Title	**Demonstrate and apply knowledge of electronics**		
Level	**3**	**Credits**	**8**

Purpose	This unit standard covers basic knowledge of electronic engineering for electrical workers. People credited with this unit standard are able to: – identify 15 different types of electronic components either by inspection of given components, or by selection from a physical or pictorial display; – demonstrate knowledge of capacitors; – demonstrate knowledge of semiconductor diodes; – test semiconductor diodes; – demonstrate knowledge of semiconductor power devices; – demonstrate knowledge of semiconductor power applications; – demonstrate knowledge of d.c. power supply principles; – demonstrate knowledge of voltage regulators; and – demonstrate knowledge of a variable d.c. power supply.

Classification	Electrical Engineering > Core Electrical

Available grade	Achieved

Guidance Information

1 This unit standard has been developed for learning and assessment off-job.

2 This unit standard and unit standard 29476 together meet the assessment requirements of ERAC EPC 6.
This unit standard and unit standards 5926, 29422, 29471, 29475, 29481, and 29482 together meet the assessment requirements of ERAC EPC 51.

3 Definitions
BJT – bipolar junction transistor.
CRT – cathode ray tube.
d.c. – direct current.
EPC – Essential Performance Capability.
ERAC – Electrical Regulatory Authorities Council.
EWRB – Electrical Workers Registration Board.
FET – field effect transistor.
Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.
LASCR – light activated silicon controlled rectifier.
LDR – light dependant resistor.

LED – light emitting diode.NTC – negative temperature co-efficient.
PIV – peak inverse voltage.
PTC – positive temperature co-efficient.
Safe and sound practice – as it relates to the installation of electrical equipment is defined in AS/NZS 3000:2007, *Electrical Installations (known as the Australian/New Zealand Wiring Rules).*
SCR – silicon controlled rectifier.
VDR – voltage dependent resistor.
Vrrm – maximum repetitive reverse voltage.

4 Range
- a Use of a calculator during assessment is permitted.
- b Candidates are expected to express calculated values in the relevant Système International (SI) units, including multiples and sub-multiples (pico, nano, micro, milli, kilo, mega, etc) and be able to convert between them.
- c Charts of resistor and capacitor colour codes may be referred to during assessment.
- d Candidates may refer to current legislation and Standards during assessment.
- e Demonstration of safe working practices and installation in accordance with *safe and sound practice* are essential components of assessment of this unit standard.
- f All activities and evidence presented for all outcomes and performance criteria in this unit standard must be in accordance with:
  - i legislation;
  - ii policies and procedures;
  - iii ethical codes;
  - iv Standards – may include but are not limited to those listed in Schedule 2 of the Electricity (Safety) Regulations 2010;
  - v applicable site, enterprise, and industry practice; and,
  - vi where appropriate, manufacturers' instructions, specifications, and data sheets.

Outcomes and performance criteria

Outcome 1

Identify 15 different types of electronic components either by inspection of given components, or by selection from a physical or pictorial display.

Range manufacturers' data may be used to assist the identification.

Performance criteria

1.1 Identify components by name and type.

1.2 Give one common application for each component.

1.3 Explain the meanings of terms that three different types of discrete components.

Range terms – tolerance, preferred values, stability, power rating, voltage rating, current rating.

1.4 Outline the meaning of the word *dissipation* (cooling) in terms of its association with power ratings.

Outcome 2

Demonstrate knowledge of capacitors.

Performance criteria

2.1 Describe capacitor types in terms of their physical construction.

2.2 State the factors influencing capacitance together with the effect of each when it is increased and decreased.

2.3 Calculated and sketch the charge for given values of capacitance, applied voltage, current, and time.

2.4 State the practical applications for air, paper, mica ceramic, electrolytic, and solid dielectric capacitors, according to industry practice.

2.5 Calculate simple series and parallel capacitor circuits.

2.6 State the safety precautions necessary to prevent electric shock from charged capacitors.

Outcome 3

Demonstrate knowledge of semiconductor diodes.

Performance criteria

3.1 Name diode types and identify their terminal.

Range small signal diode, zener diode, power diode; terminals: anode and cathode.

3.2 With the aid of sketches explain diode behaviour under forward and reverse bias conditions of the voltage versus current characteristics.

Range small signal diode, zener diode, DIAC, TRIAC, LED, power diode, SCR.

3.3 Define diode terms and state typical values during normal and abnormal operation.

Range forward bias, voltage drop, reverse breakdown, PIV, Vrrm, average forward current, power dissipation, junction temperature, leakage current.

3.4 Use labelled diagrams to explain the operation of single-phase rectifier circuits in terms of input and output waveforms, currents, and voltages.

Range half-wave, centre-tapped transformer full-wave, bridge.

3.5 With the aid of diagrams explain the use of diode in applications other than rectification.

Range applications – free wheeling diodes on solenoids, other arc suppression methods, diode matrices in lamp test circuits, voltage reference.

Outcome 4

Test semiconductor diodes.

Range small signal diode, zener diode, power diode.

Performance criteria

4.1 Test diode and document result.

Range diode tests include – forward resistance, reverse mode resistance; in-circuit testing of forward voltage drop, reverse leakage current.

4.2 Interpret test results to determine serviceability in terms of measured versus expected values.

4.3 Describe the potential for damage to diodes when carrying out insulation resistance tests and the procedures employed to prevent such damage.

Outcome 5

Demonstrate knowledge of semiconductor power devices.

Range transistor, silicon controlled rectifier, diac, triac.

Performance criteria

5.1 Identify devices from physical or pictorial displays.

5.2 Draw symbols and label all connections with terminal name and polarity.

5.3 Identify device terminals on actual devices using test equipment or manufacturers' data manuals.

5.4 Describe devices with reference to principle of operation and characteristic curves.

Outcome 6

Demonstrate knowledge of semiconductor power applications.

Range devices – diode, transistor, silicon controlled rectifier, diac, triac;
typical applications – light dimmer, single-phase and three-phase full-wave rectifier, inductive coil energy dissipation, standby circuit for soldering iron, trigger circuits for triac;
one application is required for each device.

Performance criteria

6.1 Draw a functional circuit diagram for one semiconductor power application.

6.2 Describe the operation of the circuit with reference to the role played by the semiconductor, its characteristics, and all other components.

Outcome 7

Demonstrate knowledge of d.c. power supply principles.

Range may include but are not limited to – regulation, rectification, reservoir capacitor, three-pin regulator.

Performance criteria

7.1 Define d.c. power supply terms in accordance with industry practice.

7.2 With the aid of a labelled block diagram describe power supply operation.

7.3 Describe possible causes of failure/access with the aid of a circuit diagram, and outline methods of avoiding them.

7.4 With the aid of diagrams describe filters in terms of their function and principles of operation.

7.5 One typical application for each type of filter is stated.

Outcome 8

Demonstrate knowledge of voltage regulators.

Range may include but is not limited to – resistance voltage divider, zener diode, series pass, fixed and variable three-terminal integrated circuit (IC).

Performance criteria

8.1 With the aid of diagrams describe voltage regulators in terms of their function and principle of operation.

8.2 One typical application for each type of regulator is stated.

Outcome 9

Demonstrate knowledge of a variable d.c. power supply.

Range may include but is not limited to – input supply, transformer, rectifier, variable regulator, filter, means of adjustment, output polarity.

Performance criteria

9.1 Draw a fully labelled diagram for a practical variable d.c. power supply.

9.2 Describe the operation of the circuit with reference to the function of each component and the method of varying the output voltage.

9.3 Use an oscilloscope to measure voltage and current values and record.

Range may include but is not limited to – supply input, transformer output, rectifier output, filter output, supply output.

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	21 July 2016	31 December 2027
Review	2	25 May 2023	31 December 2027

Consent and Moderation Requirements (CMR) reference	0003

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