

<b>Title</b>	<b>Demonstrate and apply knowledge of a.c. electric motor control and installation</b>		
<b>Level</b>	<b>4</b>	<b>Credits</b>	<b>5</b>

<b>Purpose</b>	<p>This unit standard covers the starting, speed control, and installation and commissioning of alternating current (a.c.) electric motors. It is intended for use in the training of electricians and related trades.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> <li>– demonstrate knowledge of motor starters;</li> <li>– demonstrate knowledge of motor speed controllers;</li> <li>– connect and test three-phase induction motor starters;</li> <li>– connect and test motor speed controllers; and</li> <li>– install and commission induction motors.</li> </ul>
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<b>Classification</b>	Electrical Engineering > Electrical Machines
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<b>Available grade</b>	Achieved
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### Guidance Information

- 1 This unit standard has been developed for learning and assessment off-job.
- 2 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.
- 3 This unit standard and unit standards 5932, 15848, 15855, 29443, and 29480 together meet the assessment requirements of ERAC EPC 12.  
This unit standard and unit standards 29443, and 29483 together meet the assessment requirements of ERAC CEPC 13.  
This unit standard and unit standards 29420, and 29443 together meet the assessment requirements of ERAC EPC 14.  
This unit standard and unit standards 29420, 29443, and 29483 together meet the assessment requirements of ERAC EPC 15.  
This unit standard and unit standards 29443 and 29480 meet the assessment requirements of ERAC EPC 52.  
This unit standard and unit standards 15848, 29420, 29421, 29422, 29443, 29481, 29483, and 29557 meet the assessment requirements of ERAC EPC 54.
- 4 Definitions  
*CEPC* – Critical Essential Performance Capability.  
*EPC* – Essential Performance Capability.

*ERAC* – Electrical Regulatory Authorities Council.

*EWRB* – Electrical Workers Registration Board.

*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)*.

## 5 Assessment

- a Candidates may refer to current legislation and Standards during assessment.
- b Demonstration of safe working practices and installation in accordance with *safe and sound practice* are essential components of assessment of this unit standard.
- c 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 applicable site, enterprise, and industry practice; and,
  - vi where appropriate, manufacturers' instructions, specifications, and data sheets.

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## Outcomes and performance criteria

### Outcome 1

Demonstrate knowledge of motor starters.

#### Performance criteria

- 1.1 Explain the advantages of using motor starters.  
Range reduced voltage and current during starting, reduced transients.
- 1.2 Describe protective features incorporated in starters to mitigate common faults.  
Range over current, no-volt, phase reversal, phase failure, mechanical stress.
- 1.3 Describe, with the aid of diagrams, the operation principles of motor starters.  
Range block diagram of electronic starter;  
circuit diagrams of – direct-on-line, star-delta, auto-transformer, primary resistance, secondary resistance.
- 1.4 Compare motor starter characteristics.  
Range motor starters – direct-on-line, star-delta, auto-transformer, primary resistance, secondary resistance, electronic;  
characteristics – starting current and torque, full load current and torque, relative cost.

**Outcome 2**

Demonstrate knowledge of motor speed controllers.

**Performance criteria**

- 2.1 Describe the operational requirements of motor speed controllers.
- Range step-less or continuous control, minimum losses, minimum harmonic and radio-frequency interference.
- 2.2 State the properties of motors that are suitable for speed control.
- Range designed for varying speeds, adequate cooling system.
- 2.3 Describe, with the aid of diagrams, motor speed controllers.
- Range block diagrams – block diagram for variable voltage and variable frequency electronic speed controllers, circuit diagram for secondary resistance speed controller.
- 2.4 Compare the characteristics of motor speed controllers.
- Range speed controllers – secondary resistance, pole changing, electronic;  
characteristics – efficiency, smoothness, torque, continuous control, relative cost.

**Outcome 3**

Connect and test three-phase induction motor starters.

- Range direct on line (DOL) starting – cage induction motors with two and three-wire control and remote start-stop stations;  
plus two of – auto transformer, star-delta, secondary resistance, DOL forward and reversing.

**Performance criteria**

- 3.1 Make connections to three-phase induction motor starters.
- 3.2 Test circuits.
- 3.3 Verify starting and stopping operations against design.
- 3.4 Test motor protection for effectiveness and calibrate to suit the motor.
- Range over-current, overload, phase failure.

**Outcome 4**

Connect and test motor speed controllers.

Range speed controllers – secondary resistance and electronic types; motors – universal single-phase, plus either three-phase cage induction, or three-phase slip ring induction.

**Performance criteria**

- 4.1 Make connections to motor speed controllers.
- 4.2 Test motor.
- 4.3 Verify operation of speed controller against design.

**Outcome 5**

Install and commission induction motors.

Range one single-phase and one three-phase induction motor.

**Performance criteria**

- 5.1 Make electrical connections to the machine, including cabling, glands, terminations, and accessories.
- 5.2 Install control and protection equipment.
- 5.3 Test to confirm that all requirements of current regulations and standards have been met and that the machine and control equipment are safe to connect.
- 5.4 Conduct commissioning tests and adjustments and confirm operation of control equipment in accordance with specifications.

Range control equipment may include, but is not limited to – switch gear, metering, over-temperature, open-circuit, short-circuit, overload protection; adjustments include, but are not limited to – phase rotation, polarity.

- 5.5 Conduct commissioning tests to confirm off-load and on-load operation of machine.

Range direction of rotation, vibration, temperature rise, current draw.

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**This unit standard is expiring. Assessment against the standard must take place by the last date for assessment set out below.**

**Status information and last date for assessment for superseded versions**

Process	Version	Date	Last Date for Assessment
Registration	1	21 July 2016	31 December 2027
Revision	2	16 March 2017	31 December 2027
Review	3	25 May 2023	31 December 2027

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