

<b>Title</b>	<b>Demonstrate knowledge of electric machine winding</b>		
<b>Level</b>	<b>4</b>	<b>Credits</b>	<b>5</b>

<b>Purpose</b>	<p>This unit standard is for people intending to qualify in the electrical industry in motor rewinding and repair. It provides the underpinning knowledge for those people who have responsibility for the refurbishment of electric machines. This includes dismantling, stripping, rewinding, assembling and testing electric machines.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> <li>– identify machine design features;</li> <li>– read and interpret electrical diagrams to describe machine windings;</li> <li>– interpret machine manufacturer's technical information;</li> <li>– describe coil winding and testing methods; and</li> <li>– demonstrate knowledge of insulation used in electric machines.</li> </ul>
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<b>Classification</b>	Electrical Engineering > Electrical Machines
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<b>Available grade</b>	Achieved
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### Guidance information

- 1 This unit standard has been developed for learning and assessment on-job.
- 2 Definitions
  - Industry practice* – those practices that competent practitioners within the industry recognise as current industry best practice.
  - Machines* – electric motors, generators, regulators, transformers, and other similar equipment having windings.

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### Outcomes and performance criteria

#### Outcome 1

Identify machine design features.

**Performance criteria**

1.1 Identify design features of machines in accordance with industry practice.

Range design features – generator, motor, and transformer; alternating current (a.c.) or direct current (d.c.), single-phase and three-phase; cage rotor, wound rotor and slip-rings, armature and commutator; salient poles, main poles, other poles; number of poles.

**Outcome 2**

Read and interpret electrical diagrams to describe machine windings.

**Performance criteria**

2.1 Describe winding characteristics for rotor and stator.

Range concentric, lap and wave windings.

2.2 Describe coil connections for each type of winding.

Range series, parallel.

2.3 Describe coils per slot, coils per group, and groups per pole.

2.4 Describe winding connection methods.

Range star and delta; series, shunt, and compound; separate, dual, tapped windings; progressive and regressive armature connections.

**Outcome 3**

Interpret machine manufacturers' technical information.

**Performance criteria**

3.1 Interpret data from manufacturer's technical information sheets.

3.2 Explain rating plate data including the insulation class.

3.3 Present and explain examples of typical machine data for a.c. and d.c. motors and generators.

Range coils per slot, number of turns per coil, direction of turns; size of conductor; coil shape and dimensions; insulation types, thickness and layers, coil pitch, commutator pitch.

**Outcome 4**

Describe coil winding and testing methods.

**Performance criteria**

- 4.1 Describe winding equipment in accordance with electrical diagrams.
- Range construction, set-up procedures, operation, and maintenance.
- 4.2 Describe coil winding methods in terms of machine types, equipment used, advantages, and disadvantages.
- 4.3 Describe winding and connection tests.
- Range tests – open circuits, short-circuited turns, abnormal resistance, inductance, impedance.

**Outcome 5**

Demonstrate knowledge of insulation used in electric machines.

**Performance criteria**

- 5.1 Describe machine insulation materials in terms of machine type and application.
- Range insulation materials – varnishes, mica and its derivatives, fibre, tape, insulation cloths, slot liners;  
properties – physical strengthening and filling abilities, dielectric strength, rigidity, imperviousness to moisture, dust, dirt, oil, corrosive substances.
- 5.2 Describe machine insulation selection, installation, and application methods.
- Range brushing, spraying, dipping, vacuum pressure impregnation, baking.

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<b>Replacement information</b>	This unit standard and unit standard 19470 replaced unit standard 1198.
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<b>Planned review date</b>	31 December 2023
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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 2002	31 December 2013
Revision	2	19 April 2005	31 December 2013
Review	3	22 August 2008	31 December 2023
Rollover and Revision	4	15 March 2012	31 December 2023
Revision	5	15 January 2014	31 December 2023
Review	6	22 August 2019	N/A

**Consent and Moderation Requirements (CMR) reference**

0003

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

**Comments on this unit standard**

Please contact The Skills Organisation [reviewcomments@skills.org.nz](mailto:reviewcomments@skills.org.nz) if you wish to suggest changes to the content of this unit standard.