

Title	Demonstrate and apply knowledge of complex power protection engineering		
Level	6	Credits	12

Purpose	People credited with this unit standard are able to demonstrate knowledge of: <ul style="list-style-type: none"> • applying complex protection to electricity transmission and distribution networks, • complex protection schemes applied to electricity generators or transmission and distribution substation buses and power transformers; and • apply settings, and test protection equipment.
----------------	--

Classification	Electricity Supply > Electricity Supply - Power System Maintenance
-----------------------	--

Available grade	Achieved
------------------------	----------

Prerequisites	Unit 29736, <i>Demonstrate and apply knowledge of power system protection in the electricity supply industry.</i>
----------------------	---

Guidance Information

Performance and work practices in relation to the outcomes and evidence requirements must comply with all current legislation, in particular:

- the Electricity Act 1992 and any subsequent amendments, and any regulations, codes of practice recognised under that statute;
- the Health and Safety at Work Act 2015, the Resource Management Act 1991, and their subsequent amendments;
- any electricity supply industry codes of practice and documented enterprise procedures. These include, *Safety Manual – Electricity Industry (SM-EI)* (parts 1, 2 and 3) Wellington: Electricity Engineers' Association.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of applying complex protection to electricity transmission and distribution networks.

Performance criteria

- 1.1 The factors influencing line protection are described.
- Range includes but is not limited to – load transfer, system stability, fault clearing time, line length, communication, system feeding line, configuration of line, physical construction, line loading, protection equipment, lightning strikes.
- 1.2 The two different protection options available for transmission or distribution systems for fast fault clearance with selective tripping are compared.
- 1.3 The concepts of applying line protection are explained.
- Range may include – pilot, line current differential, line phase comparison, line differential, directional overcurrent, stepped distance.
- 1.4 The concept of advanced distance protection of transmission or distribution lines is explained.
- 1.5 The characteristics of a distance relay are explained.
- Range may include – Mho, quadrilateral, offset Mho, under reach, over reach.
- 1.6 Test and setup procedures for substation or line protection relays is explained.
- Range may include – pilot, line current differential, line phase comparison, line differential, directional overcurrent, stepped distance.

Outcome 2

Demonstrate knowledge of complex protection schemes applied to electricity generators or transmission and distribution substation buses and power transformers.

Range evidence of two protection schemes is required.

Performance criteria

- 2.1 The concept of applying protection to generator or bus and/or power transformer protection is explained.
- Range may include – directional overcurrent/power, overload, differential, bus bar protection (three schemes), directional overcurrent, over temperature, pressure, gassing, over speed, excitation, machine stator and rotor windings, transformer primary and secondary windings, earth faults, overvoltage, negative sequence.
evidence of three protection concepts is required.

2.2 Single line drawings are drawn and explained showing how protection schemes are applied.

2.3 Test and setup procedures for generator or bus and/or power transformer protection relays are explained.

Range may include – directional overcurrent/power, overload, differential, bus bar protection (three schemes), directional overcurrent, over temperature, pressure, gassing, over speed, excitation, machine stator and rotor windings, transformer primary and secondary windings, earth faults, overvoltage, negative sequence. evidence of two procedures is required.

Outcome 3

Apply settings, and test protection equipment.

Range may include – pilot, line current differential, line phase comparison, line differential, directional overcurrent, stepped distance, negative sequence, zero sequence, distance, overcurrent, overload, high impedance, pressure, gassing, over speed, excitation, stator and rotor windings, primary and secondary windings, over voltage, earth faults. evidence of four different types of protection schemes is required.

Performance criteria

3.1 Work test, isolation and safety plans are prepared and implemented, and communicated and managed during tests.

3.2 Plant and equipment is isolated and relay prepared for setting and testing.

3.3 The selected settings or tests are carried out in accordance with the standard procedures and commissioning plan, or as specified by the asset owner or equipment supplier.

3.4 The results of the tests and inspections are accurately analysed and recorded as required by standard documentation or as specified by the asset owner.

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	20 July 2017	31 December 2024
Review	2	2 March 2023	31 December 2024

Consent and Moderation Requirements (CMR) reference

0120

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