

<b>Title</b>	<b>Demonstrate knowledge of three-phase theory</b>		
<b>Level</b>	<b>4</b>	<b>Credits</b>	<b>4</b>

<b>Purpose</b>	<p>This unit standard covers three-phase theory for 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 three-phase generation;</li> <li>– demonstrate knowledge of three-phase load connections; and</li> <li>– demonstrate knowledge of neutral current in three-phase loads.</li> </ul>
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<b>Classification</b>	Electrical Engineering > Core Electrical
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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 For assessment purposes
  - a Candidates shall be supplied with formulae involving more than three quantities.
  - b Use of a calculator during assessment is permitted.
  - c 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.

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### Outcomes and performance criteria

#### Outcome 1

Demonstrate knowledge of three-phase generation.

#### Performance criteria

- 1.1 A three-phase alternator is described with the aid of a sketch, and with reference to construction and principles of operation.
- 1.2 Alternator output is sketched through one revolution showing the phase displacement of completed output waveforms.

- 1.3 Advantages of three-phase over single-phase supply systems are listed.
- Range conductor size and volume, switch gear current rating, induction motor construction, starting requirements, running torque, size, and power output to size ratio.
- 1.4 Calculations involving the number of poles, speed, and frequency are carried out for three-phase generators from given data.

## Outcome 2

Demonstrate knowledge of three-phase load connections.

### Performance criteria

- 2.1 Three-phase terms are defined and explained with the aid of sketches, in accordance with industry practice.
- Range line, phase, balanced, unbalanced, star, delta, phase sequence.
- 2.2 Relationship between line and phase voltages, and between line and phase currents are explained for star and delta connected loads.
- 2.3 Values of line and phase voltages and currents are calculated from given data for star and delta connected loads.
- 2.4 Power values are calculated from given data for star and delta connected loads.
- 2.5 The relationship between power in star connected loads and power in delta connected loads is determined and conclusions are drawn.

## Outcome 3

Demonstrate knowledge of neutral current in three-phase loads.

### Performance criteria

- 3.1 The effects of balanced and unbalanced loads on the neutral current are explained in terms of the instantaneous sum of the three phase currents.
- 3.2 The advantages of balanced loads are described in terms of low or no neutral current and improved efficiency for generation and distribution companies.
- 3.3 The need for a neutral conductor on an unbalanced star connected load is explained.
- 3.4 Values of neutral current are determined for given star connected three-phase loads by drawing phasor diagrams to scale, and by measurement.
- Range loads – purely resistive, mixed reactive.

<b>Planned review date</b>	31 December 2022
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#### Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	22 April 1994	31 December 2013
Review	2	23 April 1996	31 December 2013
Review	3	10 February 1999	31 December 2013
Review	4	26 May 2005	N/A
Rollover and Revision	5	15 March 2012	N/A
Revision	6	15 January 2014	N/A
Rollover and Revision	7	28 January 2021	N/A

<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>.

#### Comments on this unit standard

Please contact The Skills Organisation [reviewcomments@skills.org.nz](mailto:reviewcomments@skills.org.nz) if you wish to suggest changes to the content of this unit standard.