

Title	Demonstrate knowledge of semiconductor power devices		
Level	4	Credits	4

Purpose	<p>This unit standard covers knowledge of semiconductor power devices for electricians and related trades.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> – identify and describe semiconductor power devices – demonstrate knowledge of semiconductor power applications – demonstrate knowledge of semiconductor device cooling – demonstrate knowledge of electrostatic discharge precautions for semiconductors – test power semiconductors.
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Classification	Electrical Engineering > Core Electrical
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Available grade	Achieved
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Guidance Information

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

Outcomes and performance criteria

Outcome 1

Identify and describe semiconductor power devices.

Range diode, transistor, silicon controlled rectifier, diac, triac.

Performance criteria

- 1.1 Devices are identified from physical or pictorial displays.
- 1.2 Symbols are drawn and all connections labelled with terminal name and polarity.
- 1.3 Device terminals are identified on actual devices using test equipment or manufacturer's data manuals.
- 1.4 Devices are described with reference to principle of operation and characteristic curves.

Outcome 2

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

- 2.1 A functional circuit diagram is drawn.
- 2.2 The operation of the circuit is described with reference to the role played by the semiconductor, its characteristics, and all other components.

Outcome 3

Demonstrate knowledge of semiconductor device cooling.

Performance criteria

- 3.1 Methods used to dissipate heat from semiconductor devices are described.

Range direct dissipation from device, heat sinks using natural air circulation, forced air, water cooling, oil cooling.
- 3.2 Common heat sinks are described with reference to material, shape, and size.
- 3.3 A semiconductor device is selected for a given application.

Range selection process allows for – power dissipation, safety factor, operating conditions.

Outcome 4

Demonstrate knowledge of electrostatic discharge precautions for semiconductors.

Performance criteria

- 4.1 Causes of static electricity in the electronics workplace are described in terms of triboelectric charging and separation, and the amount of static charge generated.

Range causes include but are not limited to – induction, no earthing, poor air-conditioning, low humidity, type of floor covering, clothing, materials, aerosol sprays, solder suckers.
- 4.2 The effect of electrostatic discharge (ESD) on semiconductor devices, components, and equipment is described in terms of immediate failure, intermittent faults, re-servicing, and delayed breakdown.

- 4.3 Precautions to minimise ESD to semiconductor devices, components, and equipment are stated.

Range precautions include but are not limited to – selection or treatment of clothing, materials, furnishings, and floor coverings; the use of ionising air blowers, anti-static floor and bench mats, anti-static wrist or ankle straps, anti-static containers for transportation, use of tools with approved electrostatic conducting handles; minimum requirements for static safe work stations.

- 4.4 The minimum requirements for a static-safe workstation are listed.
- 4.5 Conductive and dissipative antistatic mats and products are compared in terms of properties and applications.
- 4.6 Purpose of the resistance used in wrist and ankle straps is stated, together with typical resistance values.
- 4.7 Use of antistatic devices and procedures is practically demonstrated in an actual or simulated field service situation.

Outcome 5

Test power semiconductors.

Performance criteria

- 5.1 Methods by which damage to semiconductor devices from the application of test instruments may be prevented are stated and explained.

Range disconnection, shorting out.

- 5.2 Awareness of electrostatic discharge precautions is demonstrated through testing methods.

- 5.3 Faulty devices are identified through in-circuit and out-of-circuit testing.

Range devices – diode, transistor, silicon controlled rectifier, diac, triac; tests must include a good and a faulty device of each type.

- 5.4 Devices and circuitry are not damaged by testing due to test voltages.

- 5.5 Test results are compared to values in manufacturer data sheets, and variations explained as appropriate in terms of device failure, tolerance, circuit configuration, instrument error, measurement error, and in-circuit test loading by test instruments.

Replacement information	This unit standard replaced unit standard 1712.
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Planned review date	31 December 2028
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	10 February 1999	31 December 2013
Review	2	26 May 2005	31 December 2025
Rollover and Revision	3	15 March 2012	31 December 2025
Revision	4	15 January 2014	31 December 2025
Rollover and Revision	5	28 January 2021	31 December 2025
Review	6	28 March 2024	N/A

Consent and Moderation Requirements (CMR) reference	0003
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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.