Title	**Demonstrate knowledge of electrical calculations and principles for electromechanical maintenance and repair**		
Level	**3**	**Credits**	**10**

Purpose	This unit standard covers electricity knowledge for people intending to qualify in the electrical industry in electromechanical maintenance 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. People credited with this unit standard are able to demonstrate knowledge of: – direct current, single and three phase sinusoidal alternating voltages and currents for electromechanical maintenance and repair; – resistors, capacitors, and inductors used in the electromechanical maintenance and repair industry; – three phase circuits used in the electromechanical maintenance and repair industry; and – electrical measuring instruments used in the electromechanical maintenance and repair industry.

Classification	Electrical Engineering > Electrical Machines

Available grade	Achieved

Guidance Information

1 This unit standard has been developed for learning and assessment off-job and can be completed by passing the Electrical Apparatus Service Association (EASA) distance learning programme *Electricity II – Principles of Alternating Current, Mathematics in AC Circuits, Inductance and Inductive reactance, Capacitance and Capacitive reactance, Impedance, Three-Phase Circuits, DC Instruments, and Measuring Electrical Resistance*.

2 Definitions
AC – alternating current.
CR – capacitance and resistance.
DC – direct current.
Electrical principles – in this unit standard means the fundamental understanding of electricity and how it works.
LCR – inductance, capacitance and resistance.

LR – inductance and resistance.
RMS – root mean square.

3 For assessment purposes:
a Candidates will be supplied with formulae involving more than three quantities.
b Use of a calculator during assessment is permitted.
c Candidates are expected to express calculated values in the relevant Système Internationale (SI) units, including multiples and sub-multiples, for example: pico (p) 10^{-12}; nano (n) 10^{-9}; micro (μ) 10^{-6}; milli (m) 10^{-3}; kilo (k) 10^{3}; mega (M) 10^{6}; Giga (G) 10^{9}; and to be able to convert between them.
d Conventional current flow direction (positive to negative) is implied. Trainees should be aware of the opposite direction of electron flow.

4 Range
Evidence presented for all outcomes and performance criteria in this unit standard must be in accordance with industry best practice and the Electrical Apparatus Service Association (EASA) Technical Manual.

5 Recommended unit standard for entry
Unit 31741, *Demonstrate knowledge of electrical theory for electromechanical maintenance and repair*.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of direct current, single and three phase sinusoidal alternating voltages and currents for electromechanical maintenance and repair.

Performance criteria

1.1 Define waveform terminology.

Range voltage, current, period, frequency, peak, peak-to-peak, average (full and half) wave, RMS, form factor, harmonics.

1.2 Explain the relationship between RMS and average values in direct current and sinewave circuits.

Range heating effect of AC and DC compared.

1.3 Calculate RMS, average, and peak values for a sinewave.

1.4 Sketch single phase waveforms showing phase relationship between supply voltage and current.

Range leading and lagging.

1.5 Sketch three phase waveforms showing the phase relationships and phase sequence.

Outcome 2

Demonstrate knowledge of resistors, capacitors, and inductors used in the electromechanical maintenance and repair industry.

Range LCR in series, LR and CR in parallel.

Performance criteria

2.1 Explain circuit reactance and impedance using calculation examples.

2.2 Describe the relationship between circuit reactance, circuit resistance, impedance, component voltages, supply voltage and current using vector diagram sketches.

2.3 Calculate phase angles and power factor.

2.4 Explain the effect of using inductors and resistors, capacitors and resistors in DC circuits.

Range exponential growth and decay of terminal voltage and current against time, time constant.

Outcome 3

Demonstrate knowledge of three phase circuits used in the electromechanical maintenance and repair industry.

Performance criteria

3.1 Explain and sketch delta and star connected circuits.

3.2 Calculate phase and line voltages and currents for resistive loads in star and delta configuration.

3.3 Explain and calculate power dissipation in three phase circuits.

3.4 Explain methods of measuring power in three phase circuits.

Range two and three wattmeter methods.

Outcome 4

Demonstrate knowledge of electrical measuring instruments used in the electromechanical maintenance and repair industry.

Performance criteria

4.1 Describe the construction and operation of moving coil instruments.

4.2 Explain methods of extending the basic movement range to measure practical DC voltages, currents and resistance.

4.3 Explain methods of taking practical measurement in electrical circuits safely.

4.4 Explain limitations to measurement accuracy.

Range parallax error, instrument sensitivity, meter ranges.

4.5 Describe the concept of digital measuring instruments.

Range dual slope conversion, binary-coded decimal system, digital displays, accuracy of reading.

Planned review date	31 December 2025

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	26 April 2019	N/A
Review	2	30 January 2025	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 Waihanga Ara Rau Construction and Infrastructure Workforce Development Council qualifications@waihangaararau.nz if you wish to suggest changes to the content of this unit standard.