

Title	Demonstrate and apply electrical and electronic knowledge to mechanical engineering systems		
Level	5	Credits	15

Purpose	<p>People credited with this unit standard are able to: demonstrate and apply knowledge of the function and performance of electrical components in mechanical engineering systems; select electrical components to meet mechanical engineering operational requirements; Identify causes of electrical and/or electronic faults in mechanical engineering systems; and explain the function and performance of electronic components and subsystems in mechanical engineering systems.</p> <p>This unit standard applies to mechanical engineering systems that contain electrical components and systems, and electronic subsystems. It is designed to provide technician mechanical engineers with a working knowledge of electrical principles, properties, and components, and electronic principles, components, and control systems so that they can communicate requirements to, and interact with, electrical and electrotechnical personnel.</p>
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Classification	Mechanical Engineering > Applied Principles of Mechanical Engineering
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Available grade	Achieved
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Entry information	
Recommended skills and knowledge	Previously acquired competence in the transposition of formulae, the manipulation of equations, and the use of trigonometric functions; and have previously acquired understanding of fundamental concepts of physics (mass, length, time, charge, and current) and their derived units, including voltage, resistance, pressure, force, gravitational effect, velocity, acceleration, energy, and power.

Explanatory notes

- References
Health and Safety at Work Act 2015 and supporting Regulations.

2 Definitions

Accepted industry practice refers to approved codes of practice and standardised procedures accepted by the wider mechanical engineering industry sectors as examples of best practice.

Workplace procedures refer to procedures used by the organisation carrying out the work and applicable to the tasks being carried out. They may include but are not limited to – standard operating procedures, safety procedures, equipment operating procedures, codes of practice, quality management practices and standards, procedures to comply with legislative and local body requirements.

3 Assessment information

- a Examples given must be within the context of mechanical engineering or manufacturing.
- b Numerous reference texts and training manuals on this topic are available and may be used; however, no one textbook or source of information is envisaged. All activities must comply with applicable workplace procedures and must be consistent with accepted industry practice.

Outcomes and evidence requirements

Outcome 1

Demonstrate and apply knowledge of the function and performance of electrical components in mechanical engineering systems.

Evidence requirements

- 1.1 The properties of electrical components and circuits are calculated to meet the requirements of specific mechanical engineering situations.

Range	components – motors, transformers, cables, relays, protective devices (fuses, circuit breakers, switch gear), residual current devices; properties – voltage, current, resistance, power, capacitance, earthing.
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- 1.2 The functions and principles of operation of electrical components, and their applications and limitations in mechanical engineering situations are explained.

Range	components – motors, transformers, cables, relays, protective devices (fuses, circuit breakers, switch gear), residual current devices.
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- 1.3 Electrical systems are analysed to identify their safety features.

Range	systems – insulation, earthing, circuit protection (fuses, circuit breakers, isolating transformers, residual current devices), switch gear.
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- 1.4 Methods of controlling electrical supply are explained in relation to the operation of mechanical systems.
- Range methods include but are not limited to – power factor control, rectification, transformation.
- 1.5 The performance of electrical components in mechanical systems is assessed in terms of electrical principles and properties.
- Range components – motors, transformers, cables, relays, protective devices (fuses, circuit breakers, switch gear), residual current devices;
principles and properties – current flow, resistance, electrical pressure, power, temperature rise, capacitance, conduction, induction, magnetism, earthing, and their inter-relationships.
- 1.6 The performance of electric motors in mechanical systems is assessed in terms of speed, torque, and energy conversion efficiency.
- 1.7 The speed control of AC and DC motors is explained in terms of electrical principles.
- 1.8 A programmable logic controller (PLC) is programmed to perform a simple task.

Outcome 2

Select electrical components to meet mechanical engineering operational requirements.

Range electric motors, transformers, residual current devices.

Evidence requirements

- 2.1 Operating systems are analysed to establish the required operating parameters of electrical components.
- Range parameters may include but are not limited to – speed, torque, voltage, current, power.
- 2.2 Components are selected to match plant, regulatory requirements, and features of the operating environment.
- Range plant requirements may include but are not limited to – starting requirements, speed, load, cycling times, duty cycle;
features of the operating environment – moisture, vibration, hazardous gases, hygiene.
- 2.3 Components are identified using terminology that meets the requirements of users.
- Range users – suppliers, installers, electrical personnel.

Outcome 3

Identify causes of electrical and/or electronic faults in mechanical engineering systems.

Range electric motors, transformers, protective devices, power supplies.

Evidence requirements

3.1 Instruments for measuring electrical parameters are selected to match the instruments' performance characteristics and the operational requirements of mechanical engineering application.

Range instruments – voltmeters, ammeters, ohmmeters, wattmeters, multimeters, oscilloscopes.

3.2 Measuring instruments are used in accordance with established engineering practice and manufacturers' instructions, recommendations, and specifications.

3.3 Collation and analysis of measurement data establish the nature of the problems and/or failures as being electrical in origin.

3.4 Probable root causes of electrical and/or electronic problems and/or failures are identified in electrical and/or electronic terms.

Range root causes may include but are not limited to – power supply problems and/or failures, component failure, inappropriate selection and/or application of components.

Outcome 4

Explain the function and performance of electronic components and subsystems in mechanical engineering systems.

Evidence requirements

4.1 The functions and operation of electronic components and their applications in electronic subsystems are explained.

Range components – resistors, capacitors, diodes, silicon controlled rectifiers, Triacs, transistors, thermistors, optoelectronic devices.

4.2 The functions and principles of operation of electronic subsystems, and their applications and limitations in mechanical engineering systems are explained.

Range subsystems – DC power supplies and voltage regulators, residual current devices rectifiers, PLCs, electronic speed control.

4.3 The effects of the operating environment on the performance of electronic subsystems are explained in terms of radio frequency interference, temperature, and hazardous atmospheres.

Replacement information	This unit standard replaced unit standard 11395 and unit standard 11396.
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Planned review date	31 December 2021
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	27 October 2005	31 December 2016
Rollover	2	19 March 2010	31 December 2021
Review	3	20 October 2016	N/A

Consent and Moderation Requirements (CMR) reference	0013
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMRs). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.