



Electrical Workers Registration Board

# **Teaching Guidelines for Electrical Engineer**

**Examination Prescription  
for Electrician Regulations Tuition**

**and**

**Practical Skill Assessments  
(Electrician Stages 1, 2 and 3)**

Issued by:  
NJJ Sickels  
Registrar  
12 July 2011

## Contents

|    |  |    |
|----|--|----|
| 1  | Introduction   | 1  |
| 2  | Scope  | 1  |
| 3  | Electrical Engineer Registration Requirements              | 2  |
| 4  | Limits of Work under “Rules of the Board”                  | 2  |
| 5  | Examination  | 2  |
| 6  | Electrician Regulation Examination Prescription            | 3  |
| 7  | Practical Skill Assessments                                | 3  |
| 8  | Safety   | 3  |
| 9  | Definitions  | 3  |
| 10 | Reference Texts  | 4  |
|    | Electricity (Safety) Regulations 2010 Schedule 2 Standards | 4  |
| 11 | Regulations Examination Prescription                       | 7  |
| 12 | Electrician Practical Tasks and Skills Assessment          | 8  |
|    | 5.1 Stage 1 – practical assessment skills                  | 9  |
|    | 5.2 Stage 2 – practical assessment skills                  | 10 |
|    | 5.3 Stage 3 – practical assessment skills                  | 12 |

## 1 Introduction

Under the Electricity Amendment Act 2006 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.

As part of the competency requirements sixty-six (66) essential capabilities for Electrician incorporating 31 critical items have been agreed between the Board and Australian licensing authorities.

Electrical engineer examination prescriptions in these Teaching Guidelines are structured around the agreed essential capabilities.

Theory examination exemption – electrical engineer candidates as defined in the Board “classes of registration” document are exempt from undertaking an electrical theory registration examination on the basis of their underpinning electrical theory knowledge.

This document has therefore 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 provided for Regulations and Practical Skill Assessments must therefore cover **ALL** subject matter in the relevant parts of this document.

The examination prescription in these guidelines will not cover every aspect. For example, the theory exemption assumes that candidates have the necessary underpinning electrical theory knowledge to competently apply aspects the Electricity Act, the Electricity (Safety) Regulations 2010, Standards and Codes to undertake the:

- Electrician Regulations Examination.

## 2 Scope

The Regulations Examination is a competency capstone examination that incorporates critical items and elements from the agreed 66 essential capabilities.

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

- satisfactorily completing a Board approved Electrician Regulations training course; and
- satisfactory completion of training under an experience pathway in New Zealand which is satisfactory to the Board.

### 3 Electrical Engineer Registration Requirements

To be eligible for registration as an electrical engineer, under the “Rules of the Board” applicants must provide evidence to the Board that:

- immediately prior to the promulgation of the Electricity (Safety) Regulations 2010 they were a “qualified engineer” under the Electricity Act 1992; and
- have satisfactorily completed instruction in safe working practices, testing, basic first aid and cardiac-pulmonary resuscitation as approved by the Board; or
- they hold a Bachelor of Engineering (Electrical) qualification and have passed the Electrician Regulations written examination, and electrician practical examination or three-stage assessments; and
- have satisfactorily completed instruction in safe working practices, testing, basic first aid and cardiac-pulmonary resuscitation as approved by the Board; or
- they hold a National Diploma in Engineering (Electrotechnology Level 6) or New Zealand Certificate in Engineering (NZCE Electrical) and have passed the Electrician Regulations written examination and the electrician practical examination or three stage assessments and, have three years’ practical experience which is satisfactory to the Board; and
- have satisfactorily completed instruction in safe working practices, testing, basic first aid and cardiac-pulmonary resuscitation as approved by the Board.

### 4 Limits of Work under “Rules of the Board”

Unless limited by the Board a person registered as an electrical engineer may undertake the following:

- (a) the installation or maintenance of conductors used in works or installations; and
- (b) the installation or maintenance of fittings connected, or intended to be connected, to conductors used in works or installations; and
- (c) the connection or disconnection of fittings to or from a power supply, other than by means of a plug or pin inserted into a socket, or an appliance coupler inserted into an appliance inlet; and
- (d) the maintenance of appliances; and
- (e) the testing of work described in paragraphs (a) to (d) above; and
- (f) the certification of work described in paragraphs (a) to (d) above; and
- (g) the supervision of any work described in paragraphs (a) to (f) above.

### 5 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, a sound 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 3000:2007 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 Programme established by the Board that incorporate agreed essential capabilities and critical items.

## 8 Safety

Safety must be emphasised 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:

|                    |  |
|--------------------|--|
| <b>Act</b>         | means the Electricity Act 1992 as at 1 April 2010 (incorporating the Electricity Amendment Act 2006) |
| <b>Code or ECP</b> | means New Zealand Electrical Code of Practice issued under the Act                                   |
| <b>Regulation</b>  | means the Electricity (Safety) Regulations 2010  |

- Standard** means, as the case may be:
- AS/NZS3000:2007 and companion Standards as cited in Schedule 2 of the Electricity (Safety) Regulations 2010, being:
    - a New Zealand Standard (NZS)
    - a Australian Standard (AS)
    - a joint Australian/New Zealand Standard (AS/NZS)
    - a British Standard (BS)
    - an International Electrotechnical Commission Standard
    - an International Standards Organisation (ISO)
- Section** means a section of the Electricity Act 1992 (as at 1 April 2010 incorporating the Electricity Amendment Act 2006).

**Interpretations and terms** are also defined in the Electricity Act 1992, Electricity Safety (Regulations) 2010 and AS/NZS 3000:2007 incorporating Amendment 1.

## 10 Reference Texts

The Electricity Act 1992 reprint as at 1 April 2010 (incorporating the Electricity Amendment Act 2006).

The Electricity (Safety) Regulations 2010.

EWRB supervision procedures for Trainees (published 31 March 2010).

Standards cited in Schedule 2 of the Electricity (Safety) Regulations 2010.

AS/NZS 3000/2007 incorporating Amendment 1 and Companion Standards listed in Schedule 2 of the regulations.

### Electricity (Safety) Regulations 2010 Schedule 2 Standards

| Abbreviations used in regulations | Full title   |
|-----------------------------------|--|
| AS 4777.1                         | AS 4777.1:2005 Grid connection of energy systems via inverters – Installation requirements.  |
| AS/NZS 1677.2                     | AS/NZS 1677.2:1998 Refrigeration systems – Safety requirements for fixed applications: including Amendment 2.                                  |
| AS/NZS 2500                       | AS/NZS 2500:2004 Guide to safe use of electricity in patient care.   |
| <b>AS/NZS 3000</b>                | <b>AS/NZS 3000:2007 incorporating Amendment 1. Electrical Installations (known as the Australian/New Zealand Wiring Rules).</b>                |
| <b>AS/NZS 3001</b>                | <b>AS/NZS 3001:2008 Electrical Installations – Transportable structures and vehicles including their site supplies: including Amendment A.</b> |

| Abbreviations used in regulations | Full title   |
|-----------------------------------|--|
| AS/NZS 3002                       | AS/NZS 3002:2008 Electrical Installations – Shows and carnivals, subject to variation that references to AS/NZS 3439.4 must be read as AS/NZS 3439.4:2009.                             |
| AS/NZS 3003                       | AS/NZS 3003:2003 Electrical Installations – Patient areas of hospitals, medical and dental practices and dialysing locations.  |
| AS/NZS 3004.1                     | AS/NZS 3004.1:2008 Electrical Installations – Marinas and recreational boats – marinas.  |
| AS/NZS 3004.2                     | AS/NZS 3004.2:2008 Electrical Installations – Marinas and recreational boats – recreational boats installations.   |
| AS/NZS 3009                       | AS/NZS 3009:1998 Electrical Installations – Emergency power supplies in hospitals.   |
| AS/NZS 3010                       | AS/NZS 3010:2005 Electrical Installations – Generating sets.   |
| <b>AS/NZS 3012</b>                | <b>AS/NZS 3012:2003 Electrical Installations – Construction and demolition sites, subject to variation that references to AS/NZS 3439.4 must be read as references to AS/NZS 3439.</b> |
| AS/NZS 3014                       | AS/NZS 3014:2003 Electrical Installations – Electric fences including Amendment 1.   |
| AS/NZS 3016                       | AS/NZS 3016:2002 Electrical Installations – Electric security fences including Amendment 1.  |
| AS/NZS 3112                       | AS/NZS 3112:2004 Approval and test specification – Plugs and sockets including Amendment 1.  |
| AS/NZS 3190                       | AS/NZS 3190:2009 Approval and test specification – Residual current devices (current-operated earth leakage devices).  |
| AS/NZS 3439                       | AS/NZS 3439.4:2009 Low-voltage switchgear and control gear assemblies – Particular requirements for assemblies for construction sites (ACS).   |
| AS/NZS 3551                       | AS/NZS 3551:2004 Technical management programmes for medical devices including Amendment 1.  |
| <b>AS/NZS 3760</b>                | <b>AS/NZS 3760:2003 In-service safety inspection and testing of electrical equipment including Amendment 1.</b>  |
| AS/NZS 3820                       | AS/NZS 3820:2009 Essential safety requirements for electrical equipment.   |
| AS/NZS 3823                       | AS/NZS 3823:1998 Electrical installations – Cold-cathode illumination systems.   |
| AS/NZS 4509.1                     | AS/NZS 4509.1:2009 Stand alone power systems – safety and installation.  |
| AS/NZS 4701                       | AS/NZS 4701:2000 Requirements for domestic electrical appliances and equipment for reconditioning or parts recycling.  |
| AS/NZS 5033                       | AS/NZS 5033:2005 Installation of photovoltaic (PV) arrays including Amendment 1.   |

| Abbreviations used in regulations | Full title   |
|-----------------------------------|--|
| AS/NZS 5761                       | <b>AS/NZS 5761:2005 In-service safety inspection and testing – Second-hand electrical equipment prior to sale.</b>   |
| AS/NZS 5762                       | <b>AS/NZS 5762:2005 In-service safety inspection and testing – Repaired electrical equipment.</b>  |
| AS/NZS 60079.14                   | AS/NZS 60079.14:2009 Explosive atmospheres – Electrical installations design, selection and erection.  |
| AS/NZS 60079.17                   | AS/NZS 60079.17:2009 Explosive atmospheres – Electrical installations inspection and maintenance.  |
| AS/NZS 60950                      | AS/NZS 60950.1:2003 Information technology equipment – Safety – General requirements including Amendments 1, 2 and 3.  |
| AS/NZS 61000.3.2                  | AS/NZS 61000.3.2:2007 Electromagnetic compatibility (EMC) – Limits – Limits for harmonic current emissions (equipment input current less than or equal to 16 amperes per phase) including Amendment 1.   |
| IEC 60050                         | IEC 60050: International Electro technical Vocabulary.   |
| <b>IEC/TS 60479-1</b>             | <b>IEC/TS 60479-1 Ed 4.0 Effects of current on human beings and livestock – Part 1: General aspects.</b>   |
| IEC 61000-3-2                     | IEC 61000-3-2 Ed 3.2 Electromagnetic compatibility (EMC) – Limits – Limits for harmonic current emissions (equipment input current less than or equal to 16 amperes per phase) as amended by deviation in IEC 61000-3-2;2007 including Amendment 1.                              |
| IEC 61000-3-3                     | IEC 61000-3-3 Ed 2.0 Electromagnetic compatibility (EMC) – Part 3-3 Limits – Limits of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems with current less than or equal to 16 amperes per phase and not subject to conditional connection. |
| IEC 61000-3-4                     | IEC 61000-3-4 Ed 1.0 Electromagnetic compatibility (EMC) – Part 3-4 Limits – Limitation of emission of harmonic currents in low-voltage supply systems with rated current less greater than 16 amperes.  |
| IEC 61000-3-5                     | IEC 61000-3-5 Ed 2.0 Electromagnetic compatibility (EMC) – Part 3-5 Limits – Limits of voltage fluctuations and flicker in low-voltage supply systems with rated current greater than 75 amperes.  |
| IEC 61000-3-11                    | IEC 61000-3-11 Ed 1.0 Electromagnetic compatibility (EMC) – Part 3-11 Limits – Limits for harmonic currents produced by equipment connected to public low-voltage supply systems with input current greater than 16 amperes and less than or equal to 75 amperes per phase.      |
| IEC 62128-1                       | IEC 62128-1 Ed 1.0 Railway applications – Fixed installation-Part 1 Protective provisions relating to electrical safety and earthing.  |
| ISO/IEC 17050-1                   | ISO/IEC 17050-1 Conformity assessment – Supplier's declaration of conformity – Part 1 General requirements.  |
| NZS 3003.1                        | NZS 3003.1: (2003) Electrical installations – Patient areas of hospitals and medical and dental practices – Testing requirements.  |



| Abbreviations used in regulations | Full title  |
|-----------------------------------|---|
| NZS 6115                          | NZS 6115:2006 Electrical installations – Mobil Electro-medical Connectable Installations: subject to variation that references in this standard to NZS3019 must read as references to AS/NZS3001. |
| NZS 6116                          | NZS 6116:2006 Safe application of electricity in meat processing industry.  |
| NZS 7901                          | NZS 7901:2008 Electricity and gas industries – Safety management system for public safety.  |

| Codes of practice | Full title  |
|-------------------|---|
| <b>ECP 34</b>     | <b>New Zealand Electrical Code of Practice for Electrical Safety Distances (NZECP 34:2001).</b>   |
| ECP 35            | New Zealand Electrical Code of Practice for Power Systems Earthing (NZECP 35:1993).   |
| ECP 36            | New Zealand Electrical Code of Practice for Harmonic Levels (NZECP36:1993) issued on 4 February 1993.   |
| ECP 41            | New Zealand Electrical Code of Practice for Single Wire Earth Return Systems (NZECP41:1993) issued on 4 February 1993.  |
| ECP 46            | New Zealand Electrical Code of Practice for High Voltage Live Line Work (NZECP46:2003) issued on 12 October 2001.   |
| ECP 50            | New Zealand Electrical Code of Practice for Repair of Domestic Electrical Equipment (NZECP50:1993) issued on 4 February 1993.   |
| ECP 51            | New Zealand Electrical Code of Practice for Electrical Wiring Work in Domestic Premises (NZECP51:1993) issued on 4 February 1993.   |
| ECP 60            | New Zealand Electrical Code of Practice for Inspection, Testing and Certification of Low Voltage AC Railway Signalling Control Circuits (NZECP60:1997) issued on 6 July 1997. |

## 11 Regulations Examination Prescription

Regulations examinations are open book and cover all or 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 candidate competency.

Therefore, elements from 66 essential capabilities incorporating 31 critical items are included in the Regulation prescription.

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:

A = Thorough knowledge.

B = Good working knowledge.

C = General knowledge.

D = Basic understanding.

|  |   |
|--|---|
| The Electricity (Safety) Regulations 2010.   | A |
| The Electricity Act 1992 (as at 1 April 2010 incorporating the Electricity Amendment Act 2006).  | B |
| AS/NZS3000:2007 incorporating Amendment No. 1.   | A |
| Companion Standards  |   |
| AS/NZS3008.1.2 (Electrical installations – Selection of cables, typical New Zealand conditions). | B |
| AS/NZS3001   | B |
| AS/NZS3012   | C |
| AS/NZS3019   | C |
| AS/NZS3760   | A |
| AS/NZS5761   | C |
| AS/NZS5762   | C |
| NZECP 34   | A |
| 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:

|   |   |
|---|---|
| Other Companion Standards as listed in Schedule 2 | C |
| Additional NZECPs 35 to 60                        | D |

## 12 Electrician Practical Tasks and Skills Assessment

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**.

### Skill assessment grading –

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

**C = competent, and**

**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 a practical assessment stage all skills must be successfully completed with “C” entered into corresponding result column and initialled by skill assessor.

### 5.1 Stage 1 – practical assessment skills

| Skill no. | Definition and task requirements  | Essential capability references |
|-----------|---|---------------------------------|
| 1         | Cardiac Pulmonary Resuscitation (CPR) training in New Zealand Resuscitation Council approved methods.   | 57 and 58                       |
| 2         | Electrical Safety and safe working practices by observing candidate's ability to competently use the appropriate tools for the job, apply safety principles whilst carrying out practical skills.   | 40, 54                          |
| 3         | Make up two single-phase cord extension sets using different types of plug-tops and cord connector fittings.  | 42                              |
| 4         | (a) Identify, withdraw and replace re-wireable fuse elements at a functional switchboard (selection of correct fuse element size for cable rating).<br>(b) Identify, withdraw and replace HRC fuse links at a functional switchboard – emphasis on replacing fusing factor with correct utilisation category. | 31                              |
| 5         | Terminate flexible cords, cables and conductors using crimp lugs.   | 42                              |
| 6         | Soldering and de-soldering of: components on printed circuit boards, solder tags.   | 42                              |
| 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/NZS3000.  | 31, 44                          |
| 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/NZS3000.   | 31,43, 44, 52, 65               |
| 9         | Design, install and terminate a three heat switching control circuit to a suitable load.  | 42,52                           |
| 10        | Design, install and terminate an energy regulator control circuit to a suitable load.   | 51, 52                          |
| 11        | Using appropriate test instruments obtain voltage and current ratings of single-phase appliances.   | 6                               |

| <b>Skill no.</b> | <b>Definition and task requirements</b>  | <b>Essential capability references</b> |
|------------------|--|--|
| 12               | Test three portable electrical appliances in accordance with AS/NZS3760, AS/NZS5761, AS/NZS5762, affix appropriate tag and complete a EWRB test sheet for each appliance (minimum of two class I appliances).    | 34, 46                                 |
| 13               | Identify at least ten (10) electrical fittings and accessories and state an application for each.  | 43                                     |
| 14               | Identify at least ten (10) flexible cords and cable types and specify a typical application for each type.   | 41                                     |
| 15               | Install a single-phase induction motor and direct on line 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. | 20, 47                                 |
| 16               | Install a three-phase induction motor and direct on line motor starter, test for safety, connect to the supply, test run. Isolate and change the motor connections to change direction of rotation and run.      | 16, 47                                 |
| 17               | Make up, test and tag a three-phase cord extension set.  | 43                                     |
| 18               | Install class I and class II fixed wired appliances connected by flexible cord to permanent connection units.  | 43, 44, 47                             |
| 19               | Disconnection and re-connection of single-phase fixed wired electrical appliances including safety tagging.  | 40, 62                                 |
| 20               | Basic first aid training – complete a course with St John or Red Cross.  | 57 and 58                              |

## 5.2 Stage 2 – practical assessment skills

| <b>Skill no.</b> | <b>Definition and task requirements</b>  | <b>Essential capability references</b> |
|------------------|--|--|
| 1                | Electrical safe working practices – observation of candidate's competency to apply safety principles whilst carrying out practical skill tasks.                        | 40, 54                                 |
| 2.               | Visual checks of sub-circuit wiring for compliance with Section 8.2 of AS/NZS3000:2007.  | 46                                     |
| 3                | Testing of an existing installation main earthing conductor and equipotential bonding conductors for compliance with Section 8.3.5 of AS/NZS3000:2007.                 | 22, 38, 46                             |
| 4                | Testing installation protective earthing conductors for continuity and acceptable resistance values in accordance with Section 8.3.5.2 of AS/NZS3000:2007.             | 22, 38, 46                             |
| 5                | Testing sub-circuit wiring for polarity and correct connections for compliance with Sections 8.3.7 and 8.3.8 of AS/NZS3000:2007.                                       | 13, 38                                 |
| 6                | Test switchboard mounted residual current devices (RCDs) affording personal protection for compliance with regulation 20, and Section 8.3.10.2 (b) of AS/NZS3000:2007. | 28, 38, 46                             |

| Skill no. | Definition and task requirements  | Essential capability references |
|-----------|---|---------------------------------|
| 7         | Test portable RCDs for compliance with Section 2.2.3.4 and Appendix "D" of AS/NZS3760.  | 46                              |
| 8         | Insulation resistance testing of a Class I portable electrical appliance using the leakage current test method in accordance with Section 2.3.3.2 of AS/NZS3760.  | 13, 38, 46                      |
| 9         | Testing earth fault loop impedance of socket-outlet sub-circuits that <u>are not</u> RCD protected for compliance in accordance with Section 8.3.9.1 of AS/NZS3000:2007.  | 21, 22                          |
| 10        | Live test single-phase and three-phase sub-circuits using appropriate test instruments to obtain voltage, current and earth fault loop impedance values.  | 6, 13, 38                       |
| 11        | Design, install and terminate sub-circuit wiring for single-phase lighting and socket-outlets enclosed in PVC conduit to comply with AS/NZS3000:2007.   | 29, 45                          |
| 12        | Design, install and terminate sub-circuit wiring for three-phase socket-outlets enclosed in PVC conduit to comply with AS/NZS3000:2007.   | 29, 45                          |
| 13        | Make up, test and tag single-phase and three-phase cord extension sets suitable for industrial applications.  | 13, 42                          |
| 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/NZS3000:2007 (energy revenue meters are not required) | 31, 32, 43                      |
| 15        | Design. Install and connect electrical appliance control circuits including protective devices for domestic water heating or space heating or similar applications.   | 46, 47                          |
| 16        | Design, install, terminate and protected 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.        | 37, 52                          |

### 5.3 Stage 3 – practical assessment skills

| Skill no. | Definition and task requirements  | Essential capability references                                |
|-----------|---|--|
| 1         | <p>A comprehensive installation wiring exercise that incorporates Stage 1 and Stage 2 skills including:</p> <ul style="list-style-type: none"> <li>• wiring a MEN switchboard</li> <li>• mains cabling</li> <li>• sub-circuits wired in TPS</li> <li>• sub-circuits enclosed in PVC conduit</li> <li>• lighting control sub-circuits protected by switchboard mounted RCDs</li> <li>• single-phase socket-outlets sub-circuits protected by switchboard mounted RCDs</li> <li>• a range socket-outlet</li> <li>• a controlled electric water heater sub-circuit</li> <li>• three-phase switched socket-outlets</li> <li>• equipotential bonding conductors connected to metallic piping</li> <li>• a single-phase induction motor supplied from a DOL starter</li> <li>• testing in accordance with AS/NZS3000:2007 for compliance</li> <li>• completion of compliance certification to satisfy regulatory requirements</li> <li>• livening the supply and testing circuits for correct operation.</li> </ul> | 28, 29, 31, 32, 34, 38, 39, 42, 43, 44, 45, 46, 47, 52, 60, 65 |
| 2         | Safe working practices – observation of candidate's competency to apply safety principles whilst carrying out practical skill tasks.  | 40, 45   |
| 3         | <p>Install necessary wiring, carry out winding, component connections and safety tests on following <b>single-phase</b> cage induction motors. Capacitor start, capacitor start/capacitor run and split-phase. Liven, test run, and then reverse direction of rotation.</p>   | 20, 47   |
| 4         | <p>Install component wiring connections and safety tests on <b>three-phase</b> cage induction motors. Liven, test run and reverse direction of rotation.</p>  | 16, 47   |
| 5         | Diagnose and locate common single-phase and three-phase cage induction motors electrical faults.  | 18   |
| 6         | <p>Direct on line 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.</p>  | 16, 17, 18, 43   |
| 7         | <p>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.</p>  | 43, 44   |

| Skill no. | Definition and task requirements  | Essential capability references |
|-----------|---|---------------------------------|
| 8         | Three-phase reduced voltage motor automatic starters – star/delta, primary resistance, auto transformer.<br>Install control wiring and power circuits, test and liven a suitable three-phase motor (at least two starter types).  | 16, 18                          |
| 9         | Testing – an existing single-phase MEN installation – mains, sub-circuit wiring and fittings <i>in accordance with Section 5 of AS/NZS3019:2007.</i><br><i>Ensuring the neutral conductor of mains has been positively identified and confirmed as correct by the candidate.</i>                                    | 13, 16, 28, 31, 39, 48          |
| 10        | Testing – an existing three-phase MEN installation – mains, sub-circuit wiring and fittings <i>in accordance with Section 5 of AS/NZS3019:2007.</i><br><i>Task is to ensure that the candidate positively identifies and confirms that neutral conductor of mains is correctly connected to the supply network.</i> | 13, 22, 28, 31                  |
| 11        | Testing – electrical appliances and electrical fittings.<br>In service testing of <b>three</b> electrical appliances and completion of a EWRB appliance test sheet for each appliance. Include at least one poly-phase appliance.   | 13, 39                          |
| 12        | Using prove-test-prove method – identification and isolation of single-phase and three-phase sub-circuits.  | 40                              |
| 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.   | 40, 44, 62                      |
| 14        | Residual current device installed for personal protection.<br>Correct connections and operational testing for compliance with regulation 24 and AS/NZS 3190.  | 28, 31                          |
| 15        | Isolating transformer installed for personal protection. Correct connections, operational testing for verification of compliance with AS/NZS3760.   | 13, 26, 46                      |
| 16        | Selection and replacement of high rupturing capacity fuse links at a functional switchboard.<br>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.           | 31                              |
| 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.  | 42, 43, 44, 65                  |
| 18        | Satisfactory completion of a basic St John or Red Cross first aid course or equivalent as approved by the Board.  | 57, 58                          |