

<b>Title</b>	<b>Demonstrate and apply knowledge of excitation systems on electrical machines</b>		
<b>Level</b>	<b>5</b>	<b>Credits</b>	<b>6</b>

<b>Purpose</b>	People credited with this unit standard are able to demonstrate knowledge of: <ul style="list-style-type: none"> <li>• the construction and operation of three phase power rectification systems,</li> <li>• direct current excitation of synchronous alternators,</li> <li>• synchronous alternator AVR systems,</li> </ul> and carry out maintenance or acceptance tests on excitation and AVR systems used on synchronous alternators.
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<b>Classification</b>	Electricity Supply > Electricity Supply - Power System Maintenance
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<b>Available grade</b>	Achieved
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### Guidance Information

#### 1 Definitions

*Asset owner* refers to the owner of an electricity generation equipment that delivers to point of supply to Transpower NZ or other local reticulation systems, and delivers electricity to industrial, commercial and residential customers.

*Industry requirements* include all asset owner requirements; manufacturers' specifications; and enterprise requirements which cover the documented workplace policies, procedures, specifications, business, and quality management requirements relevant to the workplace in which assessment is carried out.

*AVR* – automatic voltage control.

*HVDC* – high voltage direct current.

*PWM* – pulse wave modulation.

#### 2 Safety of personnel and plant must be a priority throughout the assessment. If the safety requirements are not met the assessment must stop.

### Outcomes and performance criteria

#### Outcome 1

Demonstrate knowledge of the construction and operation of three phase power rectification systems.

Range half wave, full wave, controlled, six pulse, twelve pulse.

**Performance criteria**

- 1.1 The key system components used in three phase rectifier systems are described.
- 1.2 The operating principles are explained for uncontrolled rectification.
- 1.3 The operating principles are explained for controlled rectification.  
Range may include – line commutated, forced commutated, PWM.
- 1.4 Applications for controlled rectification are explained.  
Range may include – machine drives, excitation systems, HVDC.

**Outcome 2**

Demonstrate knowledge of direct current excitation of synchronous alternators.

**Performance criteria**

- 2.1 The types of exciters used to control synchronous alternators are described.  
Range may include – direct current commutation, static, brushless.
- 2.2 The control excitation has on synchronous alternators is explained.  
Range standalone, infinite bus.
- 2.3 The conditions under which excitation will make the machine unstable are described.

**Outcome 3**

Demonstrate knowledge of synchronous alternator AVR systems.

**Performance criteria**

- 3.1 The functions provided by AVRs are described.  
Range may include – field current limits, volts/hertz, machine stabiliser, automatic tracking.
- 3.2 The key components in an AVR system are described.
- 3.3 The AVR loop diagram is described.  
Range may include – machine voltage, stability, reactive and real power, system response.

**Outcome 4**

Carry out maintenance or acceptance tests on excitation and AVR systems used on synchronous alternators.

**Performance criteria**

- 4.1 Two tests are carried out and documented in accordance with industry requirements, or as specified by the asset owner.
- 4.2 Test results are interpreted, analysed and documented for compliance with industry requirements, or as specified by the asset owner.
- 4.3 Maintenance or re-calibration is undertaken to remedy any test errors or faults.

**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>.