Title	**Demonstrate knowledge of electrical theory and legislation for electrical service technicians (EST)**		
Level	**4**	**Credits**	**8**

Purpose	This unit is not intended for use by electricians. It is designed to meet the requirements of the prerequisite course for technicians wishing to sit the EWRB written examination, which is a requirement for registration as an Electrical Service Technician (EST). Achievement of this unit standard alone does not entitle trainees to legally perform prescribed electrical work without supervision. Until registered and licensed under the Electricity Act 1992, trainees are assisting, and must work under supervision when carrying out prescribed electrical work. People credited with this unit standard are able to: – identify legislative documentation and organisations that have an impact on the work of Electrical Service Technicians; – demonstrate knowledge of the responsibilities and limitations of registered Electrical Service Technicians; – demonstrate knowledge of earthing of appliances and fittings; – demonstrate knowledge of the use of appliances and fittings in damp locations; – identify the special provisions applying to the use of electrical appliances in explosive atmospheres; – identify the special provisions applying to electrical appliances used in patient treatment areas; – demonstrate knowledge of regulatory requirements and procedures for safety testing of electrical appliances; – demonstrate knowledge of circuit protection devices; – demonstrate knowledge of safeguards for protection from electric shock when using portable electric appliances; – demonstrate knowledge of single-phase and poly-phase flexible cords and fittings; and – demonstrate knowledge of single-phase and three-phase electric motors and starters.

Classification	Electrical Engineering > Electrical Service Technicians

Available grade	Achieved

Guidance Information

1 This unit standard is intended for use by technicians for electrical engineering, electronic engineering, or telecommunications courses at certificate level.

2 References
AS/NZS 3000:2018, *Electrical Installations (known as the Australian/New Zealand Wiring Rules)*;
AS/NZS 3008.1.2:2017, *Electrical Installations – Selection of cables – Part 1.2: Cables for alternating voltages up to and including 0.6/1 kV – Typical New Zealand conditions*;
AS/NZS 3760:2010, *In-service Safety inspection and testing of electrical equipment;*
AS/NZS 5761:2011, *In-service safety inspection and testing – Second-hand electrical equipment prior to sale*;
AS/NZS 5762:2011, *In-service safety inspection and testing – Repaired electrical equipment*;
AS/NZS 60269.3.1:2002, *Low-voltage fuses*;
AS/NZS 61535:2011, *Installation couplers intended for permanent connection in fixed installations*;
Building Act 2004;
Electricity (Safety) Regulations 2010;
Electricity Act 1992;
EWRB *Rules of the Board* and *Teaching Guidelines* available at www.ewrb.govt.nz;
Health and Safety at Work Act 2015;
The New Zealand Electrical Codes of Practice 36:1997 (WorkSafe ISSN 0114-0663); and all subsequent amendments and replacements.

3 Definitions
Current regulations and standards – refer to the requirements of the above legislation and standards, applied to the context in which the term is used.
Industry conventions – a set of agreed, specified, or generally accepted standards.
Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.
EMI – electromagnet interference.
HRC – high rupturing capacity.
IP Codes – Ingress Protection Codes.
MEN – Multiple Earth Neutral.
MIMS – Mineral Insulated Metal Sheath.
MOV – Metal oxide varister.
PEC – Protective earthing conductor.

4 Range
All activities and evidence presented for all outcomes and performance criteria in this unit standard must be in accordance with:
- i legislation;
- ii policies and procedures;
- iii ethical codes;
- iv Standards – may include but are not limited to those listed in Schedule 2 of the Electricity (Safety) Regulations 2010;
- v EWRB Rules of the Board;
- vi safe and sound practice;
- vii applicable site, company and industry practice, and industry conventions;

viii where appropriate or applicable, environmental requirements, manufacturer instructions, specifications, data sheets and manufacturer, supplier and company health and safety procedures.

Outcomes and performance criteria

Outcome 1

Identify legislative documentation and organisations that have an impact on the work of Electrical Service Technicians.

Performance criteria

1.1 Identify legislative documentation of importance to the work of Electrical Service Technicians.

1.2 Identify the organisations that impact on the work of Electrical Service Technicians.

Range may include but not limited to – EWRB, WorkSafe, industry associations.

Outcome 2

Demonstrate knowledge of the responsibilities and limitations of registered Electrical Service Technicians.

Performance criteria

2.1 Define the term ‘supervision’ in accordance with current legislation, regulations, and Rules of the Board.

2.2 Explain the requirements for a person to be registered, licensed, or authorised.

2.3 Define prescribed electrical work that a registered and licensed person may do.

2.4 Identify limits and restrictions that the EWRB may impose on registered and licensed persons.

2.5 State the responsibilities of persons carrying out prescribed electrical work.

Range responsibilities may include but is not limited to – compliance with legislation, Rules of the Board standards as they apply to the work undertaken, standard of workmanship, safe working practices.

2.6 Identify persons who may assist a registered person in carrying out prescribed electrical work.

2.7 Identify situations where the services of a person holding a higher class of registration may be required.

Outcome 3

Demonstrate knowledge of earthing of appliances and fittings.

Performance criteria

3.1 Explain the need to earth metal parts of Class 1 appliances and fittings with reference to earthing methods, protection provided under fault conditions, low resistance path of PEC, operation of protection devices, and fault current path.

3.2 State the maximum resistance permitted between the exposed metal of an appliance and the earth pin of the mains plug.

3.3 Explain the term equipotential bonding in terms of earthing and electrical safety.

Outcome 4

Demonstrate knowledge of the use of appliances and fittings in damp locations.

Performance criteria

4.1 Define the term ‘damp location’ in accordance with AS/NZS 3000.

4.2 Explain why people and equipment require additional protection in damp locations in accordance with AS/NZS 3000.

4.3 Identify the intent of the IP code, and state the degree of protection provided.

Range evidence of four examples is required.

4.4 Explain the importance of making like-for-like replacements of appliances in damp locations with reference to matching of IP ratings.

4.5 Identify methods of protection from electric shock when using appliances in damp areas.

Outcome 5

Identify the special provisions applying to the use of electrical appliances in explosive atmospheres.

Performance criteria

5.1 Identify potential explosive atmospheres.

Range may include but is not limited to – petrol and CNG/LPG service stations, spray booths, petro-chemical plants, oil platforms, coal mines, flammable materials stores, laboratories; evidence of three is required.

5.2 Identify the specialist training required prior to performing disconnection or connection, repair or maintenance of appliances used in explosive atmospheres.

Outcome 6

Identify the special provisions applying to electrical appliances used in patient treatment areas.

Performance criteria

6.1 Identify patient treatment areas that use electro-medical treatment devices.

Range unprotected, body protected or cardiac protected.

6.2 Identify the regulations and standards relating to electro-medical devices.

6.3 Identify the need for specialist training prior to performing disconnection or connection, repair or maintenance of electro-medical devices.

Outcome 7

Demonstrate knowledge of regulatory requirements and procedures for safety testing of electrical appliances.

Performance criteria

7.1 Identify the circumstances under which appliances must be tested, the tests required, and required results.

7.2 Identify the test instruments and range to be used for each type of test.

7.3 Identify the test voltages required for insulation resistance tests.

Range MOV protected appliance, EMI filtered appliance, Class 1 appliance, Class 2 appliance, appliance with MIMS element.

7.4 Describe the purpose of an insulation resistance test.

7.5 Describe the appropriate actions to be taken following testing for compliant and for non-compliant appliances.

Outcome 8

Demonstrate knowledge of circuit protection devices.

Performance criteria

8.1 Describe the effects of electrical faults in terms of the danger to people and property.

Range faults – leakage current, over current, short circuit;
effects – electromechanical energy, heat energy, damaged cables and equipment, fire, explosion, electric shock.

8.2 Identify circumstances leading to over current in an electrical circuit.

Range circumstances – mechanical overload, phase to neutral fault, short circuit, phase to earth fault.

8.3 Explain the need for rapid and positive disconnection of faulty circuits.

8.4 Explain the operation of devices commonly used to provide protection against fault currents and describe their advantages and limitations.

Range devices – thermal protective devices, magnetic protective devices, rewirable fuses, cartridge fuses, HRC fuses, miniature circuit breakers, plug-in miniature circuit breakers.

8.5 Explain common terms used for fuses and circuit breakers in accordance with industry practice.

Range interrupt capacity, category of utilization, current rating, fusing current, tripping current, fusing factor, tripping factor, repairable, non-repairable, discrimination.

8.6 Explain the importance of using a replacement fuse or circuit breaker with the correct current rating with reference to the effects of under-rating and over-rating.

8.7 Describe the procedure to be followed if a fuse or circuit breaker operates a second time in response to the same fault.

Outcome 9

Demonstrate knowledge of safeguards for protection from electric shock when using portable electric appliances.

Performance criteria

9.1 Describe the means of protecting users from contact with live parts or when using portable appliances.

Range plastic and metal covers, double insulation, earthing, residual current devices, isolating transformers.

9.2 Explain the danger of using electrical appliances in the context of simultaneous contact with live parts and the earth.

Range earthing, insulation.

9.3 Identify and explain the essential features of double insulation as a means of protection against electric shock.

9.4 Describe the construction and operation of safety devices used with portable appliances, and how they protect against electric shock.

Range residual current devices – operating time, residual current; isolating transformers – use of other safeguards in conjunction with isolating transformer, fusing, connection of socket earths;

9.5 Describe the conditions of use for safety devices used with portable appliances.

Range protecting a single appliance, protecting multiple appliances.

9.6 Explain the need for, and the nature of, periodic inspection of safety devices.

Range residual current devices, isolating transformers.

Outcome 10

Demonstrate knowledge of single-phase and poly-phase flexible cords and fittings.

Performance criteria

10.1 Compare conductor colour codes and related terminal abbreviations permitted for conductors in single-phase and poly-phase flexible cords.

Range abbreviations – phase, active, line, neutral, earth.

10.2 Identify and select flexible cords for given single-phase and poly-phase applications.

Outcome 11

Demonstrate knowledge of single-phase and three-phase electric motors and starters.

Performance criteria

11.1 Demonstrate knowledge of a single-phase electric motor operation including construction, winding connections, applications, reversal of rotation methods of speed control, advantages and disadvantages of different motor types.

Range may include but is not limited to – induction motor types split phase or capacitor start or, permanently split capacitor.

11.2 Explain the principles of operation of a three-phase induction motor, application for the motor frame type and ventilation methods, and its effect when either Star or Delta connected.

11.3 Demonstrate knowledge of a three-phase induction motor starter, including the type of protection it provides, phase reversal, when reduced voltage is required, advantages and disadvantages.

11.4 Describe the faults that can occur and relevant diagnosis with single-phase and three-phase motors and starters.

Planned review date	31 December 2024

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	26 September 2019	N/A

Consent and Moderation Requirements (CMR) reference	0003

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Comments on this unit standard

Please contact The Skills Organisation reviewcomments@skills.org.nz if you wish to suggest changes to the content of this unit standard.