Title	**Demonstrate knowledge of power engineering**		
Level	**5**	**Credits**	**15**

Purpose	People credited with this unit standard are able to: • demonstrate knowledge of advanced three-phase circuit theory • demonstrate and apply knowledge of AC power in electrical circuits • demonstrate and apply knowledge of the importance of electrical MEN earthing and bonding systems in the transmission and distribution of electricity in New Zealand • demonstrate knowledge of electricity industry distribution meters, metering methods and retailer electricity tariff systems • demonstrate knowledge of commercial or industrial building's electrical mains supply services. This standard provides electricity supply industry power technicians with the fundamental knowledge of power protection and control network theory, and hardware.

Classification	Electricity Supply > Electricity Supply - Power System Maintenance

Available grade	Achieved

Guidance Information

1 Evidence presented for assessment against this unit standard must be consistent with safe working practices and be in accordance with applicable legislative and industry requirements.

2 Legislation, regulations and/or industry standards relevant to this unit standard include but are not limited to:
- Electricity Act 1992
- Health and Safety at Work Act 2015
- Electricity supply industry codes of practice and documented enterprise procedures, including *Safety Manual – Electricity Industry* (SM-EI) and relevant EEA guides available from www.eea.co.nz

and any subsequent amendments and replacements

3 Definitions
AC – alternating current.
HRC – high rupturing capacity.
kVAr – kilovolt amperes reactive.
MEN – multiple earth neutral.

4 It is recommended that Unit 29732, *Demonstrate knowledge of electrical principles in power engineering*, and Unit 29734, *Demonstrate knowledge of power engineering mathematics* be achieved, or equivalent knowledge and skills are demonstrated, prior to assessment of this standard.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of advanced three-phase circuit theory.

Range balanced and unbalanced.

Performance criteria

1.1 Three phase circuits and configurations are described with complex loads.

Range star and delta connected three-wire, star connected four wire circuits.

1.2 Three phase circuit calculations using complex notation are performed for reactive balanced and unbalanced loads.

Range star and delta connected three-wire, star connected four wire circuits.

1.3 Star-delta transformations are performed using Millman’s theorem.

Outcome 2

Demonstrate and apply knowledge of AC power in electrical circuits.

Range balanced and unbalanced.

Performance criteria

2.1 The power developed in single-phase and three-phase circuits is explained.

Range true and reactive power.

2.2 Single and three phase power circuit calculations are performed and confirmed by practical measurement.

Range true and reactive power using two or three wattmeter measurement.

2.3 Single and three phase power factor correction concepts are explained, calculations are performed and confirmed by practical measurement.

Range capacitor values in kVAr for single and three phase circuits.

2.4 Causes of, effects on electrical supply quality, and measurement and reduction techniques of harmonics in power systems are explained.

Range calculations are performed on single-phase circuits containing complex waves.

Outcome 3

Demonstrate and apply knowledge of the importance of electrical MEN earthing and bonding systems in the transmission and distribution of electricity in New Zealand.

Range electrical safety, system protection.

Performance criteria

3.1 The application of earthing systems is explained with the aid of diagrams, in accordance with the Electricity Regulations for works and installations.

3.2 Sources that cause development of hazardous step and touch voltages in electrical installations or works are explained.

Range may include – lightning strikes, fault currents.

3.3 Methods of reducing hazardous voltage exposure during faults in electrical installations or works are explained.

Range grounding, earthing and bonding.

3.4 Factors that reduce effective grounding, earthing and bonding in an electrical installation or works are explained.

Range may include – site layout, soil resistivity, climatic conditions, size and length of earthing and bonding conductors, placement of earthing electrodes, condition of terminations and electrodes; evidence of three factors is required.

3.5 Methods of measuring the resistance of earthing electrodes and soil resistivity are investigated and tests conducted.

Range Two tests on earth electrodes and soil types to be conducted using earth resistance testers.

Outcome 4

Demonstrate knowledge of electricity industry distribution meters, metering methods and retailer electricity tariff systems.

Performance criteria

4.1 Common meter types and metering methods used in the electricity distribution industry are described.

Range single-phase power, three-phase power, three-phase kVAr, smart meters.

4.2 Methods of making energy meters tamper proof are identified.

4.3 New Zealand's electricity retailers tariff system and categories 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.

Outcome 5

Demonstrate knowledge of commercial or industrial building's electrical mains supply services.

Performance criteria

5.1 Methods of providing electrical reticulation within electrical works or installation are described.

Range mains, submains, radial, ring main and rising main distribution systems.

5.2 Cables used for providing electrical reticulation in buildings are selected in accordance with industry practice.

Range based on demand load, cable temperature ratings, fault current level, and installation situation;
evidence of one practical industrial or commercial building installation is required.

5.3 The construction and operating parameters of protective devices used for the protection of electrical cables are identified and described.

Range HRC fuses, miniature circuit breakers (MCB), residual current detectors (RCD).

5.4 The co-ordination and discrimination operation of protective devices is explained.

5.5 The importance of low conductor and earthing resistance for operation of protective devices is explained.

Planned review date	31 December 2025

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	20 July 2017	N/A
Rollover and Revision	2	2 March 2023	N/A

Consent and Moderation Requirements (CMR) reference	0120

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

Comments on this unit standard

Please contact Waihanga Ara Rau Construction and Infrastructure Workforce Development Council at qualifications@WaihangaAraRau.nz if you wish to suggest changes to the content of this unit standard.