Title	**Demonstrate knowledge of electric circuit design, control, and protection**		
Level	**3**	**Credits**	**6**

Purpose	This unit standard is for electricians and related trades, who need to design, draw, and understand electrical installation, control, and electrical protection diagrams. People credited with this unit standard are able to: – design, draw, and explain control circuits; – design, draw, and explain circuits used to protect electrical circuits from static electricity and magnetic interference; – design, draw, and explain electrical protection circuits; – design, draw, and explain lighting circuits; and – prepare electrical functional drawings for an electrical installation to a given specification.

Classification	Electrical Engineering > Core Electrical

Available grade	Achieved

Guidance Information

1 This unit standard has been developed for learning and assessment off-job.

2 This unit standard and unit standards 5932, 15848, 15855, 17602, 29429, and 29465 together meet the assessment requirements of ERAC CEPC 10.
This unit standard and unit standards 5932, 15848, 15855, 29443, and 29444 together meet the assessment requirements of ERAC EPC 12.
This unit standard and unit standard 1204 and 16415 together meet the assessment requirements of ERAC CEPC 20.
This unit standard and unit standards 5931, 5932, 15848, 15855, 29419, and 29430 together meet the assessment requirements of ERAC CEPC 23.
This unit standard and unit standards 5931, 5932, 15848, 15855, 29419, 29430, 29440, and 29471 together meet the assessment requirements of ERAC CEPC 24.
This unit standard and unit standards 15870 and 29419 together meet the assessment requirements of ERAC CEPC 27.
This unit standard and unit standards 29419, 29422, 29472, and 29481 together meet the assessment requirements of ERAC EPC 41.
This unit standard and unit standards 29443 and 29444 meet the assessment requirements of ERAC EPC 52.

3 Definitions

CAD – computer aided design.
CEPC – Critical Essential Performance Capability.
EPC – Essential Performance Capability.
ERAC – Electrical Regulatory Authorities Council.
EWRB – Electrical Workers Registration Board.
Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.
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 Both hand drawing and CAD are to be used during assessment.
b Standard symbols to be used for all assessments.
c Candidates may refer to current legislation and Standards during assessment.
d Demonstration of safe working practices and installation in accordance with *safe and sound practice* are essential components of assessment of this unit standard.
e All activities and evidence presented for all outcomes and performance criteria 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.

Outcomes and performance criteria

Outcome 1

Design, draw, and explain control circuits.

Range control circuits – three-heat switch, energy regulator (simmerstat), thermostat, direct on-line motor starter, lighting control with light sensor and timer, direct current circuits.

Performance criteria

1.1 Design control circuits for four different types of equipment requiring control.

1.2 Draw diagrams to represent the circuit.

1.3 Explain circuit operation logically with reference to the purpose of each component and the time sequence of events.

Outcome 2

Design, draw, and explain circuits used to protect electrical circuits from static electricity and magnetic interference.

Performance criteria

2.1 Design circuits used to protect electrical circuits from static electricity and magnetic interference.

2.2 Draw diagrams to represent the circuit.

2.3 Explain circuit operation logically with reference to the purpose of each component and the time sequence of events.

Outcome 3

Design, draw, and explain electrical protection circuits.

Performance criteria

3.1 Design circuits that include electrical protection devices for four different types of equipment requiring protection.

Range protection 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.

3.2 Draw diagrams to represent the circuit.

3.3 Explain circuit operation logically with reference to the purpose of each component, why the type of protection was selected, and the time sequence of events.

Outcome 4

Design, draw, and explain lighting circuits.

Performance criteria

4.1 Design lighting circuits.

Range one-way, two-way two strap, two-way three strap, intermediate switching, electrical protection.

4.2 Draw diagrams to represent the circuit.

4.3 Explain circuit operation and protection logically with reference to the purpose of each component.

Outcome 5

Prepare electrical functional drawings for an electrical installation to a given specification.

Range evidence is required of a set of related drawings using standard symbols and labelling techniques, with symbol legend, for one installation.

Performance criteria

5.1 Prepare diagrams that are electrically functional and meet specification requirements.

5.2 Draw site plan.

Range diagram includes at least – meter board, switchboard, distribution board if specified, mains entry point, protection, main earth location, mains cable route, control.

5.3 Draw location diagram.

Range diagram includes at least – main switchboard, protection, control, lights, light switches, power outlets, fixed wired appliances, water heating, security alarm components, smoke detectors.

5.4 Draw power distribution line diagram.

Range diagram includes at least – mains cable, submains if specified, subcircuits, protection, switches, revenue meters, off-peak power control. All cables must be labelled for size and type.

Replacement information	This unit standard and unit standard 29479 replaced unit standard 15845 and unit standard 15854.

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	21 July 2016	31 December 2027
Revision	2	16 March 2017	31 December 2027
Review	3	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.