

Title	Demonstrate and apply intermediate knowledge of the elements of power engineering		
Level	5	Credits	15

Purpose	<p>This unit standard covers general three-phase circuit theory principles with the focus on power engineering.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> – demonstrate and apply knowledge of three-phase circuit theory; – perform calculations using power in a.c. circuits; and – describe electricity distribution industry meters and metering methods.
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Classification	Electrical Engineering > Core Electrical
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Available grade	Achieved
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Guidance Information

- 1 Recommended skills and knowledge:
Unit 22722, *Demonstrate and apply introductory knowledge of electrical circuit engineering principles*, and Unit 22734, *Demonstrate and apply introductory knowledge of electrotechnology engineering mathematics*; or demonstrate equivalent knowledge and skills.
- 2 This unit standard is intended for use in engineering courses at diploma level.
- 3 This unit standard is one of two that cover knowledge of electrical power engineering and provides a basis for Unit 22725, *Demonstrate and apply advanced knowledge of power system engineering*. It is recommended that competency in this unit standard be achieved before assessment against unit standard 22725 is attempted.
- 4 References
AS/NZS 3000:2018, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*, including Amendment 1;
Electricity Act 1992;
Electricity (Safety) Regulations 2010;
Health and Safety at Work Act 2015;
New Zealand Electrical Codes of Practice (NZECP) 36:1993, *New Zealand electrical code of practice for harmonic levels*, ISSN 0114-0663;
and all subsequent amendments and replacements.
- 5 Definitions
a.c. – alternating current.

Industry practice – practice used and recommended by organisations involved in the electrotechnology industry.

Intermediate knowledge – means employing a broad knowledge base, with substantial depth in some areas of the subject matter, to analyse and interpret a wide range of information.

kVAr – kilovolt-ampere-reactance.

μF – microfarad.

- 6 All measurements are to be expressed in Système International (SI) units, and, where required, converted from Imperial units into SI units.
- 7 All activities must comply with: any policies, procedures, and requirements of the organisations involved; the standards of relevant professional bodies; and any relevant legislative and/or regulatory requirements.
- 8 Range
 - a performance in relation to the outcomes of this unit standard must comply with the Health and Safety at Work Act 2015;
 - b laboratory and workshop safety practices are to be observed at all times.

Outcomes and performance criteria

Outcome 1

Demonstrate and apply knowledge of three-phase circuit theory.

Performance criteria

- 1.1 Three-phase circuits are described and analysed in accordance with industry practice.

Range	star and delta connected three-wire, star connected four wire circuits, three-phase relationships, phase angles.
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- 1.2 Circuit calculations using Millman's theorem and the star-delta transformations are performed.

Range	one calculation involving a three-wire star load, one calculation involving a four-wire star configuration with neutral impedance.
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Outcome 2

Perform calculations using power in a.c. circuits.

Performance criteria

- 2.1 The power developed in single-phase and three-phase circuits is calculated and analysed in accordance with industry practice.

2.2 Power factor correction calculations are performed on single-phase and three-phase circuits in accordance with industry practice.

Range capacitor values in kVAr and μF for single and multiple circuits, balanced and unbalanced loads.

2.3 Causes, effects, and amelioration of harmonics in power systems are explained in accordance with NZECP 36:1993 and industry practice.

Range calculations are performed on single-phase circuits containing complex waves;
evidence of two calculations is required.

Outcome 3

Describe electricity distribution industry meters and metering methods.

Performance criteria

3.1 Common meter types and metering methods used in the electricity distribution industry are described in accordance with industry practice.

Range single-phase power, three-phase power, three-phase kVAr, remote.

3.2 Four tariff systems used by New Zealand electricity retailers are described.

Range terms used for electricity loads, calculation of costs of supply at different tariffs, power factor correction effects on tariffs, load control improvement.

Replacement information	This unit standard replaced unit standard 11565.
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Planned review date	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	18 December 2006	N/A
Rollover and Revision	2	15 March 2012	N/A
Revision	3	15 January 2014	N/A
Rollover and Revision	4	28 January 2021	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>.

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.