Electrical Workers Registration Board
SAFETY | COMPETENCY | COMPLIANCE

Teaching Guidelines
Electrical Engineer

Written Examination Prescription
and
Practical Skill Assessments
(Electrician Stages 1, 2 and 3)

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

New Zealand Government
Te Kāwanatanga o Aotearoa

Electrical Workers Registration Board
SAFETY | COMPETENCY | COMPLIANCE

More information

Information, examples and answers to your questions about the topics covered here can be found on our website: **www.mbie.govt.nz**

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1. Introduction

Under the Electricity Act, the Electrical Workers Registration Board (the Board) has a responsibility to set the registration criterion and ensure that all persons applying for electrical registration are competent.

To be eligible for registration as an Electrical Engineer, an applicant must comply with the Board's minimum requirements and satisfy the Board that they are competent.

Electrical engineer examination prescriptions in these Teaching Guidelines are structured around the essential capabilities for electrical registration.

Theory examination exemption – electrical engineer candidates are exempt from undertaking an electrical theory registration examination on the basis of their underpinning electrical theory knowledge.

This document has been prepared to assist tutors in the development and delivery of courses for trainees and candidates required to complete the following to be eligible to apply for electrical engineer registration.

- Capstone testing – pass the Electrician Regulations Examination; and
- Pass the Electrician Three-Stage Practical Skill Assessment Programme or an Electrician Practical Examination.

Tuition courses provided for Regulations and Practical Skill Assessments must cover **all** subject matter in the relevant parts of this document.

2. Scope

The Regulations Examination is a competency capstone examination that incorporates the essential capabilities for electrical registration.

Candidates undergoing tuition in accordance with this prescription should receive comprehensive instruction by

- completing a Board approved Electrician Regulations training course, and
- completing training under an experience pathway in New Zealand.

3. Registration Requirements

To be eligible for registration as an **Electrical Engineer** an applicant must provide evidence that they have:

1) Bachelor of Engineering (Electrical) qualification, Bachelor of Engineering Technology (Electrical), or a NZ Diploma in Engineering (Electrical) (Level 6); or
2) an equivalent electrical engineering qualification that is satisfactory to the Board;

   and in addition to the above, must have:

3) passed a Board-approved Electrician regulatory written examination; and
4) passed a Board-approved Electrician practical examination; and
5) completed not less than 2 years of practical work experience and on job training in carrying out PEW that is satisfactory to the Board

4. Limits of Work

An Electrical Engineer may, subject to the limitations set out below:

- Carry out PEW on installations, works and appliances;
- Test any PEW of the type they are authorised to carry out;
- Certify any PEW of the type they are authorised to carry out;
- Supervise one or two persons at one time to carry out PEW.

Limitations

An Electrical Engineer must **not:**

- Inspect PEW;
- Carry out PEW in a mining operation, hazardous area, medical cardiac protected area or mains parallel generation system;
- Supervise more than two persons at one time to carry out PEW.

5. Written Examination

Electrical engineer candidates are required to undertake and pass the Electrician Regulations written examination. The minimum pass mark is 60.

6. Electrician Regulation Examination Prescription

Questions in the examination cover all aspects of the Electrician Regulations prescription and questions may also be structured on underpinning electrical theory knowledge necessary to understand and apply Regulations, Standards or Electrical Codes of Practice.

For example, an understanding of electrical instrument testing procedures is required to carry out installation testing, **or** in service testing of RCDs on an electrical installation.

Therefore, questions on testing will require good theoretical knowledge to comply with the Electricity (Safety) Regulations 2010, Section 8 of AS/NZS 3000 and additional requirements of any Companion Standard or Code of Practice cited in Schedule 2 of the Regulations.

7. Practical Skill Assessments

To ensure that applicants for electrical engineer registration are competent they are also required to satisfactorily complete the Electricians' Three-Stage Practical Skill Assessment that incorporates the essential capabilities and critical items.

8. Safety

Safety must be promoted at all times, whether it be classroom tuition, carrying out practical exercises or practical skill assessments. Safety, not only of tutors, assessors and candidates, but also others who may in future depend on the candidate's standard of workmanship and competency.

9. Definitions

Unless the context otherwise requires, within these guidelines:

Term	Definition
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 (Safety) Regulations 2010

Standard	means any of the following: • New Zealand Standard (NZS) • A Joint Australian / New Zealand Standard (AS/NZS • A British Standard (BS) • An International Electro-Technical Commission Standard (IEC)

Other terms and interpretations are defined in the Electricity Act 1992, Electricity (Safety) Regulations 2010, AS/NZS 3000 including any applicable amendments.

10. Reference Texts

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

- The Electricity Act 1992
- The Electricity (Safety) Regulations 2010.
- EWRB supervision companion guide
- Standards cited in Schedule 2 of the Electricity (Safety) Regulations 2010.
- AS/NZS 3000 and companion Standards listed in Schedule 2 of the regulations.

11. Regulations Examination Prescription

Regulations examinations are open book and cover any aspects of the Regulations Prescription.

A prerequisite level of underpinning knowledge of electrical theory is also expected from candidates to demonstrate how regulations or a specific Standard is applied.

As stated earlier in the scope of this document the regulations examination is for capstone testing purposes and to establish electrical engineer competency.

The majority of examination questions will be sourced from primary reference documents designated with A and B knowledge levels, supported by supplementary questions from documents designated with C and D knowledge levels, where:

Knowledge Level	Description
A	Thorough knowledge
B	Good working knowledge
C	General knowledge
D	Basic understanding

(a)	The Electricity (Safety) Regulations 2010:	**A**
(b)	The Electricity Act 1992.	**B**
(c)	AS/NZS 3000 Including Amendments.	**A**
(d)	**Companion Standards:**	
	AS/NZS 3008.1.2 (Electrical installations – Selection of cables, typical New Zealand conditions	**B**
	AS/NZS 3001	**B**
	AS/NZS 3012	**C**
	AS/NZS 3019	**C**
	AS/NZS 3760	**A**
	AS/NZS 5761	**C**
	AS/NZS 5762	**C**
(e)	NZECP 34.	**A**
(f)	NZECP 54	**B**

Supplementary questions and parts of questions will also be developed from other Companion Standards and/or additional New Zealand Electrical Codes of Practice (NZECPs) cited in Schedule 2 of the Electricity (Safety) Regulations 2010:

(a)	Other Companion Standards as listed in Schedule 2	**C**
(b)	Additional NZECPs 35 to 60	**D**

12. Electrician Practical Tasks and Skill Assessments

During the course of practical instruction and assessment, stress the importance of understanding how practical skill tasks relate to "on the job" situations.

The candidate shall demonstrate an acceptable level of skill and competency in the practical skill tasks listed for Stages 1, 2 and 3.

12.1 Skill Assessment Grading

A consistent grading system has been introduced for all registration classes.

Skill Level	Description
C	Competent
NC	Not Competent

Any skill that has not been assessed is to be awarded a NC result and the reason entered into the comments section on the practical assessment record form.

To pass the practical assessment all skills must be successfully completed with "C" entered into corresponding result column and initialled by a Board-approved skill assessor.

12.2 Stage 1 - Practical Assessment Skills

Skill No.	Skill Definitions and Task Requirements
1.	Cardiac Pulmonary Resuscitation (CPR) training in New Zealand Resuscitation Council approved methods
2.	Electrical safety and safe working practices – observe/assess candidate's ability to competently use the appropriate tools for the job and apply safety principles whilst carrying out practical skill tasks.
3.	Make up two single-phase cord extension sets using different types of plug-tops and cord connector fittings.
4.	(a) Identify, withdraw and replace re-wireable fuse elements at a functional switchboard (selection of correct fuse element size for cable rating).

Skill No.	Skill Definitions and Task Requirements
	(b) Identify, withdraw and replace HRC fuse links at a functional switchboard – emphasis on replacing fusing factor with correct utilisation category.
5.	Terminate flexible cords, cables and conductors using crimp lugs.
6.	Soldering and de-soldering of components on printed circuit boards, solder tags.
7.	Design, install and terminate single-phase TPS sub-circuits for 10 amp and 15 amp flat pin socket outlets protected by RCDs to comply with AS/NZS 3000.
8.	Design, install and terminate TPS sub-circuits incorporating one-way, two-way and intermediate switching of ES and BC lamp holders, ceiling roses and fluorescent lighting protected by RCDs to comply with AS/NZS 3000.
9.	Design, install and terminate a three heat switching control circuit to a suitable load.
10.	Design, install and terminate an energy regulator control circuit to a suitable load.
11.	Using appropriate test instruments obtain voltage and current ratings of single-phase appliances
12.	Test three portable electrical appliances in accordance with AS/NZS 3760, AS/NZS 5761, AS/NZS 5762, affix appropriate tag and complete a test sheet for each appliance (minimum of two class I appliances).
13.	Identify at least ten (10) electrical fittings and accessories and state an application for each.
14.	Identify at least ten (10) flexible cords and cable types and specify a typical application for each type.
15.	Install a single-phase induction motor and direct online motor starter, test for safety, connect to the supply and run. Isolate and change the motor connections to reverse direction of rotation and test run.
16.	Install a three-phase induction motor and direct online motor starter, test for safety, connect to the supply, test run. Isolate and change the motor connections to change direction of rotation and run.
17.	Make up, test and tag a three-phase cord extension set.
18.	Install class I and class II fixed wired appliances connected by flexible cord to permanent connection units.
19.	Disconnection and re-connection of single-phase fixed wired electrical appliances including safety tagging.
20.	Basic first aid training – complete a course with St John or Red Cross.

12.2 Stage 2 – Practical Assessment Skills

Skill No.	Skill Definitions and Task Requirements
1.	Electrical safe working practices – observation of candidate's competency to apply safety principles whilst carrying out practical skill tasks.
2.	Visual checks of sub-circuit wiring for compliance with AS/NZS 3000.
3.	Testing of an existing installation main earthing conductor and equipotential bonding conductors for compliance with AS/NZS 3000.
4.	Testing installation protective earthing conductors for continuity and acceptable resistance values in accordance with AS/NZS 3000.
5.	Testing sub-circuit wiring for polarity and correct connections for compliance with AS/NZS 3000.
6.	Test switchboard mounted residual current devices (RCDs) affording personal protection for compliance with regulation 24, and AS/NZS 3000.
7.	Test portable RCDs for compliance with AS/NZS 3760.
8.	Insulation resistance testing of a Class I portable electrical appliance using the leakage current test method in accordance with AS/NZS 3760.
9.	Testing earth fault loop impedance of socket-outlet sub-circuits that are not RCD protected for compliance in accordance with AS/NZS 3000.
10.	Live test single-phase and three-phase sub-circuits using appropriate test instruments to obtain voltage, current and earth fault loop impedance values.
11.	Design, install and terminate sub-circuit wiring for single-phase lighting and socket-outlets enclosed in PVC conduit to comply with AS/NZS 3000.
12.	Design, install and terminate sub-circuit wiring for three-phase socket- outlets enclosed in PVC conduit to comply with AS/NZS 3000.
13.	Make up, test and tag single-phase and three-phase cord extension sets suitable for industrial applications.
14.	Construct/assemble and wire a MEN switchboard for a domestic installation that incorporates correct components, fittings, layout, wiring and terminations to comply with Part 2 of AS/NZS 3000 (energy revenue meters are not required)
15.	Design, install and connect electrical appliance control circuits including protective devices for domestic water heating or space heating or similar applications.

Skill No.	Skill Definitions and Task Requirements
16.	Design, install, terminate and protect lighting control circuits suitable for switching lighting banks in commercial and industrial applications. Control circuits are to include light sensing devices, contactors or relays etc.

12.3 Stage 3 – Practical Assessment Skills

Skill No.	Skill Definitions and Task Requirements
1.	A comprehensive installation wiring exercise that incorporates Stage 1 and Stage 2 skills including: • wiring a MEN switchboard • mains cabling • sub-circuits wired in TPS • sub-circuits enclosed in PVC conduit • lighting control sub-circuits protected by switchboard mounted RCDs • single-phase socket-outlets sub-circuits protected by switchboard mounted RCDs • a range socket-outlet • a controlled electric water heater sub-circuit • three-phase switched socket-outlets • equipotential bonding conductors connected to metallic piping • a single-phase induction motor supplied from a DOL starter • testing in accordance with AS/NZS 3000 for compliance • completion of compliance certification to satisfy regulatory requirements • livening the supply and testing circuits for correct operation.
2.	Safe working practices – observation of candidate's competency to apply safety principles whilst carrying out practical skill tasks.
3.	Install necessary wiring, carry out winding, component connections and safety tests on following single-phase cage induction motors. Capacitor start, capacitor start/capacitor run and split-phase. Liven, test run, and then reverse direction of rotation.
4.	Install component wiring connections and safety tests on **three-phase** cage induction motors. Liven, test run and reverse direction of rotation.
5.	Diagnose and locate common single-phase and three-phase cage induction motors electrical faults.

Skill No.	Skill Definitions and Task Requirements
6.	Direct online starting for three-phase cage induction motors. Carry out connections and wiring of various starter components for two-wire control and three-wire control. Circuits to include overload protection and no volt release, local and remote stop/start stations.
7.	Single-phase universal motor and three-phase slip ring induction motor. Connections, testing, reverse direction of rotation of each motor. Speed control – for either a universal motor or a slip ring motor.
8.	Three-phase reduced voltage motor automatic starters – star/delta, primary resistance, auto transformer. Install control wiring and power circuits, test and liven a suitable three-phase motor (at least two starter types).
9.	Testing – an existing single-phase MEN installation – mains, sub-circuit wiring and fittings *in accordance with AS/NZS 3019.* *Ensuring the neutral conductor of mains has been positively identified and confirmed as correct by the candidate.*
10.	Testing – an existing three-phase MEN installation – mains, sub-circuit wiring and fittings *in accordance with AS/NZS 3019. Task is to ensure that the candidate positively identifies and confirms that neutral conductor of mains is correctly connected to the supply network.*
11.	Testing – electrical appliances and electrical fittings. In service testing of **three** electrical appliances and completion of an appliance test sheet for each appliance. Include at least one poly-phase appliance.
12.	Using prove-test-prove method – identification and isolation of single-phase and three-phase sub-circuits.
13.	Disconnection and reconnection of single-phase and three-phase fixed wired electrical appliances using safety tagging system – out of service tags and danger tags.
14.	Residual current device installed for personal protection. Correct connections and operational testing for compliance with regulation 24 and AS/NZS 3190.
15.	Isolating transformer installed for personal protection. Correct connections, operational testing for verification of compliance with AS/NZS 3760.
16.	Selection and replacement of high rupturing capacity fuse links at a functional switchboard.

Skill No.	Skill Definitions and Task Requirements
	Tasks to include consideration of cable sizing, connected load and conditions of use. Special emphasis on replacing links labelled fusing factor (class) with correct utilisation category gG (gL) or gM.
17.	Install, wire and terminate necessary components for at least two high intensity discharge light fittings: range – sodium vapour, mercury vapour and metal halide. Test for safety and then live test each fitting with appropriate HID lamp fitted.
18.	Satisfactory completion of a basic St John or Red Cross first aid course or equivalent as approved by the Board.





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