ELECTRICAL WORKERS REGISTRATION BOARD

PRESCRIPTION FOR ELECTRICAL INSPECTOR EXAMINATION

AND

TEACHING GUIDELINES FOR ELECTRICAL INSPECTOR PRACTICAL ASSESSMENTS

Issued by
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Contents

1. Introduction

The Electricity Act 1992 requires the Electrical Workers Registration Board to ensure the competency of all persons applying for electrical registration. For registration as an Electrical Inspector a person must have:

1. Held registration under the Act for at least 3 years.
2. The practical experience required by the Board.
3. Passed a written examination
4. Passed a practical assessment.

These Electrical Inspector Teaching Guidelines have been prepared to assist tutors in the development of courses for students who need to complete 3 and 4 above (the written examination and practical assessment) for registration as an electrical inspector. The tuition provided must cover **ALL** of the subject matter

While these guidelines aim to be a detailed as possible, they do not cover every detail. For example, it should not be inferred that a particular subject is limited to the examples listed.

Please note that the release of this document is consistent with section 77 of the Electricity Act 1992 and does not reflect any decisions the Board may make in relation to future categories of registration as required by the Electricity Amendment Act 2006.

2. Structure of Guidelines and Prescriptions

All Guidelines and Prescriptions have the same structure and numbering system. The system is based around the 66 essential capabilities for electricians agreed between the Board and Australian Licensing Authorities. These capabilities have been placed in the following groups:

A	Basic Theory	I	Switchboards
B	d.c. Theory	J	Damp and Wet Areas
C	a.c. Theory	K	Testing, Certification and Inspection
D	System Theory	L	Safety, Safe Working Practices, Basic First Aid and CPR
E	Three-phase Motors, Generators and Starters	M	Semi Conductor Devices and Circuits
F	Single-phase motors and starters	N	d.c. Motors
G	Transformers	O	Lighting
H	Circuit and Cable Installation and Protection	P	Legislation

Example H1a.27, H1b.28, H1c.31

These 3 topics relate to protection and control. For "H1b.28"
- "H" relates to the group
- "1" denotes the first topic (or set of related topics) in the group
- "b" denotes that this is the 2nd topic in the set
- "28" is the core capability

Therefore, subject matter for the Guidelines or Prescriptions - other than for electricians – is "aligned" to the equivalent electrician core capability. Also some groups and capabilities do not apply to particular guidelines. For example, capabilities relating to certification of prescribed electrical work do not apply to Electrical Service Technician Guidelines.

3. Safety

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 for others who may later depend on the standard of their workmanship.

4. Definitions

Act means the Electricity Act

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

Regulation means the Electricity Regulations

Standard means any of the following:

- New Zealand Standard (NZS)
- a joint Australian/New Zealand Standard (AS/NZS)
- a British Standard (BS)
- an International Electrotechnical Commission Standard (IEC)

Section

- means a section of the Electricity Act

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

5. Reference Texts

Training providers must use the applicable parts of the reference texts detailed in this part when providing tuition in accordance with these Guidelines. Providers:

1. Must use the most recent edition of a reference text and the current amendments.

2. May also need to use the edition of a reference text that was issued prior to the most recent edition. This may occur where a newer edition has been published after the one cited in regulations.

3. Select the course material and reference texts to be provided by students.

4. May use any other material they consider relevant to the course they are providing.

5.1 Legislation

The Electricity Act (presently the 1992 version reprinted 19 August 2005).
The Electricity Regulations (presently the 1997 version reprinted 5 September 2005).

5.2 Standards

AS/NZS1989	Specification for protected-type non-reversible plugs, socket-outlets, cable-couplers and appliance-couplers, with earthing contacts for single phase alternating current circuits up to 250 volts)
AS/NZS 2381.1	Electrical equipment for explosive atmospheres – Selection, installation, and maintenance – General requirements
AS/NZS 2430.3.1	Classification of Hazardous Areas – Examples of area classification - General
AS/NZS 2500	Guide to the safe use of electricity in patient care
AS/NZS 3000	Wiring Rules
AS/NZS 3001	Electrical installations – Relocatable premises including caravans and tents and their site installations
AS/NZS 3002	Electrical installations – Shows and carnivals
AS/NZS 3003	Electrical installations – Patient treatment areas of hospitals and medical and dental practices
AS/NZS 3004	Electrical installations – Marinas and pleasure craft at low voltage
AS/NZS 3008.1.2	Electrical installations – Selection of cables
AS/NZS 3012	Electrical installations – Construction and demolition sites
AS/NZS 3016	Electrical installations – Electric security fences
AS/NZS 3017	Electrical installations – Verification Guidelines
AS/NZS 3551	Technical management programmes for medical devices
AS/NZS 3760	In-service safety inspection and testing of electrical equipment
AS/NZS 3820	Electrical installations – Essential safety requirements for low voltage electrical equipment
AS/NZS 3832	Cold cathode illumination systems
AS/NZS 4701	Requirements for domestic electrical appliances for reconditioning or parts recycling
AS/NZS 4761.1	Competencies for working with electrical equipment for hazardous areas – Competency standards
AS/NZS 4761.2	Competencies for working with electrical equipment for hazardous areas – Guide for training and assessment.
AS/NZS 4417.1	Marking of electrical products to indicate compliance with regulations. Part 1: General rules for the use of the mark

AS/NZS 4417.2	Marking of electrical products to indicate compliance with regulations. Part 2: Specific requirement for electrical safety regulatory applications
AS/NZS 6116	Safe application of electricity in the meat processing industry
AS/NZS 60479-1	Effects of current in human beings and livestock - Part 1: General aspects
NZS 3003.1	Electrical installations – Patient treatment areas of hospitals and medical and dental practices – testing requirements
NZS 3019	Electrical installations – In-service testing
AS 3010	Electrical Installations - supply by generating set
AS 60529	Degree of protection provided by enclosures for electrical equipment (IP Code)
IEC 60050	International Electrotechnical Vocabulary - Part 121: Electromagnetism
IEC 60309	Plugs, socket-outlets and couplers for industrial purposes Part 1: General requirements

5.3 Codes

NZECP 34	New Zealand Electrical Code of Practice for Electrical Safe Distances
NZECP 35	New Zealand Electrical Code of Practice for Power Systems Earthing
NZECP 41	New Zealand Electrical Code of Practice for Single Wire Earth Return Systems
NZECP 50	New Zealand Electrical Code of Practice for Repair of Domestic Electrical Equipment
NZECP 51	New Zealand Electrical Code of Practice for Electrical Wiring Work in Domestic Premises
NZECP 54	New Zealand Electrical Code of Practice for Electrical Installations of Recessed Luminaires and Auxiliary Equipment.

6. Theory/Regulations

THE SUBJECT MATTER FOR EACH TOPIC REFLECTS WHAT A STUDENT (OR CANDIDATE) IS REQUIRED TO ACHIEVE FROM THE TUITION PROVIDED. While the subject matter is as comprehensive as possible, it will not detail every single item that should be covered in a topic.

"Regulations" subject matter can generally be considered to be that which contains direct reference to the Act, Regulations, Standards or Code.

Each topic has a desired attainment level. The letters "A", "B", "C" and "D" represent the level of knowledge that should be attained by each student as the result of timetabled course tuition and private study. The level letters mean:

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

Note: The contents of the practical assessment exercises are also examinable in the theory paper and this must be pointed out to the candidates during the theory course work.

A. Basic Theory

A2.2 Theory - Effects of current — Level A

1. Understand the effects of electricity on the human body including macro and micro electric shock.

2. Understand the zone designations and corresponding zone shock current limits detailed in figure 13 and table 4 of AS/NZS 60479-1

A3.3 Theory - Resistance — Level A

Understand the terms and meanings AS/NZS 3000 and AS/NZS 3760 for:

- Basic insulation
- Supplementary insulation
- Double insulation

D System Theory

D1.12 System theory - 3 phase systems Level A

1. Understand and apply the requirements of part 4 of the Regulations.
.
2. Understand and apply the general conditions and requirements of the Regulations, AS/NZS 3000, and NZ 3019 governing the supply of electricity to consumer installations and premises

3. Understand and apply the general conditions and requirements of the Regulations, AS/NZS 3000, and NZ 3019 and specific Standards governing the supply of electricity to particular installations including:

    - High voltage installations
    - Caravan Parks
    - Marinas
    - Hazardous areas
    - Medical electrical areas
    - Shows and carnivals
    - Construction and demolition sites

D2.14 System theory – pf correction, real and apparent power Level C

(a) Understand the reasons and importance of power factor correction.

(b) Understand the resulting effects on the ratings of cables and equipment when a poor power factor is present.

(c) Understand the dangers associated with over correction and the resulting effects when resonance occurs.

D3.21 System theory - Earthing of installations fittings and appliances Level A

1. Understand the reasons for earthing, the principles involved, and the reasons for installing an earthing system.

2. Select the most efficient and electrically sound earthing system to provide an adequate level of safety for the protection of the installation and personnel.

3. Understand and apply the requirements of:

    (a) The Regulations in relation to the earthing and bonding of works, electrical installations, fittings and electrical appliances:

(b) AS/NZS 3000 for low voltage electrical installations in relation to:

- the earthing of electrical installations and fittings
- functional and protective earthing
- MEN switchboards
- tailoring the protective devices to the earthing of an installation and circuits

(c) AS/NZS 3000 and NZECP 35 for high voltage electrical installations in relation to:

- functional and protective earthing
- earthing impedances and the setting of protective devices.
- the differences in the testing regimes between low voltage installations and high voltage electrical installations.
- the importance of controlling touch and step voltages
- the importance of controlling transferred potentials.

(d) AS/NZS 3760 in relation to the functional and protective earthing of electrical appliances.

D4.22 System theory - MEN systems **Level A**

1. Short-circuit currents

(a) Understand the dangers to persons and property associated with prospective short circuit currents.

(b) Recognise and establish the suitability of a fitting for a given application in both rating and category of duty.

(c) Be fully conversant with the physical electrical, magnetic and electro-mechanical dangers associated with PSCC if the equipment is inadequate to interrupt the short circuit current.

(d) Calculate prospective short circuit/fault current levels, including within the installation.

2. Systems

(a) Understand and explain the types of earthing systems used, their advantages and disadvantages.

(b) Select the correct equipment, apparatus and cable for a particular application associated with an earthing system.

(c) Understand and explain the dangers or hazards that can occur when an installation main neutral becomes faulty and has greater impedance than the main earthing lead.

3. Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to MEN systems

D5.59 System theory - HV, LV distribution systems **Level A**

Apply the requirements of the Regulations, AS/NZS 3000 and ECP 34 in relation to:

(a) HV systems

(b) Distribution systems

(c) Step and touch voltages

E. Three-phase Motors, Generators and Starters

E3.17 3ph-Motor/Alternators **Level A**
AS/NZS 3000 Requirements

Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the installation, protection and control of three-phase motors

F. Single-phase motors and starters

F2.20 1ph-Motors - Selection, and fault finding **Level A**

Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the installation, protection and control of single-phase motors

G. Transformers

G4.26 Transformers **Level C**
Application and safety issues

Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the installation, protection and control of transformers

H. Circuit and Cable Installation and Protection

H1a.27 Protection and Control **Level A 1-6**
Protection characteristics **Level C 7**

1. Understand and apply the general requirements of the Regulations and AS/NZS 3000 in relation to the characteristics of protection devices

2. Understand the meanings of circuit protection terms as used in accordance with industry practice, including:

   - Current rating
   - Voltage rating
   - Fusing current
   - Utilisation category
   - Tripping factor
   - Cut-off characteristic
   - Time verses current characteristic
   - Category of duty
   - Discrimination
   - Backup protection
   - Rupturing capacity
   - Prospective short-circuit current
   - Sensitivity
   - Earth-fault loop impedance.

3. Understand how the aspects detailed in (2) above are applied in practice.

4. Understand the principles of operation of:

   - Circuit breakers (types B, C and D).
   - HRC fuses
   - Rewireable fuses
   - Relays.

5. Explain the merits of different utilisation categories in accordance with industry practice.

6. Understand the term "Utilisation Category" and the labelling applicable for HRC fuse links

7. Monitored earth units
   Understand the principles of this unit and other earthing systems.

H1b.28 Protection and Control **Level A**
RCD characteristics

1. Understand and explain with the aid of fully labelled diagrams the principles of operation of RCDs.

2. Be fully conversant with RCD maximum operating times and maximum operating current values for personal protection and for the protection of property.

3. Understand that RCDs provide supplementary protection for the users of electrical appliances and equipment.

4. Be aware of how RCDs are classified including:

   - Method of operation
   - Type of operation
   - Number of poles and current paths
   - Possibility of adjusting the residual operating current
   - Resistance to unwanted tripping due to voltage surges
   - Behaviour of the presence of d.c. components
   - Protection against external influence
   - Method of mounting
   - Method of connection

5. Understand the operational characteristics of RCDs and how different types of the available RCDs operate including:

   - Residual current-operated circuit breakers (RCCB)
   - Residual current-operated circuit breakers with overcurrent protection (RCBO)
   - Socket-residual current protection devices (SRCD)
   - Portable residual current protection devices (PRCD)
   - RCDs functionally independent of line voltage (used in residential type switchboards and SRCDs)
   - RCDs functionally dependent on line or auxiliary voltage (used in PRCDs)
   - Typical residual current ratings
   - Classification of RCDs according to the presence of d.c. components.
   - Load leakage currents

6. Understand the characteristics of an RCD installed for personal protection.

H1c.31 Protection and Control **Level A**
Selection of control and protection equipment

1. Understand and apply the principles relating to protection for safety in the Regulations and AS/NZS 3000.

2. Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the installation of protection devices.

2. RCDs and Isolating Transformers

   (a) Understand the differences between the installation and use of RCDs and isolation transformers for general personal protection [AS/NZS 3003].

   (b) Apply the methodologies for installing RCDs in residential situations, industrial and commercial situations, single phase and three-phase.

3. For a specific situation in a low voltage installation, evaluate the various methods for personal protection and the protection of property available including.

   - RCDs
   - Circuit breakers (types B, C and D).
   - HRC fuses
   - Semi-enclosed rewirable fuses
   - Relays.

4. For a specific situation in a low voltage installation, select the most appropriate protective device for personal protection and the protection of property including

   (a) Understanding the capabilities of the device in relation to that situation.

   (b) The advantages and disadvantages of using a specific device in that situation.

5. (a) Understand and apply prospective short circuit current criteria (including the ratings) when selecting protective devices for the protection of:

      - Mains
      - Submains
      - Subcircuits
      - Final subcircuits
      - Equipment

   (b) Understand the effect of prospective short circuit ratings/fault current levels on the equipment supplied.

6. (a) Understand the problems caused by excessive volt-drop within an electrical installation and final subcircuits.

   (b) For a specific situation in a low voltage installation, select the most appropriate device to avoid the problems associated with excessive volt-drop.

7. Monitored earth units

   Understand the advantages/ disadvantages between this unit and other earthing systems.

H2.28 ELV **Level A**

Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to SELV and PELV systems

H3a.29 Cables and Cords **Level A**
Selection of mains and submains

1. Understand and apply the requirements for the selection and installation of submains and mains cables in accordance with AS/NZS 3000 and AS/NZS 3008.1.2

2. Select the appropriate type of cable for a particular application including:

   (a) Taking account of the environment in which it is to be installed: e.g. hot or cold ambient temperatures, abrasive, oil, chemical or water surroundings: flexibility needed.

   (b) Understanding the loadings possible from the equipment being supplied to ensure that suitable cables are selected.

   (c) The appropriate electrical and mechanical protection necessary

3. For a low voltage electrical installation:

   (a) Calculate and determine load balancing in multiphase installations.

   (b) Determine in accordance with AS/NZS 3000 the maximum demand including.

   - Total connected load and provisions for future increases.
   - Minimum permissible cable sizes.

4. Calculate in accordance with AS/NZS 3000 the maximum demand of:

   - A submain
   - A main
   - A total installation

5. Calculate the current rating and determine the size of any cable used for a particular application in accordance with AS/NZS 3008.1.2 including:

   (a) Differentiating between current rating and current carrying capacities of a cable.

   (b) How the effect of ambient temperature (soil and air) on:

- Various conductor and insulation types.
- The current carrying capacity (de-rating or re-rating cables).

(c) The limitations and restrictions imposed on the installation of various types of cable.

6. Calculate voltage drop and determine the size of cable in accordance with AS/NZS 3008.1.2 including:

(a) Identifying situations where excessive volt drop may occur and the consequences of the volt drop.

(b) Understanding how loading affects the volt drop

(c) Selecting the most appropriate conductor for a given application

H3b.30 <u>Cables and Cords</u> Level A
Selection of final subcircuits

1. Understand and apply the requirements for the selection and installation of final subcircuits in accordance with AS/NZS 3000 and AS/NZS 3008.1.2

2. Select the appropriate type of cable for a particular application including:

(a) Taking account of the environment in which it is to be installed: e.g. hot or cold ambient temperatures, abrasive, oil, chemical or water surroundings: flexibility needed.

(b) Understanding the loadings possible from the equipment being supplied to ensure that suitable cables are selected.

(c) The appropriate electrical and mechanical protection necessary

3. Calculate the current rating and determine the size of any cable used for a particular application in accordance with AS/NZS 3008.1.2 including:

(a) Differentiating between current rating and current carrying capacities of a cable.

(b) The effects of ambient temperature (soil and air) on:

- Various conductor and insulation types.
- The current carrying capacity (de-rating or re-rating cables).

(c) The limitations and restrictions imposed on the installation of various types of cable.

4. Calculate voltage drop and determine the size of cable in accordance with AS/NZS 3008.1.2 including:

   (a) Identifying situations where excessive volt drop may occur and the consequences of the volt drop.

   (b) Understanding how loading affects the volt drop

   (c) Selecting the most appropriate conductor for a given application

H3c.35 Cables and Cords **Level A**
Overhead and underground

Understand and apply the requirements of the Regulations, AS/NZS 3000 and ECP 34 in relation to the installation of overhead and underground cables and conductors

H3d.41 Cables and Cords **Level A**
Specifications

Understand and apply the requirements of AS/NZS 3000, AS/NZS 3008.1.2 and AS/NZS 3760 in relation to the colour coding and typical application of cables and flexible cords

H3e.42 Cables and Cords **Level A**
Termination of cords

Understand and apply the requirements of AS/NZS 3000 and AS/NZS 3760 in relation to the termination of flexible cords

H3f.44 Cables and Cords **Level A**
Install and terminate cables

Understand and apply the general requirements of AS/NZS 3000 in relation to the termination of cables

H3g.45 Cables and Cords **Level A**
Support systems

Understand and apply the requirements of AS/NZS 3000 in relation to the installation of typical cable support systems

H3h.47 Cables and Cords **Level A**
Switchboard terminations

Understand and apply the requirements of AS/NZS 3000 in relation to the termination of cables in switchboards

H3i.48 Cables and Cords **Level A**
Consumer main termination

Understand and apply the requirements of AS/NZS 3000 in relation to the termination of cables at the electrical installation/distribution system interface.

H3j.49 Cables and Cords **Level A**
MIMS cables

Understand and apply the requirements of AS/NZS 3000 in relation to the installation and termination of MIMS cables and ESR systems.

H3k.50 Cables and Cords **Level A**
Catenary and trailing cables

Understand and apply the requirements of AS/NZS 3000 in relation to the installation and termination of catenary and trailing cables.

H4.36 Hazardous areas **Level A**

Understand and apply the requirements of the Regulations and AS/NZS 3000 relating to hazardous areas including:

(a) Understanding which competencies are required to work in specific areas – AS/NZS 4761.1

(b) An overview of the training and assessment programme to achieve competency – AS/NZS 4761.2

(c) Understanding the general requirements of AS/NZS 2430.3.1 in relating to:

  (i) The types of hazardous areas (flammable gasses – zone 0, zone 1, and zone 2; combustible dusts zone 20, zone 21 and zone 22)
  (ii)) When zoning of an area is required (that is, when a "general" area becomes a hazardous area)

(d) Understanding the general requirements of AS/NZS 2381.1 in relation to the:

  (i) Maintenance of wiring and fittings
  (ii) The installation of wiring.

H5a.37 Emergency systems **Level A**

Understand and apply the requirements of AS/NZS 3000 in relation to emergency systems, fire control systems and lifts.

H5b.37 Construction sites **Level A**

Understand and apply the requirements of AS/NZS 3000 and AS/NZS 3012 in relation to construction and demolition sites.

H5c.37 Medical electrical areas **Level A**

1. Understand the differences between the installation and use of RCDs and isolation transformers for electro-medical installations

2. Understand and apply the requirements of AS/NZS 3000, AS/NZS 2500, AS/NZS 3003 and NZS 3003.1 relating to medical-electrical areas to the extent of understanding:

   (a) When specific personal competencies are required to work in such areas

   (b) The types of patient care areas

   (c) When zoning of an area is required (that is, when a "general" area becomes a patient care area)

   (d) The general requirements for maintenance of wiring and fittings

   (e) The general requirements for the installation of wiring.

H5d.37 Shows and Carnivals **Level A**

Understand and apply the requirements of AS/NZS 3000 and AS/NZS 3002 in relation to shows and carnivals.

H5e.37 Caravan parks - caravans **Level A**

Understand and apply the requirements of the Regulations, AS/NZS 3000 and AS/NZS 3001 in relation to caravan parks and caravan areas.

H5f.37 Marinas - Pleasure vessels **Level A**

Understand and apply the requirements of the Regulations, AS/NZS 3000 and AS/NZS 3004 in relation to marinas and pleasure vessels.

H6.43 Selection of fittings and Appliances **Level C 1-4**
Level A 5

1. Understand that all low voltage electrical appliances and fittings must comply with AS/NZS 3820

2. Understand that a low voltage electrical appliance or fitting complies with AS/NZS 3820 if it has been tested and verified to a Standard listed in AS/NZS 4417 by a testing laboratory listed in AS/NZS 4417

3. Understand that certain electrical appliances and fittings must have the express approval of the Secretary, prior to being offered for sale

4. Understand that documentation and requirements for specialised appliances and fittings (electro-medical, hazardous areas etc.) are listed in other Standards (e.g., AS/NZS 3551; AS/NZS 2381.1).

5. Apply the requirements of the Regulations, AS/NZS 3000, AS/NZS 3760 and ECP 54 in relation to the selection, installation and mechanical and electrical protection of fittings and electrical appliances.

H10.66 Fault diagnosis **Level A**

Reversed polarity in mains

(a) Understand and appreciate the dangers associated with reversed polarity and the test methods employed to establish the correct polarity

(b) Understand the dangers of reversal of polarity and the reasons why (generally) protection will not operate when a transposition in the mains occurs

(c) Describe how to carry out testing to determine whether a polarity transposition has occurred including:

- Methodology
- Instruments and equipment used
- Expected results if a transposition has occurred.
- Expected results if a transposition has not occurred.

I. Switchboards

I.32 Switchboards **Level A**

1. Understand and apply the requirements of AS/NZS 3000 for main switchboards, MEN switchboards and other switchboards.

2. Explain with reference to AS/NZS 3000 and the relevant Standards the siting requirements for switchboards considering:

   (a) Location

   (b) Access to the wiring and switchgear

   (c) Protection against the spread of fire

   (d) Environment and mechanical conditions

   (e) Power distributors requirements (use correct terminology)

   (f) Prospective short circuit currents.

J. Damp and Wet Areas

I.32 Switchboards **Level A**

Understand and apply the requirements of AS/NZS 3000 and AS 60529 in relation to damp and wet areas.

K. Testing, Certification and Inspection

K1.34 Testing - Construction Sites — Level B

Understand and apply the requirements of the Regulations, AS/NZS 3012 and AS/NZS 3760 in relation to construction and demolition sites.

K2.38 Statutory testing and inspection requirements — Level A

1. General requirements for testing and inspection of electrical installations

   (a) Understand and apply the requirements of section 114 of the Act which requires testing, certification and inspection to be carried out before that work is connected to a power supply.

   (b) Be fully conversant with types of electrical work requiring inspection under Regulation 41 and have a sound knowledge of the relevant Standards and Codes that cover the work.

   (c) Understand that wiring installation work detailed in regulation 41 must be inspected by an Inspector or those authorised under an employer licence.

   (d) Understand and apply the requirements of regulations 43A, 44 and 45 regarding the connection to the electricity supply of work requiring inspection, certification or verification

   (e) Understand that the prescribed electrical work on low voltage electrical installations detailed in regulation 39 must be tested, certified and inspected in accordance with NZS 3019.

   (f) Understand the testing and inspection requirements of Regulations 37 to 45 as they relate to:

   - Electrical Service Technicians
   - Electrical Inspectors
   - Electricians
   - Line Mechanics
   - Qualified Engineers
   - Provisional licence holders
   - Persons authorised under an employer licence.

   (g) Understand that a person cannot test or inspect work unless they are competent to inspect or do that work and their refresher courses are up-to-date [regulations 25 and 26].

   (h) Understand that a person cannot test or inspect work for payment and reward unless they hold a practising licence [section 95].

2. Verification and testing of existing installations

   Understand and apply the requirements of NZS 3019 relating to the verification of disconnected and existing electrical installations.

3. Main switchboards and earthing systems

   (a) State the requirements for testing and inspecting main switchboards and main earthing systems required by NZS 3019.

   (b) Describe the testing required and any minimum or maximum values that apply including insulation resistance, earthing and bonding, polarity, earth loop impedance, RCDs as required by AS/NZS 3000.

   (c) Describe the specific tests that must be carried out by the installing Electrician.

4. RCDs

   (a) Know the maximum tripping current and operating times as detailed in NZS 3019 or AS/NZS 3760.

   (b) Understand the testing and verification requirements as detailed in NZS 3019 or AS/NZS 3760.

   (c) Test a new RCD to ensure it meets the requirements of AS/NZS 3000.

   (d) Test an existing RCD to ensure it meets the requirements of NZS 3019 or AS/NZS 3760.

5. Electrical appliances

   (a) Understand that maintenance, repair, testing and periodic inspections of electrical appliances are covered by regulations 38, 46, 68, 69 and 76.

   (b) Understand that an in-service electrical appliance or fitting that is tested, inspected and tagged in accordance with AS/NZS 3760 complies with regulation 69(1)

   (c) Understand that an electrical appliance being hired out or leased complies with regulation 69(1) if it has been tested in accordance with AS/NZS 3760 and passed those tests before being hired or leased.

   (d) Understand that a used electrical appliance being sold complies with regulation 69(1) if, before sale, it has been

      - Tested in accordance with AS/NZS 3760 and has been tagged accordingly; or
      - Disabled and marked in accordance with AS/NZS 4701

6. Homeowners electrical work

   (a) Understand the requirements of the Act, Regulation 47 and ECP 50 and 51 for work carried out by a homeowner.

   (b) Differentiate between the testing that a homeowner is permitted to carry out under ECP 50 and 51 and the checking by an Electrical Inspector of the appliance repairs or electrical installation wiring work carried out by the homeowner.

   (c) Understand that it is an offence for homeowners to connect defective or non-compliant work to the supply.

   (d) Understand that the homeowner must verify that wiring installation work complies with Regulation 47 and ECP 51.

   (e) Understand and apply the requirements of NZS 3019 for inspecting homeowner's wiring installation work.

7. Periodic safety checks of installations and appliances

   (a) Understand and apply the requirements of regulation 46 covering safety checks for specific types of electrical installations including:

   - High voltage electrical installations
   - Carnivals or fair grounds,
   - Animal stunning and meat conditioning electrical appliances
   - Medical-electrical installations
   - Medical-electrical appliances
   - Hazardous areas
   - Caravan parks and boat marinas
   - Construction and demolition sites

   (b) Understand that safety checks can only be carried out by an Inspector, a person authorised under an employer licence to carry out the periodic inspection or by a person complying with the relevant Standard as required by regulation 46.

   (c) Understand installation owner responsibilities regarding periodic inspections for certain types of electrical installations.

8. High voltage installations and appliances

   (a) List the requirements for inspecting and testing high voltage installation or appliances by an Electrical Inspector or by another registered person.

   (b) Describe the testing required and any minimum or maximum values that apply, including insulation resistance, earthing, protection operation (tripping times etc.)

(c) State the frequency of inspection required by Regulation 46 of high voltage installations and appliances.

(d) Understand the dangers associated with testing high voltage installations.

9. Electro-medical installations and appliances

(a) List the requirements for inspecting and testing electro-medical installations by an Electrical Inspector or by other registered persons including the commissioning requirements detailed in AS/NZS 3003.

(b) List the requirements for inspecting electro-medical appliances including the safety and performance testing requirements detailed in NZS 3003.1.

(c) State the frequency for inspection required by Regulation 46 of electro-medical installations and appliances.

(d) Describe the testing required and any minimum or maximum values that apply, including insulation resistance, earthing, RCD tripping times etc.

(e) Understand the dangers associated with testing electro-medical installations.

10. Hazardous areas, equipment and appliances

(a) State the frequency of inspection required by Regulation 46 of hazardous areas installations and appliances.

(b) Describe the testing and inspection by an Electrical Inspector or by other registered persons and any minimum or maximum values that apply, including insulation resistance, earthing etc.

(c) Understand the dangers associated with testing hazardous areas.

11. Animal stunning and meat conditioning installations and appliances

(a) List the requirements for testing and inspecting animal stunning and meat conditioning installation or appliances by an Electrical Inspector or by other registered persons in accordance with AS/NZS 6116.

(b) Describe the testing required and any minimum or maximum values that apply, including insulation resistance, earthing and bonding, tripping times etc in accordance with AS/NZS 6116.

(c) State the frequency for inspection required by Regulation 46 of animal stunning and meat conditioning appliances.

(d) Understand the dangers associated with testing animal stunning and meat conditioning appliances

12. Mains parallel generation control systems

    (a) State the requirements for inspecting and testing generation control systems by an Electrical Inspector or by other registered persons.

    (b) Describe the testing required and any minimum or maximum values that apply, including insulation resistance, earthing and bonding, tripping times

    (c) Understand the dangers associated with testing generator control system installations.

    (d) Understand the requirements of AS/NZS 3000 and AS 3010 relating to generation control systems.

13. Connectable installations, Caravan Parks and caravans; Marinas and pleasure vessels

    (a) Understand and apply the requirements of the Regulations relating to connectable installations.

    (b) Understand and apply the requirements of AS/NZS 3001 (caravans and caravan parks) and AS/NZS 3004 (boats and marinas)

    (c) Understand and apply the testing and inspection requirements for caravan parks and caravans and marinas and pleasure vessels detailed on AS/NZS 3000, AS/NZS 3001 and AS/NZS 3004.

    (d) Understand that it is an offence to permit the supply to installations which are non-compliant [regulations 51, 67 and 100].

K3.39 Certification, verification, WOEF **Level A**

1. Documentation

    (a) Understand the responsibility for keeping records of inspection work. [Regulation 39].

    (b) List and describe the documents and forms relating to inspection, certification, verification and periodic inspection [Regulations 39, 40, 41, 42, 43, 43A, 44, 46, 47 and 97].

    (c) Understand the importance of accurately completing all documentation associated with testing, certification, inspection and verification.

    (d) Demonstrate a clear understanding of the terminology used throughout the documents and forms.

    (e) Understand the process and requirements of the audit trail following an inspection.

2. Certificates of Compliance

   (a) Understand that only the prescribed Certificate of Compliance forms issued by the EWRB can be used to certify compliance.

   (b) Understand that Certificates of Compliance are uniquely numbered [Regulation 43] and can be used for the purpose of auditing registered persons work by the Board [Section 149].

3. Certifying Prescribed Electrical Work

   (a) Understand the range of prescribed electrical work that is required to be certified on a certificate of compliance [regulation 39].

   (b) Understand the certification requirements [regulations 39 to 41] as they relate to:

   - Electrical Inspectors
   - Electricians
   - Line Mechanics
   - Qualified Engineers
   - Provisional licence holders
   - Persons authorised under an employer licence.

   (c) Understand that certifying prescribed electrical work means that the work:

   - Is electrically safe and has been tested in accordance with the regulations
   - Has been done in accordance with the regulations. [regulations 37, 39 and 40].

   (d) Understand that the Certificate of Compliance must be:

   - Completed within one day of the work being completed or the termination of the contract for the work [regulation 39(5)]; and
   - One copy of the Certificate must be given to the person for whom the work was carried out within 20 days of the certificate being completed [regulation 40(2)]; and
   - One copy must be retained for three years or returned to the EWRB [regulation 40 (4)].

   (e) Understand that a person cannot certify work unless they are competent to do that work and their refresher courses are up-to-date [regulations 25 and 26].

   (f) Understand that a person cannot certify work for payment and reward unless they hold a practising licence [section 95].

4. Certification and Inspection

   (a) Understand the documentation completion process required for inspection of a registered persons work

   (b) Understand it is the responsibility of the person certifying the work to:

   - Complete the appropriate section of the certificate of compliance and
   - Provide the certificate that shows the tests carried out before an inspection can be undertaken [Regulations 41 and 42].

   (c) Understand that the Inspector who inspects and certifies prescribed electrical work is the person who gives the certificate of compliance to the owner or occupier of the fittings or premises.

   (d) Understand that an Inspector cannot certify work unless they are competent to inspect that work and their refresher courses are up-to-date [regulations 25 and 26].

   (e) Understand that an Inspector cannot inspect and certify work for payment and reward unless they hold a practising licence [section 95].

   (f) Understand that an Inspector cannot inspect and certify work:

   - They have personally carried out
   - They have supervised another person who carried out the work.
   - They have certified under Regulations 39

5. Periodic inspection of installations and appliances

   (a) Understand that the person carrying out the periodic inspection check must record the results on a form prescribed by the Secretary or, if the Standard contains a form, that form.

   (b) Understand that a copy of the form must be:

   - Given to the person requesting the periodic inspection; and
   - Retained for 3 years or sent to the Secretary.

6. Connectable installations, Caravan Parks and caravans; Marinas and pleasure vessels

   (a) Be fully conversant with regulation 97 and NZS 3019 regarding the issuing of certificates of compliance or warrants of electrical fitness for connectable installations.

   (b) Understand that warrants of electrical fitness are valid for a period of 4 years from the date of issue [regulation 97).

   (c) A warrant of electrical fitness must be issued on the forms prescribed by the Secretary.

(d) Be fully conversant with the responsibilities of marina and caravan park operators to ensure that connectable installations have either a current warrant of electrical fitness or a Certificate of Compliance not more than four years old - prior to supplying electricity to that installation [regulation 98(5)]

7. Verification of existing installations

(a) Be fully conversant with regulation 43A regarding the requirements for issuing a certificate of verification for an electrical installation that has been disconnected for 6 months or longer.

(b) Understand that a certification of verification issued for the purpose of regulation 43A can only be issued by an Inspector or by a person authorised to carry out the verification under an employer licence.

8. Homeowners work

Understand:

(a) That the Certificate of Compliance can be provided by the Electrical Inspector.

(b) The homeowner must verify that the work complies with the regulations [ECP 51].

(c) It is an offence to certify and connect any non-compliant work.

9. Defective work

Understand:

(a) That only compliant work can be issued with a certificate of compliance.

(b) Only work issued with a certificate of compliance can be connected to the supply source.

(c) A certificate of compliance must not, under any circumstances, be issued for defective work and such work must not be connected to the supply source.

(d) It is an offence to issue a certificate of compliance for non-compliant electrical work [regulation 51].

L. Safety, Safe Working Practices, Basic First Aid and CPR

L1.40/ 54 Isolation
Equipment and Personal safety **Level A**

1. Understand that inspections concentrate on fundamental safety aspects relating to personnel and property and electrical fittings.

2. Recognise situations which pose a danger, exposure to electric shock, fire and the damage to safety devices in electrical equipment.

3. Understand the benefits of working on isolated equipment including for the purposes of testing for compliance.

4. State the importance of using the "DANGER TAG" system to promote safety in the work place.

5. Understand and apply the various methods employed for the isolation of equipment including:

   (a) Test to prove isolation and the use of "DANGER TAGS"
   (b) How to test to prove isolation.

L2.53 Statutory safety requirements **Level A**
H&S, Supervision

1. Supervision

   (a) Understand the requirements of the Act and Regulations in relation to the supervision of trainees and non-competent persons

   (b) Understand and apply the guidelines for the supervision of trainees as issued by the EWRB.

2. Competency requirements and refresher training

   (a) Explain how employers can take practical steps to ensure that any employee of that employer who is carrying out or assisting to carry out any work is competent to do that work [regulation 25].

   (b) List the safety tuition requirements for electrical workers [regulation 26].

   (c) List the interval requirements for classes of registration [regulation 26].

3. HSE Act

   (a) Be aware of the Health and Safety in Employment Act and how this Act may affect working conditions and safety issues.

   (b) Legislative Requirements

   Be informed and conversant with the responsibilities of the contractor to provide and maintain equipment in a safe condition.

   (c) Regular Testing of Equipment

   Understand the relevance of the Health and Safety in Employment Act 1992 to this subject.

L3.55 Hazard assessment **Level A**

1. Recognise the dangers associated with using inferior or makeshift equipment. Have a sound knowledge of the reporting procedures for the consumer and contractors involving electrical accidents.

2. Stress the dangers/hazards involved when working on High/Extra High Voltage Equipment.

3. Stress the dangers of using metal ladders around electrical equipment and supplies.

L4.56 Safe use of equipment **Level A**

1. Understand that regulation 35 require employers to:

   (a) Provide safe work procedures.

   (b) Ensure appropriate associated equipment and personal protective equipment is available.

   (c) Ensure that employees:

   - Have adequate knowledge and experience
   - Have been adequately trained in the use of associated equipment and personal protective equipment.
   - Check all equipment before using it.
   - Use the equipment.

2. Understand the need to practise and use the correct safety equipment and under no circumstances compromise on financial grounds (lead by example).

3. Be fully aware of the reasons for bonding to reduce the exposure and risk of electric shock, explosion hazard, danger to life and to remove undesirable potentials to earth which could cause a dangerous situation.

4. Be fully conversant with the requirements for RCDs and isolating transformers used for supplying handheld appliances for various conditions [regulation 77].

L5.57/58 CPR and basic first aid **Level A**

Note: These aspects are covered elsewhere within the training system such as in on-job training or practical assessments or refresher courses. Assessment will occur in those areas and not in the examination.

O. Lighting

O.65 Lighting **Level A**

Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to lighting.

P. Legislation

P1.13 Legislation **Level A 1-6**
Fundamental principles **Level B.....7**
Level C..... 8

1. Ethics

   (a) State three specific examples where Inspectors have an obligation to report dangerous or hazardous work which presents an immediate danger to life or property and shall as soon as practicable advise the owner occupier and the Secretary of that danger [regulation 50].

   (b) Be aware that it is an offence to certify non-compliant work or work which has not been inspected [regulation 51].

   (c) Understand that it is a requirement to ensure that persons working in the industry work within their own limitations and levels of competence.

2. Auditing

   (a) Understand that the EWRB operates an audit system to ensure the competency of registered persons actively engaged in electrical work and in addition to ensure compliance with the regulations [Section 149 (d)].

   (b) Understand the recording procedures laid down by the Secretary and must comply with the audit system requirements; i.e.

   - Who did the work and when?
   - Who certified the work and when?
   - Who inspected the work and when? [Section 101-105 and regulation 59]

   (c) Appreciate that Inspectors are subject to audit [Part XI of the Act].

3. Access to Properties

   Understand the limits and powers in respect to access to properties for the purposes of inspection. The rights of entry in respect of existing works and power of entry [sections 23 and 115].

4. Electricity Act

   (a) Understand and demonstrate a thorough knowledge of the requirements detailed in the Electricity Act 1992 and the Electricity Regulations 1997 pertaining to safety issues.

   (b) Be able to locate correct statements and numerical values in the Act.

(c) Have a detailed knowledge of the following sections of the Act:

2	Interpretations
5	Function of the Secretary
6	Inspection of works etc.
7	Report to be compiled
13	Secretary may require etc.
16	Accidents
17	Interference with scene of accident
18	Inquiries into accidents
19	Assistance to Secretary
20	Obstructing Secretary
36	Issue of Electrical Code
64	Definition of Domestic Premises
77	Qualifications for Electrical Inspector
86	Limits of work
95	Practising Licence
101	Employer Licence
108	Restrictions on electrical work
109	Exemption under Supervision
110	Exemption for domestic work
114	Testing
116	Power to require information
148	Electrical Workers Registration Board
149	Functions
154	Complaints Assessment Committees

5. Electricity Regulations

(a) List the objectives and reasons for the regulations.

(b) Demonstrate a thorough knowledge of each part of the regulations.

6. Dangerous work

Understand that work dangerous to life or property shall as soon as practical be reported to the owner or occupier and the Secretary [regulation 50].

7. Employer Licences

(a) Understand the requirements of Section 101-105 of the Electricity Act 1992.

(b) Understand that the Secretary may impose restrictions or limits or any conditions as the Secretary thinks fit pertaining to the issue of an employer Licence [regulation 16].

8. Disputes on technical matters

Understand that the Secretary may from time to time appoint arbitrators for the purpose of providing opinions on disputes over whether or not the technical requirements or Part III or Part IV of the regulations have been complied with [regulation 99].

P2.13 Legislation **Level A**
Registration

1. Understand that the EWRB can limit the registration of an Inspector [section 86]

2. Understand that safety must not be compromised under any circumstances or conditions and especially not as a result of employer/financial pressures.

3. Understand the registration categories for electrical workers and any limits imposed on these categories.

P3.13 Legislation **Level A**
Practising licences

Understand the requirements for all registered electrical workers to have a current practising license if working for reward including inspection, installation and maintenance [section 95].

P4.13 Legislation **Level A 1-10**
Discipline **Level B 11 & 12**
Level C 13 & 14

1. Understand that Inspectors are subject to EWRB discipline for non-compliant work [Part XI of the Act].

2. Understand that it is the responsibility of the EWRB to deal with disciplinary matters and can require information to be provided [section 116]

3. Understand that the CAC/EWRB disciplinary system only handles complaints about persons listed in section 117 (registered electrical workers; holders of a provisional licence; qualified engineers; tradespersons; trainees; persons who are already working under a type of restriction because of discipline)

4. Understand that any person wishing to lay a complaint against a person listed in section 117, the person must:

   - Make the complaint in writing to the Registrar, EWRB.
   - Must complain about the conduct of the person. [section 119]

5. Understand that the Registrar of the EWRB on receiving a written complaint shall forthwith inform the Secretary, who shall refer the complaint to the Complaints Assessment Committee [section 119].

6. Understand that a Complaints Assessment Committee is required to investigate a complaint and recommend whether or not the EWRB should hold a disciplinary hearing [section 121 and 123].

7. Understand that if a Committee recommends that the EWRB hold a disciplinary hearing, the EWRB must hold a hearing; and that this is the only process by which the EWRB can hold a hearing.

8. Understand that if a Committee recommends that the EWRB not hold a disciplinary hearing, the matter is completed.

9. Understand that the EWRB can only find a person guilty of a disciplinary offence as defined is section 118.

10. Understand that if the EWRB, after holding a hearing in accordance with the Act, are satisfied that a person is guilty of a disciplinary offence, the EWRB may:

    - Impose discipline that can include cancellation of registration, suspension of registration; limitation of a registration, retraining; fine or censure;
    - Not impose any penalty.
    - May order costs to be paid. [section 127]

11. Fully understand the disciplinary actions which can be taken against those found guilty of a disciplinary offence, including:

    - The penalties applicable.
    - Cancelling or suspending a registration by the EWRB.
      Part XI of the Act.

12. Understand that a person can appeal the EWRB's decision at a disciplinary hearing in the District Court. [sections 140 and 141].

13. Be aware of the procedures used by Complaints Assessment Committees

14. Be aware of the procedures used by the EWRB in conducting disciplinary hearings.

P5.13 <u>Legislation</u> **Level A 1**
Accidents **Level B 2**

1. Reporting

   Understand

   (a) Sections 16, 17 and 18 of the Act which cover the reporting of electrical accidents in writing to the Secretary which involve electric shock and electrically initiated fires.

   (b) Regulation 106 covers the details to be provided in reporting accidents and the methods of reporting such accidents to the Secretary.

2. Inquiries into Accidents

   Understand that, under the Electricity Act 1992, the Secretary may conduct an inquiry into any accident, to establish the cause [section 18].

7. Practical Assessment

7.1 General

1. 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 for others who may later depend on the standard of their workmanship.

2. During the course of practical instruction; stress the importance of understanding how the practical exercises relate to on-job situations.

3. Each student shall demonstrate an acceptable level of skill and competence in the practical skills listed on the EWRB Practical Assessment Work Record Form.

4. Each student shall demonstrate a sound knowledge of NZS 3019 and other relevant Standard applicable to the inspection requirements for specific installations.

5. Some situations require more than one Standard or Code. Where NZS 3019 does not cover all the requirements relating to inspection, the use of specific Standards will also be required.

6. The work requiring inspection under regulation 41 is covered by skills 11 to 16 inclusive.

7.2 Skills

H. Circuit and Cable Installation and Protection

H1c.31 **Protection and Control** **Level A**
Selection of control and protection equipment

Skill 9
Selection and installation requirements for residual current devices

(a) Understand and apply the principles relating to protection for safety in AS/NZS 3000 and the role RCDs can play in protection for safety.

(b) Apply the requirements of:

- The regulations and AS/NZS 3000 regarding the installation of RCDs in domestic and residential premises.

- The regulations regarding the use of RCDs with hand-held electrical appliances.

(c) Test an RCD to ensure it meets the requirements of NZS 3019.

(d) Apply the requirements for RCDs in body-protected electrical areas and cardiac-protected electrical areas in electro-medical locations [AS/NZS 3003]

(e) Test RCDs in accordance with the requirements of AS/NZS 3003

Skill 10
Selection and installation requirements for isolating transformers

(a) Understand and apply the principles relating to protection for safety in AS/NZS 3000 and the role isolating transformers can play in protection for safety

(b) Apply the requirements of the regulations regarding the use of isolating transformers with hand-held electrical appliances.

(c) Test an isolating transformer to ensure it meets the requirements of NZS 3019.

(d) Apply the requirements for isolating transformers in body-protected electrical areas and cardiac-protected electrical areas in electro-medical locations [AS/NZS 3003]

(e) Test isolating transformers in accordance with the requirements of AS/NZS 3003

H9.62 Commission and decommission equipment and appliances **Level A**

Metering methods and equipment

Understand:

(a) The connection methods and the various tariff metering configurations used for energy consumption recording.

(b) The typical metering methods for single phase two phase and three phase installations.

(c) Ripple relay and other load tariff switching methods.

(d) The importance of the correct connections methods when using current transformers test blocks for metering.

K. Testing, Certification and Inspection

K2.38 Statutory testing and inspection requirements **Level A**

Skill 11
Inspection of high voltage installations

Understand and explain the requirements for inspecting high voltage installations in accordance with AS/NZS 3000 and NZECP 35.

Skill 12
Inspection of hazardous areas

(a) Understand and explain the competency requirements in AS/NZS 2381.1 for carrying out inspections in hazardous areas and the need for refresher training of personnel on a regular basis.

(b) Understand and describe the wiring systems permitted in hazardous areas in accordance with AS/NZS 2381.1.

(c) Understand and describe the wiring systems that are not permitted in or above hazardous locations/areas including:

- Systems where there is a possibility of:
  - Exposed conductors;
  - Propagating an explosion
  - "Piping" flammable material to other areas
- Systems that include:
  - Bare conductors
  - Open wiring
  - Earth sheath return (ESR) wiring systems
  - Cable trunking
  - Busways
  - Aerial wiring systems
  - Low and extra-low voltage track systems

Skill 13
Inspection of new mains, new mains switchboards and new earthing systems and earthing leads of main switchboards

Demonstrate the ability to carry out the prescribed tests to ensure that the items requiring inspection meet the requirements of the regulations, AS/NZS 3000, NZS 3019 and other relevant Standards and Codes, including the skills listed in skills 2 - 6.

Skill 14
Inspection of mains-parallel generating control equipment

Demonstrate the ability to inspect mains-parallel generation control equipment for compliance. In accordance with AS/NZS 3000 including:

- The tests required by NZS 3019.
- The requirements of AS/NZS 3008.1.2 covering cable ratings.

Skill 15
Inspection of patient care areas and medical electrical appliances in electro-medical locations

Demonstrate the ability to inspect patient care areas and medical electrical appliances in accordance with AS/NZS 3003 and NZS 3003.1.

Skill 16
Inspection of electrical animal stunning and electrical meat conditioning fittings

- Demonstrate an understanding of the principles involved for the above equipment. Understand which code covers the installation and operation of such equipment.

- Demonstrate the ability to inspect electrical animal stunning and electrical meat conditioning fittings based on fundamental safety principles set out in AS/NZS 3000 and AS/NZS 6116 to ensure the safety of personnel and property.

K3.39 Certification, verification, WOEF **Level A**

Skill 8
The completion of test results and compliance documentation

Demonstrate competence to fulfil the tests and complete the documentation associated with the compliance requirements, including:

- self certification
- inspection testing
- issue of warrants of electrical fitness
- issue certificates of verification
- forms for periodic inspection [regulation 46]

K4.46 Testing and inspection methods **Level A**

Skill 1
(a) Use and care of Test instruments

(i) Have a good working knowledge of the types and use of the following:

- Insulation resistance testers.
- Earth loop impedance testers
- Phase rotation meter/testers
- Earth continuity/resistance testers
- Voltage testers

(ii) Understand the importance of the correct care and maintenance of test instruments to preserve their accuracy and reliability. Lives may depend on the correct operation of test instruments.

(iii) Calibration

- Be aware of the correct calibration methods for each of the above meters/test instruments.
- Understand that the accuracy of readings is dependant upon the correct calibration of the test instrument.

Skill 1
(b) Selection and use of Test Instruments

(i) Demonstrate a clear ability to select the correct test instrument to perform a specific test.

(ii) Select the correct function and setting to perform a stated test on meters which have multiple functions.

(iii) Demonstrate correct connection methods and:

- Decipher what value the instrument is indicating under test conditions
- Determine whether the circuit under test complies with the minimum/maximum values that apply.

(iv) Demonstrate a clear awareness and understanding of the dangers involved when using test instruments in an energised state in high prospective short current situations.

(v) Observe precautions during tests to ensure other persons are not exposed to or subject to electric shock from the test equipment connected to the installation.

(vi) Apply the precautions and measures necessary to prevent damage to test instruments and the general rules for the maintenance and care of test instruments.

Skill 2
Visual testing and checking

(a) Demonstrate the ability to apply the requirements of NZS 3019 relating to low voltage electrical installations including:

(i) Demonstrating an orderly and logical approach to the testing of a situation/installation.

(ii) Applying a mechanical check and a sight check of an area that covers all aspects for compliance certification including:

- ratings
- insulation classes
- environmental suitability
- protection afforded
- appropriateness of the protection
- certification of compliance - for appliances and equipment
- access to live parts and basic insulation is not possible
- adequate distances between live conductors and fittings and between live conductors and earth (such as overhead lines and busbars)

(iii) Demonstrating techniques for dealing with any fittings forming part of the installation which may be damaged by test voltages.

(b) Apply the requirements of regulation 98 relating to the supply of electricity to connectable installations (relocatable premises); including:

- AS/NZS 3001 as regards caravan park areas.
- AS/NZS 3004 as regards boat marinas.
- Socket outlets for supply at standard low voltage to a connectable installation.
- The ratings of protective fittings for socket outlets.
- The supplying of electricity to connectable installations.

(c) Demonstrate the ability to carry out the specific checks required AS/NZS 3000 and NZS 3019 in respect to new caravan park areas or boat marinas or caravan park areas or boat marinas where alterations or additions have been carried out.

(d) Demonstrate the ability to carry out the specific checks required in AS/NZS 3000 and NZS 3019 for the verification of caravan park areas or boat marinas

(e) Apply the requirements of regulation 97 for connectable installations (relocatable premises) in regard to caravans; pleasure vessels; relocatable buildings and the like including:

- AS/NZS 3001 as regards caravans.
- AS/NZS 3004 as regards pleasure vessels.
- The requirements for the issue or re-issue of a warrant of electrical fitness or a certificate of compliance.
- Hiring or leasing connectable installations.

(f) Demonstrate the ability to carry out the specific checks required in NZS 3019 in respect to new caravans; pleasure vessels or other connectable installations for the issue of a warrant of electrical fitness.

(g) (i) Demonstrate the ability to carry out the specific checks required in NZS 3019 in respect to existing caravans; pleasure vessels or other connectable installations for the issue of an warrant of electrical fitness

(ii) Apply those checks in relation to the requirements under which the connectable installation was wired.

Skill 3
Testing for polarity

(a) Demonstrate the ability to carry out polarity testing and inspections in low voltage installations (including caravan park areas and marinas); caravans and pleasure vessels in accordance with AS/NZS 3000 and NZS 3019.

(b) Demonstrate the initial procedure for testing polarity of an installation.

(c) Demonstrate the ability to test and verify that phases, neutral and earths are connected to the correct terminals and contacts including:

- That there is no transposition of conductors that could result in electrical equipment becoming unsafe when it is connected to supply; particularly where appliances are connected by socket outlet.
- That switches do not operate independently in the neutral or earthing conductor.

(d) Demonstrate the ability to establish that all three phase socket outlets within an installation will produce the same rotational sequence

Skill 4
Continuity of conductors

(a) Demonstrate the ability to carry out testing and inspection in low voltage installations (including caravan park areas and marinas); caravans and pleasure vessels to ensure the effective continuity of all conductors.

(b) Test and verify that the main earthing lead between the main switchboard and the earth electrode is continuous and of a low resistance.

(c) Test and verify between any point on the installation required to be earthed and the earth busbar is continuous and of a low resistance.

(d) Test and verify that all sockets outlets have effective continuity of all conductors (phase, neutral and earth) to the switchboard or appliance outlet.

(e) Test and verify that there is a link between the earth and neutral bars at the main switchboard in connectable installations that were wired to requirements that did not require the installation to be RCD protected.

(f) Test and verify all supply leads have effective continuity of all conductors (phase, neutral and earth) between plugs and sockets.

Skill 5
Insulation resistance testing

(a) Demonstrate the ability to carry out insulation resistance testing and inspection in low voltage installations (including caravan park areas and marinas); caravans and pleasure vessels in accordance with AS/NZS 3000 and NZS 3019.

(b) Understand why insulation resistance tests are necessary and demonstrate the ability to carry the tests out between parts of different polarity and between live parts and earth.

(c) Understand the tolerances required for insulation resistance testers.

(d) Understand the differing minimum outcomes required for installations when appliances are disconnected and when appliances are not disconnected.

Skill 6
Testing and checking earthing and bonding for compliance

(a) Earth continuity testing

(i) Demonstrate the ability to carry out earth continuity testing and inspection in low voltage installations in accordance with AS/NZS 3000; NZS 3019 and other special locations such as electro-medical situations.

(ii) Understand that earth continuity tests are carried out to ensure that:

- The main earthing conductor connection between the main switchboard and the earth electrode is continuous.
- The connection between any point on the installation required to be earthed and the switchboard earth bar is continuous.

(iii) Determine the minimum size of the main earthing conductor and protective earthing conductors in accordance with AS/NZS 3000.

(iv) Determine the items within an electrical installation that are required to be earthed in accordance with AS/NZS 3000

(v) Understand the differing minimum outcomes required for the resistance of the main earthing conductor and the resistance of protective earthing conductors

(b) Equipotential bonding

(i) Demonstrate the ability to carry out equipotential bonding testing and inspection in low voltage installations in accordance with AS/NZS 3000; NZS 3019 and other special locations such as electro-medical situations.

(ii) Understand that equipotential bonding tests shall be carried out to ensure that:

- The connection between any point on the installation required to be equipotentially bonded and the switchboard earth bar is continuous.
- The resistance of each connection does not exceed 0.5 ohm.

(iii) Determine the minimum size of equipotential bonding conductors for low voltage electrical installations in accordance with AS/NZS 3000.

(c) Swimming and spa pool zones

(i) Understand the requirements for bonding conductors located within swimming and spa pool zones and used for the equipotential bonding of electrical fittings or electrical appliances in accordance with AS/NZS 3000.

(ii) Determine the additional items within swimming and spa pool zones that are required to be equipotentially bonded in accordance with AS/NZS 3000.

(d) Caravan Park Areas

Understand the earthing requirements for each service pillar and switchboard providing site supply in accordance with AS/NZS 3000 and AS/NZS 3001

(e) Caravans

Understand and apply the earthing and bonding requirements of AS/NZS 3001

(f) Marinas

Understand the requirements for earthing and bonding in accordance with AS/NZS 3000 and AS/NZS 3004 including:

- Each circuit must have an earthing conductor or equipotential bonding conductor that is connected to each item of equipment.
- Metallic pipes and conduits are not used as an earthing conductor but are bonded to earth.
- Where the MEN systems of earthing is used, the method of earthing of switchboards (service pillars) detailed in AS/NZS 3000 for a separate MEN installation shall not be used.

(g) Pleasure vessels

Understand and apply the earthing and bonding requirements of AS/NZS 3004

(h) Electro-medical locations

(i) Understand and explain the difference between body-protected electrical areas and cardiac-protected electrical areas

(ii) Understand and apply the earthing requirements for body-protected electrical areas in accordance with AS/NZS 3003

(iii) Understand and apply the earthing requirements for cardiac-protected electrical in accordance with AS/NZS 3003

Skill 7
Testing of earthing systems for compliance

(a) Understand and explain the requirements of ECP 35 in relation to inspecting earthing systems for compliance including:

2.5.1 The earth impedance of an earthing system shall be determined by testing at the time of installation.

2.5.2 Inspections of earthing systems shall verify the connections from the earth grid to driven rods and the connections from earth grid to system neutrals.

2.5.3 Initial testing of an earthing system shall verify that the actual earth impedance is below its maximum safe calculated value.

2.5.4 When work has taken place that may have interfered with the earthing system, the system exposed by excavation shall be inspected for damage or deterioration

2.5.5 Where there is any probability of significant corrosion of the buried earth grid or of connections to it, more frequent inspections of the earth grid and connections shall be carried out and replacements made where necessary

(b) Understand and explain the requirements of ECP 41 in relation to earthing arrangements including:

2.2.1 Isolating and step-down transformer windings connected to single wire earth-return circuits shall be fully insulated from their tanks.

2.2.1.1 The connection with earth shall be made externally by means of duplicate conductors of stranded copper each having a cross-sectional area of not less than 16 mm².

2.2.1.2 The duplicate conductors shall be installed unbroken and without joint, using different routes, and shall have separate and independent attachment to the earth electrode.

2.2.1.3 The earth-connection shall be of resistance not greater than 5 ohms to earth and shall be so installed as to prevent danger from voltage gradients at ground level. Step and touch potentials shall be in accordance with the New Zealand Electrical Code of Practice for Power Systems Earthing 1993 (ECP 35:1993).

2.2.2 The earth electrode may be used for other earthing and bonding connections. Any such connections may be either by a direct connection to the earth electrode or by a connection to the earthing conductor.

(c) Understand and explain the requirements of ECP 41 in relation to Separation from other services and plant including:

2.5.1 The minimum separation between any conductor of an earth-return circuit and any open wire overhead communication line shall be 80 metres, except at crossings.

2.5.2 No earth-return circuit conductor shall be erected parallel to any open wire overhead communication line so that the normal induced longitudinal voltage in the communication line exceeds 2 volts rms.

2.5.3 The minimum separation between any conductor of an earth-return circuit parallel with any open wire communication circuit shall be in accordance with Table 1

L. Safety, Safe Working Practices, Basic First Aid and CPR

L1.40/ 54 Isolation Equipment and Personal safety **Level A**

Skill 17
Safe Working Practices

Demonstrate safe working practices/procedures during the practical assessment programme.

L5.57/58 CPR and basic first aid **Level A**

Instruction can only be delivered by First Aid Instructors holding current instructors certification. The instruction should cover techniques for performing emergency first aid procedures on victims by those persons that are first on the scene.