

<b>Title</b>	<b>Demonstrate knowledge of circuit protection</b>		
<b>Level</b>	<b>3</b>	<b>Credits</b>	<b>3</b>

<b>Purpose</b>	<p>This unit standard is for electricians and related trades who need to understand and select devices for the protection of electrical circuits.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> <li>– demonstrate knowledge of circuit protection terms and principles;</li> <li>– demonstrate knowledge of circuit protection devices;</li> <li>– demonstrate knowledge of residual current devices (RCDs); and</li> <li>– select circuit protection devices for electrical applications.</li> </ul>
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<b>Classification</b>	Electrical Engineering > Electrical Installation and Maintenance
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<b>Available grade</b>	Achieved
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**Explanatory notes**

- 1 This unit standard has been developed for learning and assessment off-job.
- 2 This unit standard and unit standards 5932, 15848, and 25070 together meet the assessment requirements of ERAC CEPC 5.  
 This unit standard and unit standards 5932, 15848, 17602, 29465, and 29480 together meet the assessment requirements of ERAC CEPC 10.  
 This unit standard and unit standards 5932, 15848, 29443, 29444, and 29480 together meet the assessment requirements of ERAC EPC 12.  
 This unit standard and unit standards 5931, 5932, 29419, 15848, and 29480 together meet the assessment requirements of ERAC CEPC 23.  
 This unit standard and unit standards 5931, 5932, 15848, 29419, 29426, 29430, 29440, 29471, and 29480 together meet the assessment requirements of ERAC CEPC 24.  
 This unit standard and unit standards 5931, 5932, 15848, 29419, 29430, 29440, and 29474 together meet the assessment requirements of ERAC CEPCs and 37.
- 3 Definitions  
*CEPC* – Critical Essential Performance Capability.  
*ELCB* – earth-leakage circuit-breaker.  
*EPC* – Essential Performance Capability.  
*ERAC* – Electrical Regulatory Authorities Council.  
*EWRB* – Electrical Workers Registration Board.  
*GFI* – ground-fault interrupter.  
*HRC* – high rupturing current.

*Industry practice* – those practices that competent practitioners within the industry recognise as current industry best practice.

*PSC* – prospective short-circuit current.

*RCBO* – residual current-operated circuit breaker with overcurrent protection.

*RCCB* – residual current-operated circuit breaker.

*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)*.

#### 4 Range

- 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 evidence requirements 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 evidence requirements

### Outcome 1

Demonstrate knowledge of circuit protection terms and principles.

#### Evidence requirements

1.1 Explain the meanings of five circuit protection terms.

Range may include but is not limited to – rated current, voltage rating, fusing current (fusing factor, tripping factor), utilisation category, classes of fuses and circuit breakers, cut-off characteristic, time vs current characteristic, category of duty, discrimination, back-up protection, rupturing capacity (breaking capacity), prospective short-circuit current (PSC), coarse excess-current protection, close excess-current protection, sensitivity.

1.2 State the relationship between fusing or tripping current, current rating, and fusing or tripping factor for a protective device.

1.3 Explain the merits of providing close excess-current protection.

1.4 Describe the three effects of electrical faults in terms of the danger to people and property.

Range faults – leakage current, over current, short circuit; effects may include but are not limited to – electromechanical energy, heat energy, damaged cables and equipment, fire,

explosion, electric shock.

1.5 Explain the need for rapid disconnection of faulty circuits.

## Outcome 2

Demonstrate knowledge of circuit protection devices.

### Evidence requirements

2.1 Describe protection devices with the aid of diagrams and reference to construction and operating principles.

Range devices – rewirable, cartridge and high rupturing capacity (HRC) fuses, miniature circuit-breaker (mcb), magnetic and thermal overload relays, fuses (including miniature glass cartridge type), fusible links.

2.2 Identify two fuse cartridge type and size from physical or graphical representations of cartridge markings.

2.3 Classify protection devices according to their ability to provide either coarse or close excess-current protection.

Range rewirable fuse, HRC fuse, miniature circuit breaker.

2.4 Compare time versus current curves of rewirable fuses, HRC fuses, and miniature circuit breakers in terms of speed of operation and accuracy of calibration.

2.5 Describe three effects of poor selection of protective devices for three different fault conditions.

Range poor selection may include but is not limited to – underrated, overrated, incorrect utilisation category, classes of fuses and circuit breakers, fusing or tripping factor, rupturing capacity; fault conditions may include but is not limited to – overload, short-circuit, earth leakage fault, mechanical overload, loss of one phase in a motor, excessive earth leakage.

2.6 Describe a three-phase protective device with reference to construction, operating principle, and protection afforded additional to that of a single-phase circuit.

2.7 Give practical demonstrations of resetting or reloading protective devices.

Range HRC fuse, rewirable fuse, circuit breaker, thermal overload.

## Outcome 3

Demonstrate knowledge of residual current devices (RCDs).

**Evidence requirements**

3.1 Explain RCD terms.

Range residual current-operated circuit breaker (RCCB), residual current-operated circuit breaker with overcurrent protection (RCBO), portable residual current device (PRCD), socket residual current device (SRCD).

3.2 Describe an RCD with reference to construction and principle of operation.

3.3 Describe procedures for testing RCD and record the operating times.

Range personal protection, property protection, medical area protection, schools.

3.4 Describe precautions to be taken when testing circuits containing RCDs.

3.5 Provide three examples of situations requiring RCD protection.

**Outcome 4**

Select circuit protection devices for electrical applications.

**Evidence requirements**

4.1 Select protection device to meet the application requirements in terms of electrical protection characteristic, speed of operation, and reset method.

Range overload, short circuit, locked rotor, phase failure, phase reversal;

4.2 State and compare relative merits of devices where more than one device meets the application requirements.

<b>Replacement information</b>	This unit standard replaced unit standard 755, unit standard 1207, and unit standard 1708.
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<b>Planned review date</b>	31 December 2019
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**Status information and last date for assessment for superseded versions**

Process	Version	Date	Last Date for Assessment
Registration	1	10 February 1999	31 December 2013
Revision	2	3 April 2001	31 December 2013
Review	3	26 May 2005	31 December 2021

Process	Version	Date	Last Date for Assessment
Rollover and Revision	4	15 March 2012	31 December 2021
Revision	5	15 January 2014	31 December 2021
Review	6	21 July 2016	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>.

### Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

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### Comments on this unit standard

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