flexible conductor.
 - that earth continuity is expressed in terms of conductor resistance and that this must not exceed the value stated in AS/NZS 3760. (1 Ω).
 - that as the earth continuity conductor's resistance increases it will adversely effect the operating time of the protective device.
8. Explain why all single pole switches must be connected in the phase conductor of electrical appliance wiring. A
9. Describe suitable means of preventing further use of a defective or hazardous electrical appliance, including the use of safety tags. A
10. Understand the precautions necessary when working in damp situations. A
11. Understand the various "conditions of use" and "types of safeguard" approved for use with electrical appliances. A

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7.5. Dangers of electric shock

1. Understand the effects that various values of voltages, current, contact duration or other conditions (wet skin, etc.) will have on the victim of an electric shock. A
2. To complete the requirements for the issue of the Tradespersons' Electrical Work Certificate candidates must either : A
 - Undertake items 6 and 7 as part of this course.
 - or
 - Complete first aid and CPR training prior to the course or be the holder of current certificates.
 - or
 - Complete and obtain First Aid and CPR certificate following this course and submit to the EWRB as evidence of completion.

7.6. Basic first aid

Not required if a current First Aid Certificate is produced, issued by St Johns or Red Cross

1. General

Procedures outlined in this section are intended only to give a general knowledge of safe, effective methods of applying first aid for certain types of injuries. Good first aid training is important in developing safe workers.

2. Objective

The main aim of first aid is to provide the patient with treatment as soon after the accident as possible in order to:

- sustain life,
 - prevent the condition from becoming worse, and
- then obtain professional assistance.

3. Basic rules

1. Do all you can to attract assistance.
2. Tell helpers clearly what you want them to do.
3. Warn bystanders of any possible hazards.
4. Never move a patient unless he/she is in immediate danger - you could make the injuries worse.
5. Do all you can to reassure the patient.

4. General procedure

The survival of a patient may depend upon the first aider's attention to certain priorities. These must be dealt with in the following order:

- establish clear airway.
- determine the level of consciousness.
- control external bleeding.

5. Suffocation or gassing

- remove the patient to fresh air.
- apply artificial respiration if necessary.
- treat for shock and keep any severe case lying down until he/she is seen by a doctor.

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6. Loss of consciousness

Loss of consciousness from a blow on the head or from a fall may be serious.

- place the patient in the recovery position unless he/she has neck or spinal injuries.
- treat for shock and consult a doctor even if consciousness is very quickly regained.

7. Minor cuts and scratches

Wash as clean as possible then swab with an antiseptic liquid. When dry, apply a sterile dressing, or cover with a small adhesive dressing impregnated with antiseptic.

8. Severe bleeding

- apply direct pressure with the fingers to the bleeding point or points using a dressing if available.
- if the wound area is large, press the sides of the wound firmly but gently together.
- elevate the wounded part if possible, except in the case of a fracture.
- if the bleeding is not quickly controlled by a properly applied dressing, put on more pressure by adding a second larger dressing over the top and bandaging more firmly, or by pressing on the dressing with the palm of the hand.
- do not remove the dressing. avoid disturbing any clots of blood.
- treat for shock and arrange medical attention.

9. Foreign body protruding from the wound

If a foreign body is protruding from the wound:

- DON'T remove it.
- DON'T press down on it.
- cover the wound with a sterile dressing and mould a ring pad to fit around it so that the bandage doesn't press the object further in, then bandage firmly.
- in the meantime, press firmly but gently from the sides of the wound with the flat part of the finger tips.
- the patient must be put in the recovery position unless he/she has neck or spinal injuries.
- treat for shock and arrange medical assistance.

10. Bleeding or fluid from the ear

This may mean that the patient's skull is fractured.

- place a dressing or pad over the ear and bandage tightly.
- if the patient is conscious, and provided he/she does not have neck or spinal injuries, place him/her in a half sitting position with the head leaning towards the injured side so that the blood or fluid can drain.
- treat for shock and arrange medical attention.
- if the patient is unconscious and provided he/she does not have neck or spinal injuries, place him/her in the recovery position with the injured ear downward.
- watch his breathing and pulse rate.
- get him/her to hospital urgently.

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11. Shock

Shock accompanies most injuries. The patient is pale and sweats profusely, he/she feels faint and sick and his skin is cold and clammy. His pulse becomes weak.

- reassure the patient, loosen any tight clothing and lay him/her on his back with his head low and turned to one side.
- wrap him/her in a blanket for warmth but do not overheat.
- provided it will not interfere with any injuries, raise his legs to increase the supply of blood to the brain.

12. Serious shock

If the patient loses consciousness and cannot be revived, his condition is serious and needs urgent hospital treatment. Make sure that he/she continues to breathe and control bleeding if necessary.

13. Electric shock

It is essential to free the patient from any electrical contact with electrical sources before attempting any form of treatment.

If the supply cannot be promptly switched off, free the patient from electrical contact by use of a dry stick, rope, clothing or other non-conducting material. Bare hands must not be used in direct contact with the patient unless you are insulated from ground by non-conducting material.

14. Eye injuries

If a foreign body cannot be removed from the eye by irrigation of the eye with water, and provided the foreign body is not on the pupil or embedded in the eye, try to remove with the corner of a handkerchief.

- **Do not attempt to remove the foreign body if it is:**
 - on the pupil of the eye.
 - in, or sticking to, the eyeball.
 - cannot be seen, but the eye is inflamed and painful.
- chemical splash in the eye, whether acid or alkaline, must be washed out immediately with plenty of water for several minutes. prompt application of water is essential.
- in all cases involving foreign bodies or chemical splashes to the eye, get the patient to a doctor as soon as possible.

15. Fractures

(a) Under normal circumstances it is preferable to await the arrival of qualified ambulance personnel, particularly when a spinal injury is suspected.

Fractures may be classed as:

- a closed fracture, i.e. the skin is not broken.
- an open fracture, i.e. there is a wound over the fracture.

(b) General treatment of a closed fracture

Methods of treatment vary according to the bones broken. In general the treatment consists of making the patient comfortable, immobilising the fracture by strapping or tying the affected part to a sound part of the body. For example, an arm against the side, or a leg to a leg, or splinting the broken bone as well as possible with materials to hand.

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- (c) General treatment of an open fracture
The open fracture is a much more dangerous injury than a closed fracture. Because of the open wound there is a possibility of infection. It is important to apply a sterile dressing or clean pad over the wound at once. This seals the wound, which is then given the same treatment as a closed fracture.

16. Sprains

To ease pain and control swelling, apply a firm bandage and cold packs or water. Re-apply the treatment when it ceases to give relief.

17. Burns and scalds

- the immediate treatment is cold water. place the affected part in cold water or gently running water from a tap for at least ten minutes. then cover the burn area with a sterile dressing or cloth.
- severe burns can result in fluid loss, so give the patient cold drinks at frequent intervals. this will replace the fluids and lessen shock.
- do not remove burnt clothing.
- do not apply ointments or lotions.
- do not prick blisters, breathe on, cough over, or touch the area as this increases the risk of infection.
- burns from corrosive liquids must be washed freely with water before dressing.
- treat for shock and arrange medical attention.

7.7. **Cardiopulmonary resuscitation**

Not required if a current First Aid Certificate including CPR is produced, issued by St Johns or Red Cross

Guidelines for CPR are issued by the New Zealand Resuscitation Council and are available from their website www.nzrc.org.nz.

(Click on "Courses" then "How to do CPR". Downloads for resuscitation of Adults, Children and Infants are available.)

7.8. **Circuit protection**

1. Explain the term "Excess Current Protection" B
2. Define "Close excess current protection". B
3. Describe with advantages and disadvantages :
 - Rewirable fuses.
 - HRC fuses.
 - Circuit breakers.
 - Glass cartridge fuses
4. State typical applications for the protective devices listed above. B
5. Understand and state the meaning of the following terms: A
 - Rated current.
 - Fusing current.
 - Utilisation Categories under BS88:1998, AS/NZS & IEC 60269.
 - Rupturing capacity or breaking capacity.

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6. Describe the steps required to: A
- identify a "blown" fuse.
 - isolate the fuse base from both supply and load.
 - rewire the fuse carrier or replace the cartridge.
 - replace the fuse carrier in its fuse base.
7. State the reasons for using the tortuous path provided by the manufacturer when rewiring a rewirable fuse, and: A
- understand the danger of leaving ends of fuse wire exposed to touch outside the fuse carrier of a rewirable fuse.
 - understand the current rating of tinned copper wire of various diameters used for rewiring fuses.
 - state why a "blown" HRC fuse must not be repaired or replaced with fuse wire.
8. Understand the need to replace fuse cartridges with items of the same type and rating as the "blown" cartridge, and to explain why this is necessary. B
9. HRC fuse labelling Utilisation Categories in accordance with BS88:1998, IEC & NZS/AS60269. A

7.9. Electrical insulators

1. State the purpose for which insulating materials are used, e.g.: B
- protection against accidental personnel contact with live conductors.
 - protection against short-circuiting between conductors.
2. State the importance of "insulation resistance" as an indicator of an insulator's condition. A

7.10. Flexible cords

1. Describe commonly used types of flexible cord and list typical applications for each, e.g.: B
- Twin and three core.
 - TRS and TPS sheathing.
2. State the types of sheathings used for high temperatures and give typical applications for each. B
3. State the New Zealand approved distinguishing colours by which each core in a flexible cord may be identified. A
4. Discuss the effects of excessive weight or strain, extremes of temperature and other environmental conditions on the insulation and sheathing of commonly used flexible cords. B
5. Understand the importance of secure, well made connections in prolonging the service life of a conductor. B

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7.11. Electrical fittings

1. Define the term "fitting" and list examples of those used with electrical appliances. C
2. State the reason why it is recommended that, when connecting a flexible cord to an electrical appliance or accessory, the Earth continuity conductor should be made longer than the associated Phase and Neutral conductors. B
3. Recognise the current limitations that may apply to plugs and sockets. B

7.12. Electrical appliances

1. Define the term "electrical appliance" and describe the difference between Earthed and double insulated electrical appliances. Explain how each provides safety from electric shock. B
2. Describe the characteristics of Class I and Class II appliances (ref AS/NZS 3760). A
3. Recognise the symbol for a double insulated electrical appliance C
4. Understand the operating principles and typical uses of the following types of control devices: D
 - Solenoids
 - Thermostats of various types.
 - Pressure switch.
 - Limit switch.
 - Time switch.
 - Single and double pole switches
5. Understand the operation of the appliance protective devices A
 - micro temp
 - fusible links
 - bi-metal cut outs

7.13. Electrical measuring instruments

1. Identify the correct instrument to measure: B
 - Voltage.
 - Current.
 - Resistance.
 - Insulation resistance.
 - Earth continuity.
2. Describe the correct method of connecting indicating instruments in a circuit to obtain meaningful results, e.g.: B
 - connect a voltmeter across the circuit or component.
 - connect an ammeter in series with the circuit or component.
 - connect an insulation resistance tester between open circuited conductors and from each conductor and earth.
 - connect an ohmmeter to form a closed series circuit with the power source disconnected, and -the requirement to zero the meter before carrying out the resistance test.

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3. Understand the relationship existing between different ranges of the same function/on multi meters, and State the likely results of using test instruments connected in circuit incorrectly or, where a multimeter is used, switched to incorrect functions or inappropriate ranges, and Ensure correct instrument polarity when working with moving coil analogue type meters on direct current circuits. B

7.14. Electrical appliance testing

1. Identify the appropriate instrument for testing an electrical appliance for: A
- circuit continuity
 - insulation resistance
 - polarity
 - earth continuity
2. Describe methods of carrying out tests listed above and state minimum and maximum results (where appropriate) that are considered satisfactory. A
3. Understand the reasons for each of the tests listed above. A
4. Explain why it is necessary to carry out insulation resistance tests at voltages higher than the normal applied voltage Explain why it is necessary to carry out insulation resistance tests at voltages higher than the normal applied voltage B
5. Describe the various conditions, indications and defects that can be found by visual examination of an electrical appliance being checked for compliance with regulation requirements and for general electrical and mechanical safety. A
6. Explain why an insulation resistance tester is unsuitable for carrying out the earth continuity test. B
7. Understand the necessary safety procedures when using instruments to test "live" circuits, e.g.: A
- do not energise the circuit until appropriate instrument connections have been completed.
 - maintain adequate insulation and clearances between instrument clips, probes or leads.
 - avoid personal contact with either live conductors or earth when using instruments on live circuits.

7.15. Regulations, Standards and Codes

Understand the following regulations, Standard and Codes

1.	Regulations	A
	2 Interpretation	
	17 Prescribed Electrical Work	
	18 Prescribed Electrical Work Electrical Service Technicians may do	
	25 Competency requirements for electrical workers	
	26 Safety tuition for electrical workers	
	37 Testing of prescribed electrical work.	
	38 Testing of electrical appliances	
	46 Safety checks for particular electrical installations and electrical appliances	
	51 Offences	
	61 Protective equipment	
	64 Residual current characteristics	
	68 Works, electrical installations, fittings and electrical appliances in existence on 1 April 1993	
	69 Electrical safety	
	69A Electrical installations	
	69B Compliance with regulation 69(1)	
	69C Compliance with design, construction and installation requirements of regulation 69(1)	
	70 Cables and conductors	
	72 Position of switches and protective fittings	
	74 Socket outlets	
	76 Fittings and electrical appliances	
	76A Non-complying fittings and electrical appliances	
	77 Handheld appliances	
	84 earthing in general	
	86 earthing system for MEN electrical installations.	
	90 Damp situations	
	91 Extra low voltage installations	
	94 Protection against direct and indirect electrical contact.	
	97 Connectable installations	
	98 Supply if electricity to connectable installations	
	100 Offences	
	101 Declared articles	
	106 Details to be supplied in reporting accidents	
	107 Offences	
2.	Standards	
	AS/NZS 3000 – clauses 1.6 – 1.10, section 2, clauses 3.1-3.8, 4.1-4.4, 4.9-4.11, sections 5 and 6, clauses 2.2, 7.1, 7.2, 7.7	A
	NZS 3019	A
	AS/NZS 3760	A
	AS/NZS 3003 – sections 1, 3 and 4 and Appendix D	B
	AS/NZS 2381.1 – sections 1, 4 and 5	B
	AS/NZS 3008.1.2 – sections 1 – 5 as they relate to flexible cords and cables, Tables 15 and 16	A

7.16. Limits of work and other responsibilities of Tradespersons Electrical Work Certificate holders

1. State the extent to which electrical work may be carried out in accordance with Reg 49 of the Electricity Regulations 1997 after passing the theory examination and practical assessment programme, after issue of the certificate by the Electrical Workers Registration Board. A
2. Understand that the Electrical Workers Registration Board may impose certain limits or restrictions on the work that may be undertaken or where or for whom the certificated person may work. A
3. Describe the responsibilities binding upon persons carrying out prescribed electrical work including: A
 - The need to ensure compliance with the Electricity Act 1992, Electricity Regulations 1997, Standards and Codes and other legal requirements insofar as they apply to the work undertaken.
 - The need to ensure a high standard of workmanship.
 - The need to work safely.
 - The limits and restrictions that apply to persons who may assist persons registered under the Electricity Act 1992 in carrying out prescribed electrical work.
4. State the importance of engaging a Registered Electrician to carry out any electrical work beyond that for which the Tradespersons' Electrical Work Certificate has been issued or in those instances where doubt about the work exists. A

7.17. Isolation of electrical appliances from the electricity supply

1. Explain that the difference between the actions of "switching an electrical appliance off" and "isolating an electrical appliance" is that isolation prevents accidental re-energising and switching off does not. A
2. Describe methods of isolating an electrical appliance A
3. Describe the following methods of ensuring continued isolation: A
 - withdrawal of fuses.
 - warning notice on the isolating switch.
 - locking of switch.
 - removal of plug from socket plus warning notice or removal of the electrical appliance.
 - tripping of circuit breaker plus warning notice.
4. Identify suitable test instruments and methods used to check for isolation. A
5. Understand that the dangers involved in failing to isolate correctly are: A
 - electric shock through failure to isolate correct circuit.
 - electric shock through failure to isolate **all** live conductors.
 - disruption to equipment operation and possible injury through isolating wrong circuit.
 - damage or injury through removing a fuse that is still alive and carrying current.

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6. Explain the need to check that all conductors of an "isolated" circuit are indeed "dead" and that the consequences of omitting to check are:
 - electrical shock hazard if circuit is only partially isolated.
 - danger of fire from arcing between a live conductor and earth.A
7. Explain the purpose of "Prove - Test - Prove" testing procedure for checking the isolation of a circuit and describe how the procedure is carried out. A
8. Understand that if complete isolation cannot be achieved the circuit must not be worked upon. A registered electrician must be called to correct the situation. A

7.18. Working on fixed wired appliances

1. Know that it is not satisfactory to rely on equipment indicator lamps or similar devices to judge the "live" or "dead" state of circuit conductors, e.g.:
 - the indicator on a machine may state "non-operational" or "off", but some machine circuits may still be alive.A
2. Discuss methods of ensuring that circuits supplying an isolated fixed wired electrical appliance remain isolated as required, examples are :
 - apply a safety tag to the point of isolation.
 - lock the isolating switch with personal lock.
 - remove fuses from vicinity of switchboard.
 - disconnection of circuit conductors by an appropriately registered person if the disconnection is to be for a long period.A
3. Understand that the Supervisor or Person in Charge of the area in which work is to be carried out must be kept informed of the reason for, extent of, and possible duration of the work. B
4. Understand that the positions of, and operation of, relevant isolating and safety devices or procedures must be ascertained before commencing work. B

7.19. The safety tag system

1. General
 - (a) State that the general principles involved for one's own safety and the safety of others are, e.g.:
 - any person may apply a tag.
 - it may be applied to all plant and equipment.
 - all persons must comply it with.B
 - (b) State that the two tags generally used are:
 - The Danger tag "Danger - Do not Operate".
 - The Out of Service tag "Out of Service - Not to be Operated".B
 - (c) Explain the purpose of each tag and describe how its use will increase safety in given circumstances. B
 - (d) Understand that the tags may be handmade if a proprietary item is not available B

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2. Danger Tags

- (a) State the essential information required on a danger tag and its colour. A
- (b) List circumstances in which the use of a danger tag would be essential to promote safety, examples are : A
- working on electrical fittings.
 - working on faulty machinery.
 - working with steam, gas or dangerous liquids.
- (c) Indicate where a Danger Tag must be applied, e.g.:
- at the point of isolation.
 - at any other point that, if actuated, may expose the worker to danger.
- (d) Explain why each person working on a machine or piece of equipment or circuit must put on their own Danger tag. A
- (e) Nominate who may remove a Danger tag, e.g.:
- only the person who placed the tag or the person in charge of the work party after personally checking for safety.
 - the Person in Charge immediately.
- (f) Explain what is required when a previously unnoticed danger is observed, e.g.:
- apply the Danger tag.
 - isolate the danger if possible.
 - inform the Person in Charge immediately.
- (g) State the procedure required with respect to Danger tags when a work in progress is unfinished at the end of the shift or day, e.g.:
- each worker removes his or her own Danger tag.
 - a senior person replaces their Danger tag with an Out of Service tag if a dangerous situation still exists.
 - Person in charge must be informed of situation.
- (h) Explain that, having isolated a piece of equipment and fitted a Danger tag it is necessary to check the machine or circuit to prove that isolation has been effective, e.g.:
- "Test Before Touch".
 - "Prove - Test - Prove".
- (i) Explain why some electrical switches etc are not acceptable as isolating switches, examples are :
- push button switches.
 - emergency stop buttons.
- (j) State that the procedure to be adopted by the Supervisor or person in charge when work requiring Danger tags to be used is being carried out by several workers is as follows:
- each person will place his/her own danger tag or out of service tag as appropriate.
 - each person will check the work and ensure safety before removing his/her own tag.

3. Out of Service Tags

- (a) State the essential information required on an "Out of Service" tag and its colour. A
- (b) List circumstances in which the Out of Service tag would be used to promote safety, e.g.:
- if machinery or equipment is faulty or damaged and could cause more damage or injury if operated.
 - if equipment is faulty but not currently being worked on.
 - if an item that is serviceable is likely to be connected to faulty equipment.

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- (c) State who may remove an Out of Service tag or authorise the use of the equipment that is tagged, e.g.: A
- The person working on the equipment who placed the tag on it, when the repairs or maintenance have been completed, or
 - Only the person in charge may remove an Out of Service tag or authorise the use of the equipment and **only** after **personally** checking that the item is safe to use.
- (d) Explain that, when a Danger tag has been applied to a machine or equipment already carrying an Out of Service tag, only the Person in Charge may authorise its operation for testing or other purposes after the Danger tag has been removed. A
- (e) State that, when about to work on a machine or circuit that already carries an Out of Service tag, a worker must also attach their own Danger tag to ensure their safety. A
- (f) State that a decision on how long temporarily disconnected conductors may be safely left is the responsibility of the person carrying out the work. A
- (g) List the various circumstances that will influence the above decision. A

7.20. Disconnection & reconnection of conductors

1. General

- (a) Describe the correct procedure for disconnecting conductors at an electrical appliance or at a fixed wiring terminating point is to: A
- attach the safety tag.
 - isolate circuit.
 - check isolation ("Prove - Test - Prove").
 - secure isolation.
 - identify each conductor and terminal as disconnection proceeds.
 - separate, insulate and make safe all exposed conductor ends.
 - ensure that disconnected cables are protected from mechanical damage or interference by children or animals.
- (b) Describe the correct procedure for reconnecting conductors at an electrical appliance or at a fixed wiring terminating point as: A
- check any safety tags that are in place.
 - check isolation is still effective ("Prove - Test - Prove").
 - reconnect conductors to terminals.
 - carry out prescribed tests including earthing, polarity and insulation resistance where appropriate.
 - replace all covers, screens and guards.

2. Flexible Cords and Cables

- (a) Understand the colour coding of the conductors as prescribed in AS/NZS 3000, Section 3.8. A
- (b) State the acceptable conductor colour requirements for flexible cord or flexible cables and two and three conductor configurations. A
- (c) Discuss the construction of commonly used flexible cables, flexible cords, and their uses. B
- (d) Understand the precautions that must be taken when disconnecting and reconnecting these types of cables and their enclosures: B
- TPS and TRS cables.
 - Flexible cables and cords.
 - P.V.C. cables in flexible conduit.
- (e) Explain the importance of ensuring all conductors are correctly terminated to maintain the correct polarity and what would occur if the following were accidentally interchanged on the supply to a single phase 230 volt appliance: A
- the phase and neutral conductors.
 - the neutral and earth conductors.
 - the phase and earth conductors.

7.21. Methods of connecting electrical appliances to the electricity supply

State that the methods by which electrical appliances may be connected to the fixed wire supply are: B

- by flexible cord using various approved plugs and sockets.
- by flexible cord from a ceiling rose.
- by flexible cord or flexible cable from a purpose built permanent connecting unit.
- by flexible cord or flexible cable using suitable connectors housed in an approved box, switch or terminal unit.
- by direct connection of the fixed wiring cables to the electrical appliance at its terminal box.

8. Practical Skills

The skills listed below are those contained in Regulation 49 and Schedule 7 of the Regulations. These should be instructed and assessed using exercises that are relevant to the work performed by plumbers, gasfitters or plumber/gasfitters during the normal course of their employment.

<u>Skill No</u>	<u>Description</u>
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- | | |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Electrical safety
This skill can be assessed by general observations made during the delivery of the practical instruction and assessment or by assessment using specifically designed exercises. |
| 2. | C.P.R. and Basic 1st Aid
Refer to sections 7.6 and 7.7 |
| 3. | Plugs and sockets |
| 4. | Fuses
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A. |
| 5. | Flexible cords |
| 6. | Soldering |
| 7. | Metal framed appliances - flexible cord protection and crimp connections
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A. |
| 8. | Switching of lamps
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A. |
| 9. | The disconnection and reconnection of electrical appliances supplied from permanent connection units
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A. |
| 10. | Supply voltage and current testing of electrical appliances
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A.
The tests are to be performed when the relevant electrical appliances are live on the supply. |
| 11. | Electrical appliance testing as per AS/NZS 3760
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A.
Tests are to be performed in accordance with AS/NZS 3760 to ensure that appliances are electrically safe before they are connected to a power supply. |

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12. Identification of electrical conductors within buildings and structures and fittings connected to those conductors
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A.
13. The disconnection and reconnection of permanently connected electrical appliances
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A.
14. Replacement of fittings on a like for like basis
Requires the use of electrical appliances and fittings that are relevant to those used in plumbing and gasfitting work up to a maximum of 230V 15A.