

<b>Title</b>	<b>Operate electrical switchgear in the electricity supply industry</b>		
<b>Level</b>	<b>4</b>	<b>Credits</b>	<b>10</b>

<b>Purpose</b>	People credited with this unit standard are able to: demonstrate knowledge of electrical switchgear commonly used in electricity supply systems; describe the operating principles of switchgear commonly used in electricity supply systems; identify and communicate switchgear status; operate electrical switchgear under normal service conditions; operate electrical switchgear in response to unplanned events; and report on electrical switchgear operation.
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<b>Classification</b>	Electricity Supply > Electricity Supply - Core Skills
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<b>Available grade</b>	Achieved
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### 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 the current version of the Resource Management Act 1991; Health and Safety at Work Act 2015; Electricity Act 1992; Electricity (Safety) Regulations 2010; and any subsequent amendments and replacements; Electricity supply industry codes of practice and documented enterprise procedures, including *Safety Manual – Electricity Industry (SM-EI) (2015)* available at [www.eea.co.nz](http://www.eea.co.nz).
- 3 Definitions  
*Asset owner* refers to a participant who owns or operates assets used for generating or conveying electricity.  
*HV* means 'high voltage' and refers to voltages exceeding 1000V.  
*Industry requirements* include all asset owner requirements; manufacturers' specifications; and enterprise requirements which may include the documented workplace policies, procedures, specifications, business, and quality management requirements relevant to the workplace in which assessment is carried out.  
*Normal service conditions* refer to all service conditions with the exception of switch under fault conditions.  
*SF6* is an abbreviation of sulphur hexafluoride.  
*Status* refers to the operational condition or state of any or all of the components of an electrical power system, relative to its expected or required performance level.

- 4 It is recommended people achieve Unit 18038, *Describe health and safety duties on electricity supply sites*, or demonstrate equivalent knowledge and skills, before being assessed against this unit standard.

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## Outcomes and performance criteria

### Outcome 1

Demonstrate knowledge of electrical switchgear commonly used in electricity supply systems.

Range circuit breakers (CBs), disconnectors, air break switches (ABS), earth switches.

### Performance criteria

1.1 The functions of electrical switchgear are described with reference to the ability to switch under fault, load, and no-load conditions.

1.2 The principles of operation and the construction of electrical switchgear are described.

Range bulk oil, minimum oil, SF6, vacuum, air blast, air break.

1.3 The component parts of electrical switchgear are described.

Range contacts, arc chutes or splitters, arc extinguishing medium, operating rods, insulators, closing mechanisms, release mechanisms, anti-pumping mechanisms, racking mechanism, closing and trip coils, auxiliary contacts, direct current (DC) control fuses, alternating current (AC) drive fuses, trip circuit supervision, slow closing mechanism, electrical and mechanical interlocks.

1.4 The types and functions of stored energy systems used on circuit breakers are described.

Range hydraulic, pneumatic, motor or hand charged springs CB, capacitors, batteries.

1.5 The switchgear numbering system is described for HV switchgear.

### Outcome 2

Describe the operating principles of switchgear commonly used in electricity supply systems.

### Performance criteria

2.1 The ratings of switchgear are described.

Range rated voltage, rated current, fault making ratings, fault breaking ratings, fault carrying ratings, operation duty (number of operations able to be completed and dead time in between operations).

- 2.2 The factors that may affect the rating of switchgear are described.
- Range power factor, capacitive current, magnetising current, duty cycles, circuit loop current, point on wave switching.
- 2.3 The function of reclosers and line sectionalisers is described.
- 2.4 The impacts of the Resource Management Act 1991 on the operation of switchgear are described.

### Outcome 3

Identify and communicate switchgear status.

Range type of switchgear, switching capability, load currents, indications, alarms, healthy trip, open, closed, isolated, isolated and earthed, protective relay flaggings, operations counter, loggings, service requirements; may include – insulant levels, SF6 pressure, air pressure, hydraulic pressure, pump and/or compressor starts or running times, springs charging status.

#### Performance criteria

- 3.1 Equipment is correctly identified.
- 3.2 Equipment status is determined.
- Range locally, equipment status flags, operator control screens and/or panels.

### Outcome 4

Operate electrical switchgear under normal service conditions.

Range open, close, isolate, manual, local and remote operation.

#### Performance criteria

- 4.1 Electrical switchgear operation is carried out in accordance with industry safety rules, company procedures, and ensuring that security of supply is maintained.
- 4.2 The equipment is safely operated.
- Range includes but is not limited to – switchyard or substation layout, switchgear identification, interlocking systems.
- 4.3 Switching sequences to operate equipment are carried out in accordance with organisational requirements.
- Range checked, actioned, recorded, reported.

## Outcome 5

Operate electrical switchgear in response to unplanned events.

Range includes but is not limited to – protection operation, alarms, fuse replacement.

### Performance criteria

5.1 System or situation is stabilised.

Range may include but is not limited to – alarms reset, protection reset, notification of engineering and/or maintenance support.

5.2 The event and/or cause of event is identified using available resources.

Range may include but is not limited to – alarms and protective relays identified, events lists, event recording charts, alarm lists, site information, public advice.

5.3 The impact of the event on system operation is determined and responded to.

Range local control, remote control, fault response, contingency plans, emergency operating procedures, restoration of supply.

5.4 The event is analysed to identify options to remedy or mitigate undesired conditions and identify future actions.

Range may include but is not limited to – event reporting procedures, switchgear manuals, maintenance management systems, logbook, event lists, relay flag sheets, plant history records.

5.5 The event is reported.

Range may include but is not limited to – local instructions, event reporting standards, Health and Safety at Work Act 2015, Electricity Act 1992, Electricity Industry Participation Code 2010.

5.6 The response to abnormal conditions is described.

Range switchgear fault, switchgear in distress, failure to open all phases, failure to close all phases, busbar protection operation, trip fail alarm, loss of air or gas pressure, disconnector or earth switch welded contacts.

## Outcome 6

Report on electrical switchgear operation.

Range includes but is not limited to – log book, entry approval, operating orders and switching sheets, plant outage requests.

**Performance criteria**

- 6.1 Information is recorded in a complete, concise, and legible manner.
- 6.2 Reported information is recorded in the required format and filed within the scheduled time frame according to industry specifications.

<b>Planned review date</b>	31 December 2025
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**Status information and last date for assessment for superseded versions**

Process	Version	Date	Last Date for Assessment
Registration	1	26 August 1997	31 December 2013
Review	2	21 November 2001	31 December 2013
Revision	3	10 September 2004	31 December 2013
Rollover and Revision	4	20 June 2008	31 December 2013
Review	5	9 December 2010	31 December 2013
Review	6	17 November 2011	31 December 2022
Review	7	27 February 2020	31 December 2022
Review	8	27 August 2020	N/A

<b>Consent and Moderation Requirements (CMR) reference</b>	0120
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

**Comments on this unit standard**

Please contact Connexis - Infrastructure Industry Training Organisation [qualifications@connexis.org.nz](mailto:qualifications@connexis.org.nz) if you wish to suggest changes to the content of this unit standard.