



ELECTRICAL WORKERS REGISTRATION BOARD

**PRESCRIPTIONS FOR ELECTRICIAN LEVEL
THEORY AND REGULATIONS EXAMINATIONS**

AND

**TEACHING GUIDELINES FOR ELECTRICIAN LEVEL
PRACTICAL ASSESSMENTS**

Issued by:
John Sickels
Registrar
11 August 2006

Forward

In 2000 the Board accepted the Australian and New Zealand Electrical Advisory Council (ERAC) developed core capabilities as the fundamental requirements for electrician's registration.

Since the development and acceptance of the capabilities and the concept of capstone testing all of the requirements for electrician's registration have been integrated into the National Certificate in Electrical Engineering Electrician for Registration (level 4) [Ref: 1195] qualification.

As part of the Board's capstoning policy the critical capabilities, which form part of the core capabilities, have been integrated into specific unit standards and the measurement tool for passing those unit standards will be the passing of the Board's electrician level theoretical and "regulations" examinations.

In view of the above mentioned developments the subject material for the electrician level theoretical and "regulations" examinations will be based on the critical capabilities.

The practical aspects for electrician registration have been incorporated into the National Certificate in Electrical Engineering Electrician for Registration (level 4) [Ref: 1195] qualification as a consolidation of on and off job assessments.

In August 2005, to assist examination candidates and training providers with information on the subject material which will be applicable for electrician level theoretical and "regulations" examinations the Board produced revised draft teaching guidelines for comment. Submissions from two calls for comments on the teaching guidelines have been considered and the guidelines have been amended.

As stated above the subject material for the electrician level theoretical and "regulations" examinations is now based on the critical capabilities and it is envisaged that the change will benefit candidates as the examinations will be based on material candidates should be being trained on through competency based training programmes.

The assistance of those many people from industry who provided much valued comment on this document is acknowledged as is the support received from the Electrotechnology Industry Training Organisation whose work ensured that the Trans Tasman training requirements for electricians was incorporated into the National

Certificate in Electrical Engineering Electrician for Registration (level 4)
[Ref: 1195] qualification. The support of the New Zealand Qualifications Authority is also
acknowledged.

A handwritten signature in black ink, appearing to read 'John Sickels', with a horizontal line underneath.

John Sickels
Registrar
11 August 2006

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1. Introduction

The Electricity Act 1992 requires the Electrical Workers Registration Board (the Board) to ensure the competency of all persons applying for electrical registration. As part of those competency requirements, sixty six (66) essential capabilities for electricians have been agreed between the Board and Australian Licensing Authorities. These capabilities:

- Cover the examination subject matter detailed in the Schedule 1 of the Electricity Regulations 1997.
- Are fully incorporated within the National Certificate in Electrical Engineering (Electrician for Registration) (Level 4).

To become registered as an electrician, an individual must satisfy the requirements set out in section 75 of the Electricity Act 1992; and regulation 4(1) and schedule 1 of the Electricity Regulations 1997.

These Electrician Examination Prescription and Teaching Guidelines are structured around the essential capabilities. They have been prepared to assist tutors in the development and delivery of courses for electricians and trainees who need to complete any or all of the following for registration as an electrician:

- Capstone testing. That is, pass the Electrician Theory Examination and/or the Electrician Regulations Examination.
- The Electrician Practical Assessment.

Tuition provided for Theory or Regulations or the Practical Assessment must cover **ALL** of the subject matter in the relevant part of this document.

While the prescriptions and guidelines aim to be as 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.

2. Scope

The Theory and Regulations Prescriptions are for capstone purposes and cover the 34 critical essential capabilities. They are consistent with the National Certificate unit standards 1702 (Demonstrate knowledge of, and apply electrical legislation, codes of practice, and standards) and 21766 (Demonstrate knowledge of theory for registration of electricians).

Therefore, a candidate who is undergoing tuition in accordance with these prescriptions should have received the full range of theory and regulations tuition that incorporate all 66 of the essential capabilities as part of the National Certificate requirements or under the old apprenticeship system or in an overseas jurisdiction.

The Practical Assessment Guidelines cover the requirements of part 2(c) of the Electricity Regulations 1997. Such assessments apply to those who did not complete them under the

old apprenticeship system or for those trained in overseas jurisdictions (where required by the Board).

NOTE: THE SUBJECT MATTER IN THE PRESCRIPTION AND THE GUIDELINES REFLECT WHAT A STUDENT (OR CANDIDATE) IS REQUIRED TO ACHIEVE FROM THE TUITION PROVIDED.

3. Examinations

All possible steps have been made to achieve a clear distinction between Theory and Regulations Prescriptions in this document. However, in some instances this has not been possible because it is obvious that some theory subject matter is derived from a Regulation or Standard.

1. The Electrician Theory Examination will cover any of the aspects in the Theory Prescription. It may also include some aspects from the Regulations Prescription where it is considered that the information should be known without reference to that Regulation or Standard.

For example, the 1 Mohm minimum insulation resistance for an electrical installation (a requirement from AS/NZS 3000) may be incorporated into a question relating to the insulation resistance testing of an electrical installation.

2. The Electrician Regulations Examination will cover any of the aspects in the Regulations Prescription. It may also include some aspects from the Theory Prescription that underpin the application of a Regulation or Standard.

For example, the procedure for carrying out an insulation resistance test on an electrical installation may be incorporated in a question relating to the insulation resistance test requirements of AS/NZS 3000.

4. Safety

At all times the safety aspect must be emphasised to students 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.

5. 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 any of the following: <ul style="list-style-type: none">• New Zealand Standard (NZS)• a joint Australian/New Zealand Standard (AS/NZS)• a British Standard (BS)• an International Electrotechnical Commission Standard (IEC)
Section	<ul style="list-style-type: none">• 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

6. Reference Texts

The applicable parts of following texts must be used when providing tuition in accordance with these Guidelines. Note that:

1. The most recent edition of the reference texts together with the latest amendments must be used.
2. For Standards and Codes, the most recent edition and the edition prior may have to be used. This may occur where a newer edition has been published after the one cited in regulations.
3. The reference texts cited ***include*** those which may be used by candidates in an examination. The texts that may be used in examinations will be notified by the Board from time to time.

Training providers may use any other material they consider relevant to the course they are providing.

6.1 Legislation

The Electricity Act 1992 reprint, dated 19 August 2005.

The Electricity Regulations 1997 reprint, dated 5 September 2005.

6.2 Standards

AS/NZS 2381.1	Electrical equipment for explosive atmospheres – Selection, installation, and maintenance – General requirements
AS/NZS 2500	Guide to the safe use of electricity inpatient 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 3551	Technical management programmes for medical devices
AS/NZS 3760	Inservice 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 4417.2	Marking of electrical products to indicate compliance with regulations. Part 2: Specific requirement for electrical safety regulatory applications
AS/NZS 60479-1	Effects of current in human beings and animals

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 60529	Degree of protection provided by enclosures for electrical equipment (IP Code)

6.3 Codes

NZCEP 34	New Zealand Electrical Code of Practice for Electrical Safe Distances
NZCEP 54	New Zealand Electrical Code of Practice for Electrical Installations of Recessed Luminaires and Auxiliary Equipment.

7. Electrician Theory Examination Prescription

It is expected that candidates will have a thorough knowledge of electrical theory that will underpin the knowledge required to understand the subject matter in this section.

7.1 A. Basic Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
A2.2	<u>Theory</u> Effects of current	1. Demonstrate knowledge of the effects of electricity on humans.	<u>21766</u> Element 1: 1.1
		Note: Understand: <ul style="list-style-type: none"> Why peak voltages are important in respect to electric shock and insulation resistance. The danger of being in contact with active (phase) and neutral or active (phase) and earth conductors simultaneously. 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. 	
		2 Demonstrate how energy is converted through heat, chemical, magnetic and mechanical processes	<u>21766</u> Element 1: 1.1
A5.5	<u>Theory</u> Simple circuits	- Understand the operation of a simple circuit including: <ul style="list-style-type: none"> Identification of components (emf source; conductors; control devices, protection devices; recording meters and load components). Describe and state the characteristics of series 	<u>21766</u> Element 1: 1.2

7.1 A. Basic Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
		and parallel circuits. <ul style="list-style-type: none"> Draw and label series and parallel circuit diagrams using commonly used components. 	

7.2 B. d.c. Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
B1.6	<u>d.c. Resistance, voltage, current and power</u>	- Measure and calculate resistance, current, voltage and power in a simple d.c. circuit.	<u>21766</u> Element 1: 1.3

7.3 C. a.c. Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
C2.11	<u>a.c. Measurements</u> V, A, P, pf	1. Demonstrate knowledge of alternating voltage & current generation, phase relationships, energy in an AC circuit, and actual measurement methods including: <ul style="list-style-type: none"> Understanding of and relationships between true power, reactive power and apparent power Understanding power factor, its economic effect and techniques for improving power factor 	<u>21766</u> Element 1: 1.5, 1.6, 1.7
		2. Calculate: <ul style="list-style-type: none"> Voltage current and power in single and three-phase circuits The energy usage and cost for a single-phase domestic residence 	<u>21766</u> Element 1: 1.4, 1.8
		Note: Three-phase calculations relate to star and delta resistive loads and line and phase voltage and currents.	

7.4 D System Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
D3.21	<u>System theory Earthing</u>	- 1. Understand how earth-fault loop impedances and prospective short circuit currents form part of the operation of an MEN system.	<u>21766</u> Element 6 6.3

7.4 D System Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
	installations fittings and appliances	2. Assess earth-fault loop impedances and prospective short circuit currents for a domestic installation.	
		3. Demonstrate, with the aid of fully labelled diagrams, understanding of switchboard circuitry including: <ul style="list-style-type: none"> ● MEN switchboards ● Main switchboards ● Switchboards ● Earthing arrangements ● Control devices ● Protective devices. 	<u>21766</u> Element 6 6.2
		Note: Understand: <ul style="list-style-type: none"> ● the earthing arrangements for installations and electrical appliances for protective and functional purposes. ● the earth fault loop in the NZ MEN system 	

7.4 D System Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
D4.22	<u>System theory - MEN systems</u>	1. Demonstrate, with the aid of fully labelled diagrams, an understanding of the operation of the New Zealand transmission system from power station to consumer including: <ul style="list-style-type: none"> • Active (phase), neutral, and earth conductors wherever used • Alternators, transformers, transmission lines • Typical voltages before and after transformation, • Connection details for single-phase, two-phase, and three-phase consumers. 	<u>21766</u> Element 3 3.1, 3.2, 3.3
		2. List the features of the Multiple Earth Neutral (MEN.) system used in New Zealand.	<u>21766</u> Element 3 3.1, 3.2, 3.3
		3. Demonstrate how the MEN system works including: <ul style="list-style-type: none"> • Why the neutral is multiple earthed. • The implication of a missing MEN link during fault conditions • In relation to voltage to earth, protective devices and the fault current path • The need for a neutral conductor in an unbalanced star connected loads. Graphical representation of resistive and reactive loads 	<u>21766</u> Element 3 3.1, 3.2, 3.3

7.5 E. Three-phase Motors, Generators and Starters			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
E2.16	<u>3ph-Motor/Alternators Selection, starting, protection</u>	1. Explain, with the aid of fully labelled diagrams, a comparison of the features of motor starters	<u>21776</u> Element 9 9.1
		2. Demonstrate an understanding of electronic starters through fully labelled block diagrams.	
		3. Demonstrate an understanding of direct-on-line, star-delta, auto-transformer, primary resistance, secondary resistance starters through fully labelled circuit diagrams.	
		Note: Includes where applicable: <ul style="list-style-type: none"> • stop/start stations, emergency stops • 230V or 400V control circuits and componentry 	

7.5 E. Three-phase Motors, Generators and Starters			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
		<p>4. Compare the characteristics of motor starters relating to starting current and torque, full load current and torque and cost. Types include:</p> <ul style="list-style-type: none"> ● Direct-on-line ● Star-delta ● Auto-transformer ● Primary resistance ● Secondary resistance ● Electronic 	<p><u>21776</u> Element 9 9.2</p>
		<p>Note: Includes where applicable:</p> <ul style="list-style-type: none"> ● practical applications ● comparison of advantages and disadvantages ● defining terms ● speed torque graphs ● effects of and techniques used in power factor correction 	
		<p>5. Describe the operation of protective features incorporated in electric motors and starters, including:</p> <ul style="list-style-type: none"> ● Over current ● No-volt, ● Phase failure ● Phase reversal ● Mechanical stress ● Temperature 	<p><u>21776</u> Element 9 9.3</p>
		<p>Note: Includes where applicable:</p> <ul style="list-style-type: none"> ● defining terms ● operation characteristics ● practical application 	
		<p>6. Select motors for given applications, including consideration of:</p> <ul style="list-style-type: none"> ● Single and Three-phase ● Load ● Torque ● Starting conditions ● Protection ● Environment. 	<p><u>21776</u> Element 9 9.4</p>
		<p>Note: Includes where applicable:</p> <ul style="list-style-type: none"> ● selection criteria for a given situation ● detailed selection criteria for single-phase and three-phase squirrel cage motors ● comparison of advantages and disadvantages 	

7.5 E. Three-phase Motors, Generators and Starters			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
		<ul style="list-style-type: none"> • general application for special types of motors, e.g., slip ring 	

7.6 F. Single-phase motors and starters			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
F1.19	<u>1ph-Motors</u> - Theory	1. Describe the operation of protective features incorporated in electric motors and starters, including: <ul style="list-style-type: none"> • Over current • No-volt, • Mechanical stress • Temperature 	<u>21776</u> Element 9 9.3
		2. Select motors for given applications, including consideration of: <ul style="list-style-type: none"> • Induction and universal motors • Load • Torque • Starting conditions • Protection • Environment. 	<u>21776</u> Element 9 9.4

7.7 G. Transformers			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
G2.24	<u>Transformers</u> <u>Operating principles</u>	Calculate transformer primary and secondary currents and voltages, turns and turns ratios, VA rating, and efficiency, for different winding configurations, including: <ul style="list-style-type: none"> • Single-phase • Star-star • Delta-delta • Star-delta • Delta-star. 	<u>21766</u> Element 8 8.3
G4.26	<u>Transformers</u> <u>Application and safety issues</u>	1. Describe typical applications and identify key safety issues for transformers, including: <ul style="list-style-type: none"> • Step-up and step-down of voltage and current • Safety isolation • Safety extra-low voltage source • Auto-transformers • Instrumentation (voltage and current transformers) 	<u>21766</u> Element 8 8.1

7.7 G. Transformers			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
		<ul style="list-style-type: none"> ● Reduced-voltage motor starters ● Variable-voltage supplies ● Welding equipment. 	
		2. Explain the reason for rating transformers in volt-amps rather than in Watts.	<u>21766</u> Element 8 8.2

7.8 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
H1a.27	<u>Protection and Control</u> Protection characteristics	1. Understand the meanings of circuit protection terms as used in accordance with industry practice, including: <ul style="list-style-type: none"> ● 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. 	<u>21766</u> Element 4 4.1
		2. Explain the merits of different utilisation categories in accordance with industry practice.	<u>21766</u> Element 4 4.2
		3. Understand how the aspects detailed in (1) above are applied in practice.	
H1b.28	<u>Protection and Control</u> RCD characteristics	Describe the properties of different types of RCDs including: <ul style="list-style-type: none"> ● RCCB, RCBO, SRCD, PRCD ● RCDs that function independent of line voltage ● RCDs that are functionally dependant on line or auxiliary voltage ● Residual current ratings for personal protection and property protection ● Correctly operating with pulsating d.c. component present ● Load leakage currents. 	<u>21766</u> Element 4 4.4
H1c.31	<u>Protection</u>	1. Describe, with the aid of fully labelled	<u>21766</u>

7.8 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
	<u>and Control</u> Selection of control and protection equipment	<p>diagrams, the construction, operating principles, and applications of protection devices, including:</p> <ul style="list-style-type: none"> ● Rewireable fuses (existing installations only) ● Cartridge fuses ● HRC fuses ● Fusible links ● MCBs ● Magnetic and thermal overload relays ● RCDs. 	Element 4 4.3
		2. Describe the procedures for testing and verifying the operation of RCDs to achieve the outcomes of the regulations and standards.	<u>21766</u> Element 4 4.5

7.8 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
H2.28	<u>ELV</u>	Understand the merits of using SELV and PELV systems for protection against direct and indirect contact are explained	<u>21766</u> Element 4 4.6
H3a.29	<u>Cables and Cords</u> Selection of mains and submains	1. Determine the maximum demand for a domestic or non-domestic mains and submains.	<u>21766</u> Element 5 5.1
H3b.30	<u>Cables and Cords</u> Selection of final subcircuits	2. Determine the cable type and size of mains and submains for given applications, including: <ul style="list-style-type: none"> • Cables types: <ul style="list-style-type: none"> - flexible (PVC, TPS, rubber-sheathed) - fixed wiring (TPS, conduit wire, neutral screened cable, XLPE, SWA) - underground - aerial • Consideration of: <ul style="list-style-type: none"> - conductor material - maximum conductor temperature - air and soil ambient temperatures (de-rating and re-rating factors) - mechanical protection - installation method - maximum demand - length of run - grouping - current carrying capacity - short circuit capability - voltage drop - earth loop impedance. 	<u>21766</u> Element 5 5.2
		3. Provide examples and explain how a cable is chosen for a stated application considering all of the above factors.	<u>21766</u> Element 5 5.2
H3f.44	<u>Cables and Cords</u> Termination of cables	Demonstrate techniques for installing a wide range of cables in a variety of situations including: <ul style="list-style-type: none"> • Cables types: <ul style="list-style-type: none"> - flexible (PVC, TPS, rubber-sheathed) - fixed wiring (TPS, conduit wire, neutral screened cable, XLPE, SWA) - underground - aerial • Consideration of: <ul style="list-style-type: none"> - conductor material 	<u>21766</u> Element 5 5.2
H3h.47	<u>Cables and Cords</u> Switchboard terminations		
H3i.48	<u>Cables and Cords</u>		

7.8 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
	Consumer main termination	<ul style="list-style-type: none"> - cable type - installation method - length of run - grouping 	

7.8 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
H7.51	<u>Read and interpret diagrams</u>	Draw, understand and interpret block, schematic and wiring (circuit) diagrams.	<u>21766</u> Element 1: 1.9
H9.62	<u>Commission and decommission equipment and appliances</u>	Describe, with the aid of fully labelled diagrams, procedures for the safe isolation of electrical equipment and systems, including: <ul style="list-style-type: none"> ● Sequential steps to achieve isolation and safe working environment ● Prove-test-prove ● Test before touch ● Switch lock-off ● Safety tag system ● Written isolation procedures. 	<u>21766</u> Element 2: 2.5
H10.66	<u>Fault diagnosis</u>	Describe, with the aid of fully labelled diagrams, procedures for the safe isolation of electrical equipment and systems, including: <ul style="list-style-type: none"> ● Sequential steps to achieve isolation and safe working environment ● Prove-test-prove ● Test before touch ● Switch lock-off ● Safety tag system ● Written isolation procedures. 	<u>21766</u> Element 2: 2.5

7.9 I. Switchboards			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
I.32	<u>Switchboards</u>	1. Understand and define the meanings of the terms switchboard, main switchboard, MEN switchboard, switchboard, and switchgear.	<u>21766</u> Element 6 6.1
		2. Explain, with the aid of fully labelled diagrams, switchboard circuitry, including: <ul style="list-style-type: none"> ● MEN switchboard ● Switchboards ● Main switchboard ● Earthing arrangements ● Control devices ● Protective devices. 	<u>21766</u> Element 6 6.2
		3. Select switchboard control and protective devices for given applications.	<u>21766</u> Element 6 6.4

7.10K. Testing, Certification and Inspection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
K2.38	<u>Statutory testing and inspection requirements</u>	Understand and explain the terms <i>testing and inspection</i> .	<u>21766</u> Element 7 7.1
K3.39	<u>Certification, verification, WOEf</u>	Understand and explain the terms <i>certification, inspection</i> and <i>verification</i> are explained.	<u>21766</u> Element 7 7.1
K4.46	<u>Testing and inspection methods</u>	1. Describe, with the aid of fully labelled diagrams, the checks and tests to be performed to ensure electrical installations are safe, including: <ul style="list-style-type: none"> ● Explaining methods of measurement ● Quoting minimum or maximum values. ● Visual tests ● Continuity of the earthing system ● Insulation resistance ● Polarity ● Correct circuit connections ● Operation of RCDs ● Earth fault-loop impedance. 	<u>21766</u> Element 7 7.2
		2. Describe, with the aid of fully labelled diagrams, the checks and tests to be performed to ensure electrical equipment and appliances are safe, including: <ul style="list-style-type: none"> ● Explaining methods of measurement ● Quoting minimum or maximum values. ● Visual tests ● Protective earthing conductor continuity ● Insulation resistance ● Polarity ● Correct connections ● Operation of RCDs 	<u>21766</u> Element 7 7.3

7.11L. Safety, Safe Working Practices, Basic First Aid and CPR			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
L1.40/54	<u>Isolation Equipment and Personal safety</u>	1. Describe electrical safe working practices in accordance with industry documents and practices.	<u>21766</u> Element 2 2.2
		2. Detail procedures for the safe isolation of electrical equipment and systems including: <ul style="list-style-type: none"> ● Sequential steps to achieve isolation and safe working environment ● Prove-test-prove ● Test before touch ● Switch lock-off ● Safety tag system ● Written isolation procedures. 	<u>21766</u> Element 2 2.5
L5.59	<u>System theory - HV, LV distribution systems</u>	Understand concepts relating to working safely in the vicinity of high voltage equipment and distribution systems, including: <ul style="list-style-type: none"> ● Step and touch voltages ● Induced voltages ● Creepage and clearance requirements ● Stored energy ● Earthing ● Safe working procedures. 	<u>21766</u> Element 2 2.3
L6.57/58	<u>CPR and basic first aid</u>	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.	

8. Electrician Regulations Examination Prescription

8.1 A. Basic. Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
A2.2	<u>Theory Effects of current</u>	1. Understand figures 14 and 15 of AS/NZS 60479-1 as they relate to residual current ratings for personal protection.	<u>21766</u> Element 1: 1.1 <u>1702</u>

8.2 D System Theory			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
D3.21	<u>System theory - Earthing of installations fittings and appliances</u>	1. Understand and apply the requirements of AS/NZS 3000 including: <ul style="list-style-type: none"> • The earthing of electrical installations and fittings for functional and protective earthing purposes • The role of MEN switchboards • Tailoring the protective devices to the earthing of an installation and circuits • The earth fault loop in the NZ MEN system • Calculating earth fault magnitudes in installations. 	<u>1702</u>
		2. Understand and apply the requirements of AS/NZS 3760 including: <ul style="list-style-type: none"> • The earthing of electrical appliances • Calculating earth fault magnitudes in appliances. 	<u>1702</u>
D4.22	<u>System theory - MEN systems</u>	Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to MEN systems	<u>1702</u>

8.3 E. Three-phase Motors, Generators and Starters			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
<u>E3.17</u>	<u>3ph-Motor/Alternators AS/NZS 3000 Requirements</u>	1. Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the installation, protection and control of motors. 2. Understand the typical requirements of a network company in relation to the installation, protection and control of motors.	<u>1702</u>

8.4 F. Single-phase motors and starters			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
F1.19	<u>1ph-Motors Theory</u>	Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the installation, protection and control of motors.	<u>1702</u>

8.5 G. Transformers			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
G4.26	<u>Transformers Application and safety issues</u>	Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the installation, protection and control of transformers.	<u>1702</u>

8.6 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
H1a.27	<u>Protection and Control Protection characteristics</u>	Understand and apply the general requirements of the Regulations and AS/NZS 3000 and NZS 3019 in relation to the protective devices	<u>1702</u>
H1b.28	<u>Protection and Control RCD characteristics</u>	Understand and apply the requirements of the Regulations, AS/NZS 3000 and NZS 3019 in relation to RCDs	<u>1702</u>
H1c.31	<u>Protection and Control Selection of control and protection equipment</u>	<ol style="list-style-type: none"> 1. Understand and apply the requirements of the Regulations, AS/NZS 3000 and NZS 3019 in relation to the selection and installation of protection and control equipment 2. Understand and apply the requirements of the Regulations, AS/NZS 3000 and NZS 3019 in relation to the selection and installation of RCDs. 	<u>1702</u>
H2.28	<u>ELV</u>	Understand the merits of using SELV and PELV systems for protection against direct and indirect contact in accordance with AS/NZS 3000:2000.	<u>1702</u>

8.6 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
H3a.29	<u>Cables and Cords</u> Selection of mains and submains	<ol style="list-style-type: none"> 1. Calculate the size of cable required in terms of volt drop and current loading for mains and submains under specified conditions, using the appropriate parts of the Regulations, AS/NZS 3000 and AS/NZS 3008.1.2 for a stated application. 2. Determine the maximum demand of domestic and non-domestic installations in accordance with AZ/NZS 3000 3. Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the environmental considerations, mechanical protection and electrical protection of mains and submains cables. 	<u>1702</u>
H3b.30	<u>Cables and Cords</u> Selection of final subcircuits	<ol style="list-style-type: none"> 1. Calculate the size of cable required in terms of volt drop and current loading for a final sub circuit under specified conditions, using the appropriate parts of the Regulations, AS/NZS 3000 and AS/NZS 3008.1.2 for a stated application. 2. Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the environmental considerations, mechanical protection and electrical protection of final subcircuit cables. 	<u>1702</u>
H3c.35	<u>Cables and Cords</u> 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	<u>1702</u>
H3f.44	<u>Cables and Cords</u> Termination of cables	Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the termination of cables in general	<u>1702</u>
H3h.47	<u>Cables and Cords</u> Switchboard terminations	Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the termination of cables in switchboards	<u>1702</u>
H3i.48	<u>Cables and Cords</u> Consumer main termination	<ol style="list-style-type: none"> 1. Understand and apply the requirements of the Regulations and AS/NZS 3000 in relation to the termination of cables at the electrical installation/distribution system interface. 2. Understand the typical requirements of a network company in relation to the termination of cables at the electrical 	<u>1702</u>

8.6 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
		installation/distribution system interface.	

8.6 H. Circuit and Cable Installation and Protection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
H4.36	<u>Hazardous areas</u>	<p>Understand and apply the requirements of the Regulations, AS/NZS 3000, AS/NZS 2381.1 and NZS 3003.1 relating to hazardous areas to the extent of understanding:</p> <p>(a) When specific personal competencies are required to work in such areas</p> <p>(b) The types of hazardous areas</p> <p>(c) When zoning of an area is required (that is, when a “general” area becomes a hazardous area</p> <p>(d) The general requirements for maintenance of wiring and fittings</p> <p>(e) The general requirement for installation of wiring.</p>	<u>1702</u>

8.7 I. Switchboards			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
I.32	<u>Switchboards</u>	1. Understand and define the terms ‘mains switchboard’, ‘switchboard’, and ‘switchgear’ refer to the regulations and AS/NZS 3000.	<u>1702</u>
		2. Understand and apply the requirements for main switchboards, MEN switchboards and switchboards as per AS/NZS 3000.	<u>1702</u>
		3. Explain with reference to AS/NZS 3000 and the relevant Codes of Practice the siting requirements for switchboards considering: <ul style="list-style-type: none"> (a) Location (b) Access to the wiring and switchgear (c) Protection against the spread of fire (d) Environment and mechanical conditions (e) Network operator requirements (use correct terminology) (f) Prospective short circuit currents. 	<u>1702</u>

8.8 J. Damp and Wet Areas			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
J.33	<u>Damp and wet areas</u>	Understand and apply the requirements of the Regulations, AS/NZS 3000 and AS 60529 in relation to damp and wet areas.	<u>1702</u>

8.9 K. Testing, Certification and Inspection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
K1.34	<u>Testing Construction Sites</u>	1. Understand and apply the requirements of the Regulations, AS/NZS 3012 and AS/NZS 3760 in relation to construction and demolition sites.	<u>1702</u>
		2. Testing of construction sites, including: <ul style="list-style-type: none"> (a) Explaining the specific tests that are required by AS/NZS 3000 and 3012 and state the types of test instruments required to perform those tests. (b) Describing the methods of carrying out the tests referred to in NZS 3019, stating the minimum and maximum values (where appropriate) that are acceptable. (c) Explaining the specific tagging and inspection requirements of AS/NZS 3760. (d) Explaining the testing and inspection requirements and testing methods required by AS/NZS 3760 in relation to portable electrical equipment. 	<u>1702</u>
K2.38	<u>Statutory testing and inspection requirements</u>	1. Testing and inspection – General <ul style="list-style-type: none"> (a) Understanding and defining the terms “testing” and “inspection”. (b) Listing the types of installation work which can only be inspected by a registered electrical inspector. (c) Listing the installations that are subject to periodic inspections by electrical inspectors. 	<u>1702</u>
		2. Testing of electrical installations <ul style="list-style-type: none"> (a) Describing the methods of carrying out the tests required by AS/NZS 3000 and stating the types of test instruments required to perform those tests. (b) Describing the methods of carrying out the tests referred to in NZS 3019, stating the minimum and maximum values (where appropriate) that are acceptable. (c) Explaining that specific installations have additional checks and test requirements prescribed and these are covered in other Standards. (d) Understanding the regulations relating to the installation work requiring inspection by a registered electrical inspector prior 	<u>21766</u> Element 7 7.4

8.9 K. Testing, Certification and Inspection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
		to connection to the power supply. (e) Understanding the regulations relating to all the tests for installation wiring work and compliance documentation are required to be completed prior to inspection.	
		3. Connection of electrical installations Understand and apply the requirements for the connection of installations including polarity and phase rotation, protection devices, safety of revenue meters and load control and verification of main earthing system	<u>21766</u> Element 7 7.4
K3.39	<u>Certification, verification, WOE</u>	1. Understand and define “certification”	<u>1702</u>
		2. List the types of installation work requiring testing and certification by a registered electrician.	<u>1702</u>
		3. Explain who is responsible for performing the prescribed tests associated with the completion of the compliance documentation involving: <ul style="list-style-type: none"> • self certification – work which does not require inspection • work requiring inspection – by a registered electrical inspector. 	<u>1702</u>
		4. Understand what certifying prescribed electrical work means including: <ul style="list-style-type: none"> • the work is electrically safe and has been tested in accordance with the regulations • The work has been done in accordance with the regulations. [regulations 37, 39 and 40]. 	<u>21766</u> Element 7 7.5
		5. Understand that the Certificate of Compliance must be: <ul style="list-style-type: none"> • 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 with 20 days of the certificate being completed [regulation 40(2)]; and • one copy must be retained for three years or returned to the EWRB 	<u>1702</u>

8.9 K. Testing, Certification and Inspection			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
		[regulation 40 (4)].	

8.10L. Safety, Safe Working Practices, Basic First Aid and CPR			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
L1.40/54	<u>Isolation Equipment and Personal safety</u>	Understand and apply the requirements of the regulations, AS/NZS 3000, ECP 34 and ECP 35 in relation to public and personal safety	<u>1702</u>
L2.53	<u>Statutory safety requirements H&S, Supervision</u>	1. Identify the requirements of the Act and regulations relating to the safety of electrical workers are identified, including: <ul style="list-style-type: none"> • Employer and employee responsibilities • Competency requirements • Supervision requirements • Maintain equipment in safe condition. 	21766 Element 2 2.1
		2. Understand the Guidelines for Supervision issued by the Electrical Workers Registration Board	<u>1702</u>

8.11P. Legislation			
No.	Topic	<u>Subject Matter</u>	<u>Unit standard</u>
P1.13	<u>Legislation Fundamental principles</u>	Understand and apply the fundamental principles of the Regulations and section 1 of AS/NZS 3000	<u>21766</u> Element 2 2.6 <u>1702</u>
P2.13	<u>Legislation Registration</u>	1. Understand the process for auditing wiring installation work used by the Electrical Workers Registration Board. 2. Understand the requirements of sections 74 to 88 of the Electricity Act and Regulations 9, 10, 11, 14, 18 and 20	<u>1702</u>
P3.13	<u>Legislation Practising licences</u>	Understand the requirements of sections 95 to 105 of the Electricity Act and Regulations 12, 13, 14 25 and 25 and Schedule 5	<u>1702</u>
P4.13	<u>Legislation Discipline</u>	Understand the requirements of the sections 117 to 147 of the Electricity Act in relation to discipline	<u>1702</u>
P5.13	<u>Legislation Accidents</u>	Understand the requirements of sections 16 to 18 of the Electricity Act and Regulation 106 in relation to the defining and reporting of accidents	<u>1702</u>

9. Electrician Practical Assessment

Each student should be able to demonstrate a thorough knowledge of and be able to carry out each skill.

9.1 Stage 1 Practical Assessment

E. Three-phase Motors, Generators and Starters		
No.	Topic	<u>Subject Matter</u>
E2.16	<u>3ph-Motor/Alternators</u> Selection, starting, protection	<u>Skill 16</u> Electric motors –three-phase connections and reversal of rotation <u>Skill 22</u> Electric motor starters – direct on line three-phase

F. Single-phase Motors and Starters		
No.	Topic	<u>Subject Matter</u>
F2.20	<u>1ph-Motors</u> - Selection, and fault finding	<u>Skill 15</u> Electric motors –single-phase connections and reversal of rotation <u>Skill 21</u> Electric motor starters –direct on line single-phase

H. Circuit and Cable Installation and Protection		
No.	Topic	<u>Subject Matter</u>
H1c.31	<u>Protection and Control</u> Selection of control and protection equipment	<u>Skill 4</u> Selection and replacement of rewirable and high rupturing capacity fuses
H3d.41	<u>Cables and Cords</u> Specifications	<u>Skill 14</u> Identification of cables
H3e.42	<u>Cables and Cords</u> Termination of cords	<u>Skill 5</u> Flexible cord terminations including various crimp connector types <u>Skill 6</u> Soldering <u>Skill 7</u> Metal framed appliance connected by flexible cord (insulation protection and earthing)

H. Circuit and Cable Installation and Protection		
No.	Topic	<u>Subject Matter</u>
H6.43	<u>Selection of fittings and Appliances</u>	<u>Skill 3</u> Plugs and sockets (cord connectors) single-phase <u>Skill 8</u> Edison screw and bayonet cap lampholders <u>Skill 13</u> Identification of accessories <u>Skill 17</u> Three-phase plugs and cord connection sockets <u>Skill 18</u> Permanent connection units
H8.52 A	<u>Design and connect switching circuits</u>	<u>Skill 9</u> Switching of lamp circuits and control circuitry –1 way, 2 way and the use of double pole switches <u>Skill10</u> Three heat switching and energy regulator control

L. Safety, Safe Working Practices, Basic First Aid and CPR		
No.	Topic	<u>Subject Matter</u>
L1.40/ 54	<u>Isolation Equipment and Personal safety</u>	<u>Skill 2</u> Electrical safety and safe working practices <u>Skill 20</u> Disconnection and reconnection of fixed wired electrical appliances including safety tagging systems
L5.57/ 58	<u>CPR and basic first aid</u>	<u>Skill 1</u> Cardio pulmonary resuscitation instruction and practice in approved methods 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.)

O. Lighting		
No.	Topic	<u>Subject Matter</u>
O.65	<u>Lighting</u>	<u>Skill 19</u> Fluorescent lighting connection methods

9.2 Stage 2 Practical Assessment

H. Circuit and Cable Installation and Protection		
No.	Topic	<u>Subject Matter</u>
H3e.42	<u>Cables and Cords Termination of cords</u>	<u>Skill 15</u> Connections and termination of conductors
H3f.44	<u>Cables and Cords Install and terminate cables</u>	<u>Skill 9</u> Installation of sub-circuit wiring in tough plastic sheath cables for lighting circuits and socket outlets <u>Skill 10</u> Installation of sub-circuit wiring in tough plastic sheath cables for three-phase switched socket outlets.
H3g.45	<u>Cables and Cords Support systems</u>	<u>Skill 11</u> Installation of sub-circuit wiring enclosed in conduit
H6.43	<u>Selection of fittings and Appliances</u>	<u>Skill 12</u> Make up single-phase cord sets <u>Skill 13</u> Make up single-phase and three-phase cord extension sets for industrial applications
H8.52 A	<u>Design and connect switching circuits</u>	<u>Skill 16</u> Electrical appliance control circuits

I. Switchboards		
No.	Topic	<u>Subject Matter</u>
I.32	<u>Switchboards</u>	<u>Skill 14</u> Construction of a switchboard for a domestic or light commercial installation – including choice of the correct components – layout – wiring and testing

K. Testing, Certification and Inspection		
No.	Topic	<u>Subject Matter</u>
K4.46	<u>Testing and inspection methods</u>	<u>Skill 2</u> Testing – insulation resistance of electrical appliances <u>Skill 3</u> Testing – insulation resistance of sub-circuits single-phase and three-phase <u>Skill 4</u> Testing – for the correct polarity of single-phase and three-phase socket outlets <u>Skill 5</u> Testing – circuit continuity <u>Skill 6</u> Testing – earthing conductor continuity and resistance <u>Skill 7</u> Testing – earthing conductor continuity and resistance <u>Skill 8</u> Live testing of circuits using electrical test instruments – single-phase and three-phase

L. Safety, Safe Working Practices, Basic First Aid and CPR		
No.	Topic	<u>Subject Matter</u>
L1.40/54	<u>Isolation Equipment and Personal safety</u>	<u>Skill 1</u> Safe working practices and safety rules

O. Lighting		
No.	Topic	<u>Subject Matter</u>
O.65	<u>Lighting</u>	<u>Skill 17</u> Lighting control circuits

9.3 Stage 3 Practical Assessment

D System Theory		
No.	Topic	<u>Subject Matter</u>
D3.21	<u>System theory</u> - <u>Earthing of installations fittings and appliances</u>	<p><u>Skill 7</u> Testing – single-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing single-phase sub-circuits.</p> <p><u>Skill 8</u> Testing – three-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing three-phase sub-circuits.</p>

E. Three-phase Motors, Generators and Starters		
No.	Topic	<u>Subject Matter</u>
E2.16	<u>3ph-Motor/Alternators</u> <u>Selection, starting, protection</u>	<p><u>Skill 2</u> Three-phase cage induction motor Carry out winding, component and connection tests after installing the necessary wiring.</p> <p><u>Skill 3</u> Single-phase and three-phase cage induction motors</p> <p><u>Skill 4</u> Three-phase cage induction motor - starting direct on line Carry out the connection and wiring of various starter components for 2 wire control and 3 wire control that include remote stop/start stations.</p> <p><u>Skill 5</u> Universal three-phase cage induction motor Three-phase slip ring induction motor. Connections, testing, reversal of rotation and speed control of any two types.</p> <p><u>Skill 6</u> Three-phase cage induction motor starters Reduced voltage starters – star-delta, primary resistance, auto transformer. Electronic – soft starting, wave chopping, speed controller</p>

F. Single-phase motors and starters		
No.	Topic	<u>Subject Matter</u>
F2.20	<u>1ph-Motors</u> - <u>Selection, and fault finding</u>	<p><u>Skill 1</u> Single-phase cage induction motor Carry out winding, component and connection tests after installing the necessary wiring.</p>

F. Single-phase motors and starters		
No.	Topic	<u>Subject Matter</u>
		<u>Skill 3</u> Single-phase and three-phase cage induction motors

H. Circuit and Cable Installation and Protection		
No.	Topic	<u>Subject Matter</u>
H1c.31	<u>Protection and Control</u> Selection of control and protection equipment	<u>Skill 12</u> Personal protection - Residual Current Device Connections, operation and verification of compliance with NZS 3019 <u>Skill 13</u> Personal protection - Isolating Transformer Connections, operation and testing for verification of compliance with NZS 3019 <u>Skill 14</u> Protection - high rupturing capacity fuse links Selection related to the cable size, load and conditions of use
H3f.44	<u>Cables and Cords</u> Install and terminate cables	<u>Skill 1</u> Single-phase cage induction motor Carry out winding, component and connection tests after installing the necessary wiring. <u>Skill 2</u> Three-phase cage induction motor Carry out winding, component and connection tests after installing the necessary wiring. <u>Skill 4</u> Three-phase cage induction motor - starting direct on line Carry out the connection and wiring of various starter components for 2 wire control and 3 wire control that include remote stop/start stations. <u>Skill 5</u> Universal three-phase cage induction motor, three-phase slip ring induction motor. Connections, testing, reversal of rotation and speed control of any two types.

H. Circuit and Cable Installation and Protection		
No.	Topic	Subject Matter
H7.51	<u>Read and interpret diagrams</u>	<p><u>Skill 1</u> Single-phase cage induction motor Carry out winding, component and connection tests after installing the necessary wiring.</p> <p><u>Skill 2</u> Three-phase cage induction motor Carry out winding, component and connection tests after installing the necessary wiring.</p> <p><u>Skill 4</u> Three-phase cage induction motor - starting direct on line Carry out the connection and wiring of various starter components for 2 wire control and 3 wire control that include remote stop/start stations.</p> <p><u>Skill 5</u> Universal three-phase cage induction motor Three-phase slip ring induction motor. Connections, testing, reversal of rotation and speed control of any two types.</p> <p><u>Skill 6</u> Three-phase cage induction motor starters Reduced voltage starters – star-delta, primary resistance, auto transformer.</p> <p><u>Skill 7</u> Testing – single-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing single-phase sub-circuits.</p> <p><u>Skill 8</u> Testing – three-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing three-phase sub-circuits.</p>
H10.66	<u>Fault diagnosis</u>	<p><u>Skill 9</u> Testing - electrical appliances and electrical fittings In service testing of three electrical appliances and the completion of an appliance test sheet for each appliance. Include at least one poly-phase appliance.</p>

K. Testing, Certification and Inspection		
No.	Topic	<u>Subject Matter</u>
K2.38	<u>Statutory testing and inspection requirements</u>	<p><u>Skill 7</u> Testing – single-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing single-phase sub-circuits.</p> <p><u>Skill 8</u> Testing – three-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing three-phase sub-circuits.</p> <p><u>Skill 12</u> Personal protection - Residual Current Device Connections, operation and verification of compliance with NZS 3019</p> <p><u>Skill 13</u> Personal protection - Isolating Transformer Connections, operation and testing for verification of compliance with NZS 3019</p>
K3.39	<u>Certification, verification, WOE</u>	<p><u>Skill 15</u> Electrical Certificates of Compliance Carry out the tests in accordance with the provisions of the Electricity Regulations 1997 and complete the documentation for specific electrical installation work.</p>
K4.46	<u>Testing and inspection methods</u>	<p><u>Skill 7</u> Testing – single-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing single-phase sub-circuits.</p> <p><u>Skill 8</u> Testing – three-phase Existing fixed sub-circuit wiring in accordance with NZS 3019 Carry out visual, insulation, polarity, earth continuity and bonding tests on existing three-phase sub-circuits.</p>

L. Safety, Safe Working Practices, Basic First Aid and CPR		
No.	Topic	<u>Subject Matter</u>
L1.40/ 54	<u>Isolation Equipment and Personal safety</u>	<u>Skill 10</u> Safety of personnel The identification and isolation of sub-circuits using the Prove-Test-Prove method. <u>Skill 11</u> Safety of personnel The disconnection and reconnection of fixed wired electrical appliances utilizing the safety tagging system – Out of Service Tags and Danger Tags.
L5.57/ 58	<u>CPR and basic first aid</u>	<u>Skill 17</u> Basic first aid Undertake an approved 1st Aid course. Complete basic 1st Aid course, i.e. St Johns or Red Cross or equivalent.

O. Lighting		
No.	Topic	<u>Subject Matter</u>
O.65	<u>Lighting</u>	<u>Skill 16</u> Discharge Lamps – sodium, mercury vapour, or metal halide Carry out the wiring of the necessary components, test and live test at least one type.