Title	**Demonstrate knowledge of three-phase theory**		
Level	**4**	**Credits**	**4**

Purpose	This unit standard covers three-phase theory for electricians and related trades. People credited with this unit standard are able to: – demonstrate knowledge of three-phase generation; – demonstrate knowledge of three-phase load connections; and – demonstrate knowledge of neutral current in three-phase loads.

Classification	Electrical Engineering > Core Electrical

Available grade	Achieved

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.

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.

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	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	31 December 2027
Rollover and Revision	5	15 March 2012	31 December 2027
Revision	6	15 January 2014	31 December 2027
Rollover and Revision	7	28 January 2021	31 December 2027
Review	8	25 May 2023	31 December 2027

Consent and Moderation Requirements (CMR) reference	0003

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