

Title	Demonstrate and apply advanced knowledge of power system engineering		
Level	6	Credits	15

Purpose	<p>This unit standard covers knowledge of three-phase power systems with an emphasis on distribution systems.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> – demonstrate knowledge of and compare various methods of earthing; – demonstrate knowledge of power cables; – perform fault calculations on electrical systems; – describe the process of current interruption; – demonstrate knowledge of protection devices; and – describe key components in a protection system.
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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 22723, *Demonstrate and apply intermediate knowledge of the elements of power engineering*, 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, the other being Unit 22723, *Demonstrate and apply intermediate knowledge of the elements of power engineering*, which this unit standard builds on.
- 4 References
 AS/NZS 3000:2007, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*, including Amendment 1;
 Electricity Act 1992;
 Electricity (Safety) Regulations 2010;
 Health and Safety in Employment Act 1992;
 and all subsequent amendments and replacements.

- 5 Definitions
Advanced knowledge – means employing specialised knowledge, with depth in more than one area of the subject matter, to analyse, reformat, and evaluate a wide range of information.
Industry practice – practice used and recommended by organisations involved in the electrotechnology industry.
- 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 in Employment Act 1992;
b laboratory and workshop safety practices are to be observed at all times.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of and compare various methods of earthing.

Performance criteria

- 1.1 Applications of earthing systems are explained in accordance with the Electricity (Safety) Regulations 2010, with the aid of diagrams.
Range evidence of three applications is required.
- 1.2 Terms used in earthing systems are explained in accordance with the Electricity (Safety) Regulations 2010, and industry practice.
Range earthed, earthing system, electrical bonding, earth bonding, equipotential bonding.
- 1.3 Components of earthing systems are described with the aid of wiring diagrams in terms of their function and operation.
- 1.4 Earthing systems are identified and compared in terms of application and practicality in accordance with industry practice.

Outcome 2

Demonstrate knowledge of power cables.

Performance criteria

2.1 Power cable construction and applications are described.

Range insulation, conductor material, formation of conductors, current capacity, capacitance, inductance, losses, and installation.

2.2 The principles of electrical reticulation within buildings and outdoor installations are described in terms of the intent and application of the Electricity (Safety) Regulations 2010 and AS/NZS 3000:2007.

Range radial, ring main and rising main distribution systems, installation of cable commonly used for industrial and commercial installations.

Outcome 3

Perform fault calculations on electrical systems.

Performance criteria

3.1 Causes of faults and their effect on electrical equipment are explained.

Range partial short circuit, short circuit; limiting fault current by generator reactance, reactors, and bus bar sectioning; electromagnetic, heating, and arcing effects during fault conditions.

3.2 Fault magnitudes are calculated for both symmetrical and asymmetrical faults.

Range the per unit system, faults on high voltage and low voltage systems.

Outcome 4

Describe the process of current interruption.

Performance criteria

4.1 Current interruption is explained in terms of the various parameters on a current interruption oscillogram.

Range recovery voltage, restriking voltage, current chopping, arc current.

Outcome 5

Demonstrate knowledge of protection devices.

Performance criteria

- 5.1 Current making and breaking capacities for various types of switchgear are compared in accordance with industry practice.
- Range evidence of five required.
- 5.2 Operation and use of autoreclosers and sectionalisers are explained in accordance with industry practice.
- 5.3 Operation and use of fuses and dropout fuses are explained in accordance with industry practice.
- 5.4 Operation of common types of protection relays is explained in accordance with industry practice.
- Range types of relays, principles of operation, speed of operation in accordance with industry practice.
- 5.5 Operation principles of current and voltage transformers are explained in terms of various construction types in accordance with industry practice.
- Range evidence of two current transformers and two voltage transformers is required.

Outcome 6

Describe key components in a protection system.

Performance criteria

- 6.1 Key components in a protection system are described with the aid of diagrams.
- Range terminology; unit, graded, and distance protection; primary and backup protection; relay settings.
- 6.2 The operation and application of a protection system is described in accordance with industry practice.

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	18 December 2006	31 December 2021
Rollover and Revision	2	15 March 2012	31 December 2021
Revision	3	15 January 2014	31 December 2021
Review	4	28 January 2021	31 December 2021

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>.