

Title	Demonstrate and apply knowledge of single-phase and three-phase rotating machines		
Level	3	Credits	4

Purpose	<p>This unit standard covers theory of single-phase rotating machines for electricians and related trades.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> – demonstrate knowledge of single-phase and three-phase generation; – demonstrate knowledge of single-phase motors; – apply knowledge of single-phase motors; – diagnose single-phase motor faults; – demonstrate knowledge of three-phase induction motors; – apply knowledge of three-phase motors; and – diagnose a three-phase motor fault.
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Classification	Electrical Engineering > Core Electrical
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Available grade	Achieved
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Explanatory notes

- 1 This unit standard has been developed for learning and assessment off-job.
- 2 This unit standard and unit standards 29443 and 29444 together meet the assessment requirements of ERAC CEPC 13.
This unit standard and unit standards 29420, 29443, and 29444 meet the assessment requirements of ERAC EPC 15.
This unit standard and unit standards 15848, 29420, 29421, 29422, 29443, 29444, and 29481, 29557 meet the assessment requirements of ERAC CEPC 54.
- 3 Definitions
CEPC – Critical Essential Performance Capability.
d.c. – direct current.
EPC – Essential Performance Capability.
ERAC – Electrical Regulatory Authorities Council.
Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.
Safe and sound practice – as it relates to the installation of electrical equipment is defined in AS/NZS 3000:2007, *Electrical Installations (known as the Australian/New Zealand Wiring Rules)*.
- 4 Range
 - a Candidates are to be supplied with formulae involving more than three quantities.

- b Standard symbols to be used for all assessments.
- c Use of a calculator during assessment is permitted.
- d Candidates are expected to express calculated values in the relevant Système International (SI) units, including multiples and sub-multiples (pico, nano, micro, milli, kilo, mega, etc) and be able to convert between them.
- e Candidates may refer to current legislation and Standards during assessment.
- f Demonstration of safe working practices and installation in accordance with *safe and sound practice* are essential components of assessment of this unit standard.
- g All activities and evidence presented for all outcomes and evidence requirements 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 applicable site, enterprise, and industry practice; and,
 - vi where appropriate, manufacturers' instructions, specifications, and data sheets.

Outcomes and evidence requirements

Outcome 1

Demonstrate knowledge of single-phase and three-phase generation.

Evidence requirements

- 1.1 With the aid of a sketch describe the construction and operating principles of generators.
- 1.2 Graph the alternator output through one revolution.
- 1.3 Carry out calculations involving the number of poles, speed, and frequency for single-phase generators from given data.
- 1.4 Define Watts and convert between Watts and horsepower for electric motors.

Outcome 2

Demonstrate knowledge of single-phase motors.

Range motors – universal, shaded-pole, standard split-phase induction, capacitor-start, permanently-split capacitor, capacitor start and run.

Evidence requirements

- 2.1 Describe motor construction and identify all components with the aid of a diagram or from physical examples.
- 2.2 Identify types of motor enclosures and state the features of each.
- 2.3 Describe operating principles in terms of starting, production of rotating magnetic field, and production of torque.

- 2.4 Describe speed control methods, where achievable.
- 2.5 Describe method of reversal of rotation with the aid of a diagram.
- 2.6 State a typical application for each type of motor and give reasons for the suitability of the choice.
- 2.7 Identify types of motor enclosures and state the features of each.

Outcome 3

Apply knowledge of single-phase motors.

Evidence requirements

- 3.1 Test motor to ensure safe operation.

Range visual, earth continuity, insulation resistance.
- 3.2 Connect three motors for safe operation.

Range may include but is not limited to – universal, shaded-pole, standard split-phase induction, capacitor-start, permanently-split capacitor, capacitor start and run.
- 3.3 Connect three motors to change direction.

Range may include but is not limited to – universal, shaded-pole, standard split-phase induction, capacitor-start, permanently-split capacitor, capacitor start and run.

Outcome 4

Diagnose single-phase motor faults.

Evidence requirements

- 4.1 Diagnose a single-phase motor fault and identify potential remedies.
- 4.2 Identify potential remedies and establish viability of repair.

Outcome 5

Demonstrate knowledge of three-phase induction motors.

Evidence requirements

- 5.1 With the aid of diagrams and with reference to components, describe the construction of three-phase induction motors.
- 5.2 Explain the operating principles of three-phase induction motors in terms of the

action of the rotating magnetic fields, the interactions of stator and rotor fluxes, and methods of starting.

5.3 With the aid of a diagram describe methods of rotation reversal.

5.4 With the aid of a sketch describe star and delta motor connections.

5.5 Sketch and label speed versus torque curves that show starting torque, running torque, rated torque, pull-out speed, and rated speed.

Range motors – squirrel cage, wound rotor with slip-rings, double cage rotor.

5.6 State a typical motor application with reasons for the suitability of the choice.

Range motors – squirrel cage, wound rotor with slip-rings, double cage rotor.

Outcome 6

Apply knowledge of three-phase motors.

Evidence requirements

6.1 Test motor to ensure safe operation.

Range visual, earth continuity, insulation resistance.

6.2 Connect an induction motor and a slip ring motor for safe operation.

Range star, delta.

6.3 Connect an induction motor and a slip ring motor to change direction.

Outcome 7

Diagnose a three-phase motor fault.

Evidence requirements

7.1 Diagnose a three-phase motor fault and identify potential remedies.

7.2 Identify potential remedies and establish viability of repair.

Planned review date	31 December 2019
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
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Process	Version	Date	Last Date for Assessment
Registration	1	21 July 2016	N/A

Consent and Moderation Requirements (CMR) reference	0003
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

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.