

Title	Demonstrate advanced knowledge of electrical installation practice and knowledge of data communication principles		
Level	5	Credits	10

Purpose	<p>This unit standard and is intended for use in the training and assessment of electricians beyond trade level, and covers electrical installation practice at a level more advanced than the requirements for the National Certificate in Electrical Engineering (Electrician for Registration) (Level 4) [Ref: 1195].</p> <p>People credited with this unit standard are able to demonstrate:</p> <ul style="list-style-type: none"> – advanced knowledge of cables; – advanced knowledge of busbars; – advanced knowledge of a.c. measurement; – knowledge of load assessment and control of electrical installations; and – knowledge of data communication and networking principles.
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Classification	Electrical Engineering > Electrical Installation and Maintenance
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Available grade	Achieved
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Guidance Information

- 1 Recommended skills and knowledge:
National Certificate in Electrical Engineering (Electrician for Registration) (Level 4) [Ref: 1195] or equivalent trade qualification for electricians.
- 2 This unit standard has been developed for learning and assessment off-job.
- 3 References
AS/NZS 3000:2018, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*, including Amendment 1;
AS/NZS 3008.1.2:2017, *Electrical installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV – Typical New Zealand conditions*;
New Zealand Electrical Codes of Practice available at
<https://www.worksafe.govt.nz/laws-and-regulations/standards/electricity-standards-and-codes-of-practice/>;
and all subsequent amendments and replacements;
- 4 Definitions
a.c. – alternating current.
Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.

kVA – kilo volt amps.

LAN – local area network.

MAN – Metropolitan Area Network.

OSI – Open System Interconnect, a model developed by the International Standards Organisation.

SAN – storage area network.

STP – spanning tree protocol.

TCP/IP – transmission control protocol over internet protocol.

UTP – unshielded twisted pair.

VPN – virtual private network.

WAN – wide area network.

Outcomes and performance criteria

Outcome 1

Demonstrate advanced knowledge of cables.

Performance criteria

- 1.1 Materials used in the construction of heavy duty cables are identified.
- Range materials used for – conductors, insulation, sheathing, armouring, oversheath or serving materials.
- 1.2 Cables are identified from standard abbreviations.
- Range abbreviations of – conductor material, number of cores, cross-sectional area of cores, insulating material, sheathing material, armouring material, oversheath or serving material.
- 1.3 Cables suitable for given applications and conditions are selected in accordance with NZECP, AS/NZS 3008.1.2:2017, industry practice and, where appropriate, manufacturers' data.
- Range applications may involve – moisture, vibration, corrosive conditions, mechanical strength, abnormal temperatures, flammable or explosive conditions; conditions may involve – current rating, allowable voltage drop, connected load, maximum demand, future loading, grouping, disposition, class of excess current protection, method of installation; two selections are required for different given applications and conditions.

Outcome 2

Demonstrate advanced knowledge of busbars.

Performance criteria

- 2.1 Materials and profiles used in the construction of busbars are identified.

2.2 Factors determining busbar arrangements are explained with reference to voltage rating, current rating, and clearances.

Range factors – formation, insulation, heat dissipation, skin effect, proximity effect, mechanical strength, expansion and contraction.

2.3 Constructional features and applications of industrial busbar systems are identified.

Range busbar systems – rising main, overhead, trolley.

Outcome 3

Demonstrate advanced knowledge of a.c. measurement.

Performance criteria

3.1 Principles of instrument transformers and their use for metering purposes are explained.

Range reference to – voltage transformers, current transformers, connections, terminal markings, burden, accuracy, open circuited secondary, summation transformer.

3.2 The operating principles and methods of connection of a.c. instruments are described.

Range instruments – wattmeter used to measure single-phase, three-phase four-wire, and three-phase three-wire loads; summation metering; power factor meter; frequency meter; kVA meter; kVA reactive meter; phase sequence indicator; synchroscope; energy meter.

Outcome 4

Demonstrate knowledge of load assessment and control of electrical installations.

Performance criteria

4.1 Load and demand terms are defined and related calculations are performed for a given electrical installation.

Range maximum demand, average demand, load factor, demand factor.

4.2 Terms *diversity factor* and *after diversity maximum demand* of a group of consumers are defined, and calculations are made demonstrating their application.

4.3 Load control methods to improve load factor are outlined for given types of loads.

Range three of – offices, continuous-process factories, seasonal-process factories, shopping complex, tourist accommodation.

Outcome 5

Demonstrate knowledge of data communication and networking principles.

Performance criteria

5.1 Networking terminology is explained in accordance with industry practice.

Range includes but is not limited to – common networking devices, topology, protocols, LAN, MAN, WAN, SAN, STP, VPN.

5.2 Bandwidth is described in terms of its importance in relation to information transfer.

Range measurement, limitations, throughput data transfer calculations, digital versus analogue.

5.3 Uses of networking models are explained in terms of operation of data communication.

Range use of layers, OSI model, TCP/IP model, encapsulation process.

5.4 Features of data communication equipment are described in terms of synchronous and asynchronous data communication.

Range modem, network terminating unit, send and receive equipment, power supply.

5.5 Characteristics of data communication media are described in terms of capacity, data speed, application, and data security.

Range copper, Category 5, Category 6, UTP, fibre optic cable, wireless.

5.6 Installation requirements and precautions relating to data communication cables are explained in accordance with industry practice.

Range separation from power cables, bend radii, securing, cross talk, noise, interference.

5.7 The correct termination procedures for data communication cables are explained in accordance with industry practice.

Replacement information	This unit standard replaced unit standard 19003.
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Planned review date	31 December 2022
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	19 June 2009	N/A
Rollover and Revision	2	15 March 2012	N/A
Revision	3	15 January 2014	N/A
Rollover and Revision	4	28 January 2021	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 The Skills Organisation reviewcomments@skills.org.nz if you wish to suggest changes to the content of this unit standard.