

Certificate III Electrotechnology Systems Electrician — National module and assessment structure

EE QSB Australia

Summary of learning strategies supporting the achievement of essential capabilities required of a Licensed Electrician



Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
1. Demonstrate a knowledge of basic electrical and energy concepts.	Fundamentals of electrical energy, other energy forms, voltage, current and resistance.	Essential	NUE052 Applied electricity 1
			LO 2 Explain the principle of the conversation of energy and the effects of losses in electrical systems and machines
			LO 5 Demonstrate an understanding of the relationships between voltage, current and resistance and the power dissipated in a circuit
2. Demonstrate a knowledge of the various effects of electric current.	Physiological effects on humans, heating and other energy conversion effects and principles.	Critical	NUE052 Applied electricity 1
			LO 6 Demonstrate an understanding of the physiological effects of current the principles for protection against these effects.
			LO 7 Describe the effects of electric current in terms of the conversion of electrical energy to other forms and the uses and disadvantages of these effects
			NUE 505A Electrical systems safety See Note 1
3. Demonstrate a knowledge of resistivity and resistors.	Ohm’s law, material resistivity, resistor parameters and introduction to measuring methods.	Essential	NUE052 Applied electricity 1
			LO 9 Use digital and analogue instruments to measure voltage, current and resistance.
			NUE054 Applied Electricity 2
			LO 1 Demonstate a knowledge of the factors affecting resistance and determine their influence on practical circuits and devices.
			LO 6 Take accurate measurements of voltage, current and resistance and identify typical instruments used in the field.
4. Demonstrate a knowledge of the various sources of electromotive force (e.m.f.).	How electrical energy is produced from various forms of energy, including batteries.	Essential	NUE052 Applied electricity 1

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			LO 8 Describe how other forms to electrical energy are converted to electrical energy and where each is used.
5. Explain the operation of a simple practical circuit.	Include current path, circuit control, load, EMF source and conductors.	Critical	<p>NUE052 Applied electricity 1</p> <p>LO 4 Set-up and operate simple single load electrical circuit incorporating a switch and circuit protection device.</p> <p>NUE 505A Electrical systems safety <i>See Note 1</i></p>
6. Determine the resistance, voltage, current and power in any part of a d.c. circuit using theory and actual measurement methods.	Theoretical and practical knowledge of measuring instrument use and safe practises whilst using instruments. Include series and/or parallel circuit analysis.	Critical	<p>NUE054 Applied Electricity 2</p> <p>LO 5 Work with single source series / parallel circuits and solve problems related to voltages, currents, resistances and power dissipated in such circuits.</p> <p>LO 6 Take accurate measurements of voltage, current and resistance and identify typical instruments used in the field.</p> <p>NUE 505A Electrical systems safety <i>See Note 1</i></p>
7. Demonstrate a knowledge of the theory and application of Capacitors and Inductors.	Concepts and characteristics of Capacitors and Inductors and their application in d.c. circuits.	Essential	<p>NUE054 Applied Electricity 2</p> <p>LO 7 Demonstrate an understanding of the concepts of capacitance, the units by which it is measured and the characteristics of series dc circuits containing resistance and capacitance.</p>
8. Demonstrate a knowledge of permanent and electro magnetic theory and application.	Magnetism, magnetic induction, magnetic fields and the fundamental magnetic quantities.	Essential	<p>NUE045 Applied electromagnetism</p> <p>LO 1 Demonstrate an understanding of magnetism, magnetic induction the nature of magnetic materials and their application.</p>
9. Demonstrate a knowledge of electromagnetic induction and state practical examples which make use of this principle.	Principles of EMF induced in a conductor and its application in electrical machines and devices.	Essential	NUE045 Applied electromagnetism

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			LO 5	Demonstrate an understanding of the principles by which an emf is induced in a conductor, the magnitude of the induced emf and the direction in which it acts.
			LO 7	Describe how electromagnetic principles can be applied to electrical machines and devices.
			NUE056 Applied Electricity 4	
			LO 8	Demonstrate an understanding of the operating principles and function of an ideal transformer.
10. Demonstrate a knowledge of Capacitance and Inductance in a.c. circuits and their effects.	To include calculation of capacitive and inductive reactance, effects on V and I phase relationships, resonance and impedance in AC series and parallel circuits.	Essential	NUE056 Applied Electricity 4	
			LO 4	Explain how inductance behaves in an a.c. circuit.
			LO 5	Explain how capacitance behaves in an a.c. circuit
			LO 6	Work with single-source a.c. circuits and solve problems related to voltages, currents and impedance in such circuit.
11. Demonstrate a knowledge of alternating voltage & current generation, phase relationships, energy in an a.c. circuit, and actual measurement methods.	Explain sinusoidal voltage generation and resultant current flow. Define key terms, calculate and apply measuring techniques to derive required parameters. Eg power factor.	Critical	NUE056 Applied Electricity 4	
			LO 1	Demonstrate an understanding of alternating voltage and current waveforms and how they are generated
			LO 2	Show the phase relationship between sinusoidal alternating voltages and current
			LO 6	Work with single-source a.c. circuits and solve problems related to voltages, currents and impedance in such circuit.
			NUE057 Applied Electricity 5	
			LO 1	Demonstrate an understanding of the consequences of low power factor and how this is dealt with in practice.

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			<p>NUE 505A Electrical systems safety <i>See Note 1</i></p> <p>NEWP402b Test apparatus and circuits - Electrical work performance</p> <p><i>Note: Aspects of this capability that are fundamental to safety are included in Work Performance Module for each core competency standard unit. See Note 2</i></p>
12. Describe Star and Delta three phase a.c. systems and the reason why three phase is used.	Multiphase systems and their advantages – reduced current flow, equipment size etc. Calculation (phase diagrams) of line and phase voltages.	Essential	<p>NUE057 Applied Electricity 5</p> <p>LO 2 Demonstrate an understanding of the principle of multiphase systems and the reasons for the adoption of a three phases for power systems</p> <p>LO 4 Demonstrate an understanding of three phase star-connections.</p> <p>LO 5 Demonstrate an understanding of three phase four wire systems.</p> <p>LO 6 Demonstrate an understanding of three phase delta-connections</p> <p>LO 7 Demonstrate an understanding of interconnected star and delta connected devices.</p> <p>LO 8 Demonstrate an understanding of the energy and power requirements of a.c. power systems and loads and how these are dealt with in practice.</p>
13. Demonstrate an understanding of the fundamental safety principles of the AS/NZS 3000:2000 Section 1.	Definitions, alterations, protection, design, selection and installation of electrical equipment for electrical safety requirements. This includes protection from direct and indirect contact with live parts.	Critical	<p>NUE400 Electrical installations— protection methods and devices</p> <p>LO 2 Demonstrate knowledge of methods for protecting persons and livestock against dangers that may arise from contact with exposed conductive parts, which may become live under fault conditions.</p>

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			<p>NUE403 Electrical installations — design and equipment selection</p> <p>LO 2 Demonstrate knowledge of methods intended to ensure the safety of persons, livestock and property against dangers and damage that may arise in the reasonable use of electrical installations.</p> <p>LO 6 Select methods and devices for protecting person and livestock against the dangers that may arise from contact with exposed conductive parts which may become live under fault conditions for a given installation.</p> <p>LO 7 Select overload and short circuit protection devices in compliance with coordination requirements of AS/NZS 3000 and load characteristics</p> <p>NUE 505A Electrical systems safety</p> <p>LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p>LO 4 Demonstrate knowledge and skills for ensure electrical fault protection devices will operate as intended.</p>
14. Demonstrate a knowledge of power factor, power factor improvement principles and power measurement techniques to a.c. circuits in 1 and multiphase systems.	Consequences of low power factor, value of capacitance required for correction, measurement theory and methods to obtain real power and apparent power values.	Essential	<p>NUE057 Applied Electricity 5</p> <p>LO 1 Demonstrate an understanding of the consequences of low power factor and how this is dealt with in practice.</p>

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			LO 8	Demonstrate an understanding of the energy and power requirements of a.c. power systems and loads and how these are dealt with in practice
15. Describe the rationale and operating principles and characteristics of three phase induction motors and generators.	Concept of a rotating magnetic field, stator and rotor construction. Power, torque and speed relationships.	Essential	NUE 046 Alternating current machines	
			LO 1	Describe the operating principles and characteristics of three phase induction motors.
16. Describe methods of electric motor selection, starting, connection and protection.	Reduced current starting, methods of starting (star-delta etc), typical motor lead terminations and protection (including by electronic devices) of the motor from environmental, overload, internal faults and supply variation conditions.	Critical	NUE 046 Alternating current machines	
			LO 2	Describe methods of protecting motors against over-temperature
			LO 3	Select starters for given three phase induction motors, load conditions and local requirements
			NUE 505A Electrical systems safety	
			LO 3	Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables
			NEWP106b Install electrical/electronic apparatus - <i>Electrical work performance</i>	
17. Describe the AS/NZ 3000:2000 and local Supply Authority requirements for three phase motor installations and starters.	Design of motor circuits for operator control, isolation, automatic starting and emergency stopping. Starting methods required by the local supply authority to limit the transient current.	Essential	NE 32.1 Circuit Development 1	
			LO 3	Select appropriate contractors and control circuit devices to perform specified functions.
			LO 4	Design and connect basic control circuits.
			NUE 046 Alternating current machines	
			LO 4	Connect three phase induction motors to a range of starters utilising local and remote stop-start.
			LO 5	Determine the AS/NZS 3000 and local requirements with regards to motors.

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			NEWP106b Install electrical/electronic apparatus - <i>Electrical</i> work performance
18. Describe the possible causes of malfunction of three phase induction motors and demonstrate the tests required for diagnosing faults	Common causes of malfunction – starting equipment failure, insulation deterioration, water ingress etc. Common testing methods – voltage, ampere and insulation resistance checks.	Essential	<p>NUE 046 Alternating current machines</p> <p>LO 9 Describe possible causes of malfunction of three phase and single phase induction motors and demonstrate the tests required for diagnosing faults.</p> <p>NEWP402b Test apparatus and circuits - <i>Electrical</i> work performance</p> <p>NEWP501b Diagnose and rectify faults in apparatus and associated circuits - <i>Electrical</i> work performance</p>
19. Describe the operating principles, typical control methods and characteristics of single phase motors and their key components.	The rotating magnetic field and components for single phase motors, methods to achieve starting and operating torque. Control methods used including voltage/speed reduction, reversal and impact on performance.	Essential	<p>NUE 046 Alternating current machines</p> <p>LO 6 Describe the operating principles and characteristics of split-phase, shaded-pole and universal motors</p>
20. Describe the suitability of various types of single phase motors for particular applications and describe the fault finding methods.	Application of various motor starting/operating torque curves to various mechanical loads. Eg drills, fans and pumps etc.	Essential	<p>NUE 046 Alternating current machines</p> <p>LO 8 Determine the suitability of various types of single phase motors for particular applications.</p> <p>LO 9 Describe possible causes of malfunction of three phase and single phase induction motors and demonstrate the tests required for diagnosing faults</p>
21. Describe and apply in practice the requirements of AS/NZ 3000:2000 in relation to earthing arrangements and fault loop impedance calculations.	Earthing arrangements for protective and functional purposes, earthing connections and conductor selection. Calculation of the correct cable size for an installation to achieve protective device and cable co-ordination.	Critical	<p>NUE400 Electrical installations— protection methods and devices</p> <p>LO 3 Demonstrate knowledge of the purpose of earthing systems, their function under fault conditions and the AS/NZS 3000 requirements for earthing and equipotential bonding.</p>

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			<p>LO 5 Explain the structural features and operating principles of devices that provide protection against indirect contact by automatic disconnection of supply and protection against overcurrent.</p> <p>NUE403 Electrical installations — design and equipment selection</p> <p>LO 5 Select optimum cables for given circuits based on current-carrying capacity, voltage drop limitations, fault loop impedance requirements, installation condition and external influences.</p> <p>LO 7 Select overload and short circuit protection devices in compliance with coordination requirements of AS/NZS 3000 and load characteristics</p> <p>NUE 505A Electrical systems safety</p> <p>LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p>LO 4 Demonstrate knowledge and skills for ensure electrical fault protection devices will operate as intended.</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>
22. Demonstrate a comprehensive knowledge and understanding of the MEN system and its application, including on sub-installations.	Multiple Earthed Neutral arrangement, resultant fault current path and magnitude, operation of protective devices and implication of MEN link absence during fault condition.	Critical	<p>NUE057 Applied Electricity 5</p> <p>LO 5 Demonstrate an understanding of three phase four wire systems.</p>

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			<p>NUE400 Electrical installations— protection methods and devices</p> <p>LO 3 Demonstrate knowledge of the purpose of earthing systems, their function under fault conditions and the AS/NZS 3000 requirements for earthing and equipotential bonding.</p> <p>NUE403 Electrical installations — design and equipment selection</p> <p>LO 5 Select optimum cables for given circuits based on current-carrying capacity, voltage drop limitations, fault loop impedance requirements, installation condition and external influences.</p> <p>LO 6 Select methods and devices for protecting person and livestock against the dangers that may arise from contact with exposed conductive parts which may become live under fault conditions for a given installation.</p> <p>NUE 505A Electrical systems safety</p> <p>LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use</p> <p>LO 4 Demonstrate knowledge and skills for ensure electrical fault protection devices will operate as intended.</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>
23. Describe the basic construction of transformers.	Design of different types of core lamination styles, winding types and assembly techniques.	Essential	<p>NUE048.1 Single and three-phase transformers</p> <p>LO1 Describe the construction and operation of transformers</p>

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24. Demonstrate understanding of the principle of operation of transformers.	Production of secondary winding induced EMF from primary winding and core. Open circuit and full load parameters.	Essential	NUE048.1 Single and three-phase transformers
			LO1 Describe the construction and operation of transformers LO 2 Explain and determine the main parameters of a transformer.
25. List the main types of transformers.	Single and double wound, auto, current and voltage transformers.	Essential	NUE048.1 Single and three-phase transformers
			LO1 Describe the construction and operation of transformers LO 5 Explain the operation and uses of special purpose transformers
26. List typical applications of various types of transformers and key safety issues.	Distribution and transmission systems, large consumers' installations, within electrical equipment, appliances including welders. Safe working procedures when connecting and testing transformers.	Critical	NUE048.1 Single and three-phase transformers
			LO1 Describe the construction and operation of transformers
			LO 3 Describe the methods and equipment used to cool a transformer
			LO 4 Describe the function and operation of transformer auxiliary equipment used on distribution transformers
			LO 5 Explain the operation and uses of special purpose transformers
			NUE505A Electrical systems safety
LO 1 Demonstrate knowledge and skills for working safely with electricity			
LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables			

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27. Describe and apply in practice the requirements for circuit protection using AS/NZS 3000:2000 and other relevant Australian Standards. Eg AS/NZS 3018.	Causes of excess current (and voltage) within a circuit. Calculation and selection of protective devices to satisfy the required Standards.	Critical	NUE400 Electrical installations— protection methods and devices
			LO 1 Demonstrate an understanding of the need to ensure electrical installations are safe.
			LO 4 Demonstrate knowledge of methods and devices for protecting persons and livestock from injury and property from damage due to overload and short circuit current.
			LO 5 Explain the structural features and operating principles of devices that provide protection against indirect contact by automatic disconnection of supply and protection against overcurrent.
			LO 6 Demonstrate knowledge of the need for protection against overvoltage and undervoltage.
			NUE403 Electrical installations — design and equipment selection
			LO12 Demonstrate knowledge of special installations and locations that shall comply with additional requirement of AS/NZS 3000 and/or other standards.
			NUE505A Electrical systems safety
			LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use
			LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables
LO 4 Demonstrate knowledge and skills for ensure electrical fault protection devices will operate as intended.			

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			NEWP106b Install electrical/electronic apparatus - <i>Electrical</i> work performance.
28. Demonstrate a knowledge of the SELV, PELV and earth leakage current protection systems and their application in accordance with AS/NZS 3000:2000.	Protection against both direct and indirect contact using SELV and PELV systems. Protection using Residual Current Device.	Critical	<p>NUE400 Electrical installations— protection methods and devices</p> <p>LO 2 Demonstrate knowledge of methods for protecting persons and livestock against dangers that may arise from contact with exposed conductive parts, which may become live under fault conditions.</p> <p>LO 5 Explain the structural features and operating principles of devices that provide protection against indirect contact by automatic disconnection of supply and protection against overcurrent.</p> <p>NUE403 Electrical installations — design and equipment selection</p> <p>LO11 Select equipment for extra-low voltage installations to comply with the requirements of AS/NZS 3000.</p> <p>NUE505A Electrical systems safety</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p>
29. Demonstrate the ability to select cables for mains and submains using AS/NZS 3000:2000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capacity, maximum demand and voltage drop, for single phase and three phase installations including multiple installations.	Determination of maximum demand, voltage drop, interpretation of cable supplier data tables and the impact of various installation methods. Selection of the appropriate cable installation route/method.	Critical	<p>NUE403 Electrical installations — design and equipment selection</p> <p>LO 5 Select optimum cables for given circuits based on current-carrying capacity, voltage drop limitations, fault loop impedance requirements, installation condition and external influences.</p> <p>NUE505A Electrical systems safety</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>

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30. Demonstrate the ability to select cables for final subcircuits using AS/NZS 3000:2000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capability, maximum demand, earth loop impedance and voltage drop.	Application of maximum demand methods to calculate current requirements and ensure voltage drop is within specification, evaluation of the installation method.	Critical	<p>NUE403 Electrical installations — design and equipment selection</p> <p>LO 5 Select optimum cables for given circuits based on current-carrying capacity, voltage drop limitations, fault loop impedance requirements, installation condition and external influences.</p> <p>NUE505A Electrical systems safety</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>
31. Describe the control and protection requirements for installations and equipment. Demonstrate the ability to select suitable equipment and switchgear for a particular installation or part of an installation.	Main board controls, sub-installation control and submain/final subcircuit controls. Assessment of the prospective short circuit current and operating current. Selection of equipment and suitable protection equipment to protect conductors and installed equipment. Inclusion of RCD's where required.	Critical	<p>NUE400 Electrical installations— protection methods and devices</p> <p>LO 4 Demonstrate knowledge of methods and devices for protecting persons and livestock from injury and property from damage due to overload and short circuit current.</p> <p>NUE403 Electrical installations — design and equipment selection 3</p> <p>LO 7 Select overload and short circuit protection devices in compliance with coordination requirements of AS/NZS 3000 and load characteristics.</p> <p>LO 8 Select devices for isolation and switching in an electrical installation in compliance with AS/NZS 3000.</p> <p>NUE505A Electrical systems safety</p>

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			<p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p>NEWP106b Install electrical/electronic apparatus - <i>Electrical work performance</i></p>
32. Demonstrate an understanding of the AS/NZS 3000:2000 and regulatory requirements for the location of switchboards and arrangement of switchboard equipment in installations	Suitable locations for switchboards (eg well ventilated and dry) including personnel access requirements. Requirements for metering and equipment positions and the identification of switchboard equipment (and the switchboard).	Essential	<p>NUE403 Electrical installations — design and equipment selection</p> <p>LO 9 Design the layout for main switchboards with capacities up to 400 A per phase to comply with the requirements of AS/NZS 3000 and local electricity distributor’s service rules.</p>
33. Demonstrate an understanding of the AS/NZS 3000:2000 and regulatory requirements for the installation of electrical equipment in given damp situations and wet areas.	Damp zones and related equipment requirements. Assessment of the earthing requirements and wiring systems for damp and wet areas as per Section 7 of the AS/NZS 3000:2000 Wiring Rules.	Critical	<p>NUE403 Electrical installations — design and equipment selection</p> <p>LO10 Select equipment for installation in a damp situation to comply with the requirements of AS/NZS 3000.</p> <p>NUE505A Electrical systems safety</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p> <p>NEWP106b Install electrical/electronic apparatus - <i>Electrical work performance</i></p>
34. Demonstrate the appropriate methods for the installation, modification and testing of electrical installations and equipment for construction and demolition sites, complying with AS/NZS 3012 and applicable workplace safety legislation.	<p>Assessment of supply requirements, final circuit protection and socket outlet requirements.</p> <p>Portable tool tagging requirements to AS/NZS 3760 and electrical installation testing requirements.</p>	Critical	<p>NUE403 Electrical installations — design and equipment selection</p>

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			LO 3 Design the circuit arrangements for a given electrical installation. NUE408 Electrical installations — testing and verification LO 2 Demonstrate the ability to conduct the tests required to ensure an electrical installation is safe in accordance with regulatory requirements. NUE505A Electrical systems safety LO 1 Demonstrate knowledge and skills for working safely with electricity LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables LO 4 Demonstrate knowledge and skills for ensure electrical fault protection devices will operate as intended. NEWP106b Install electrical/electronic apparatus - <i>Electrical</i> work performance NEWP402b Test apparatus and circuits - <i>Electrical</i> work performance
35. Demonstrate knowledge of AS/NZS 3000:2000 requirements for the installation of aerial conductors and underground wiring.	Various types of aerial conductors and their application/installation methods. Assessment of underground and aerial conductor ratings and selection process. Underground cable installation systems.	Critical	NUE403 Electrical installations — design and equipment selection LO 4 Demonstrate an understanding of the factors affecting the type of wiring system suitable for a range of installations

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			<p>LO 5 Select optimum cables for given circuits based on current-carrying capacity, voltage drop limitations, fault loop impedance requirements, installation condition and external influences.</p> <p>NUE505A Electrical systems safety</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p>NEWP105g Install and terminate wiring systems (<i>Cable/wiring Support and Protection</i>) Work performance</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>
36. Demonstrate a knowledge of the AS/NZS 3000:2000 requirements for electrical installations in hazardous areas and an awareness of the standards to which it refers (e.g. AS 2430, AS 2381.1).	Basics as set out in AS/NZS 3000:2000, awareness of concepts and practices in specialised standards.	Critical	<p>NUE403 Electrical installations — design and equipment selection</p> <p>LO12 Demonstrate knowledge of special installations and locations that shall comply with additional requirement of AS/NZS 3000 and/or other standards.</p> <p>NUE505A Electrical systems safety</p> <p>LO 3 Demonstrate knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables</p> <p><i>Note: Installation of wiring and equipment for hazardous areas is an optional competency standards unit.</i></p>
37. Demonstrate knowledge of the AS/NZS 3000:2000 requirements and the standards referenced for special electrical installations including emergency systems, and construction/demolition sites.	Standards for special installations eg Movable premises, Caravan parks and Shows and Carnivals AS 3001, High Voltage Neons AS/NZS 3832, standards for the electrical installations of emergency systems and construction/demolition sites	Essential	<p>NUE403 Electrical installations — design and equipment selection</p> <p>LO12 Demonstrate knowledge of special installations and locations that shall comply with additional requirement of AS/NZS 3000 and/or other standards</p>

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38. Describe and perform to AS/NZS 3000:2000 and AS/NZS 3017 standards the electrical checks and tests required to ensure electrical installations are safe.	Tests to ensure the requirements of the Standards have been met, include: visual checks, testing energised and de energised circuits – earth continuity, insulation resistance, polarity test, fault loop impedance tests etc.	Critical	<p>NUE408 Electrical installations — testing and verification</p> <p>LO 2 Demonstrate the ability to conduct the tests required to ensure an electrical installation is safe in accordance with regulatory requirements.</p> <p>NUE505A Electrical systems safety</p> <p>LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use</p> <p>LO 4 Demonstrate knowledge and skills for ensure electrical fault protection devices will operate as intended.</p> <p>NEWP206b Maintain and repair apparatus and associated circuits - <i>Electrical</i> work performance</p> <p>NEWP402b Test apparatus and circuits - <i>Electrical</i> work performance</p>
39. Demonstrate the reporting of test results for an electrical installation as typically required to satisfy regulatory requirements.	Statutory documentation requirements and the practices necessary to achieve compliance.	Essential	<p>NUE408 Electrical installations — testing and verification</p> <p>LO 3 Complete documentation reporting results of tests of an electrical installation as required by local supply authorities.</p> <p>NUE403 Electrical installations — design and equipment selection</p> <p>LO13 Explain the need for documenting the reasons for a particular installation design and the equipment selected and installed</p>

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40. Demonstrate the knowledge and skill to perform effective safe isolation of any equipment, including switch and lock off, circuit isolation, equipment testing and tagging procedures.	The sequential steps needed to achieve an isolated, tested and safe work area. Preparation of a written isolation procedure.	Critical	<p>NBB002.1 Occupational health and safety</p> <p>LO 4 Develop the knowledge and skills that are essential for working safely with electrical tools or equipment.</p> <p>NE172.2 Electrical wiring and equipment 1</p> <p>LO 1 Demonstrate safe isolation, testing and tagging procedures.</p> <p>NUE 505A Electrical systems safety</p> <p>LO 1 Demonstrate knowledge and skills for working safely with electricity</p> <p><i>Note: This capability is fundamental to safety and is included in Work Performance Module for each core competency standard unit. See Note 2</i></p>
41. Describe the construction, specifications, colour coding and application of various types of cords and cables.	Conductor material, stranding, colour coding, sheathing types and other construction parameters of cords and cables. Typical application examples of the various cable types and interpretation of cable manufacturers data.	Essential	<p>NE172.1 Electrical wiring and equipment 1</p> <p>LO 3 Describe the construction, specifications, colour coding and application of cords and cables</p>
42. Demonstrate the skill to prepare and terminate cords and cables.	Requirements for cable jointing and termination in a variety of installation situations and accessories.	Essential	<p>NE172.2 Electrical wiring and equipment 1</p> <p>LO 4 Prepare and terminate cords and cables.</p> <p>NE173.1 Electrical wiring and equipment 2</p> <p>LO 4 Connect consumers mains to an installation, in accordance with Wiring Rules and local</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>

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Performance	Level	Status	National Modules
43. Demonstrate the Selection and attachment of electrical accessories, using appropriate fixing devices and methods.	Various fixing devices, methods and the tools which may be used – need for safety whilst performing this work.	Essential	<p>NE172.1 Electrical wiring and equipment 1</p> <p>LO 5 Select and fix electrical accessories, using appropriate fixing devices and methods in a given electrical installation</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>
44. Demonstrate the knowledge and skill to install and terminate a variety of electrical cables in a wide range of applications (including final subcircuits) to AS/NZS3000:2000.	Installation requirements for a wide range of typically used electrical cables in a variety of situations: e.g. thermoplastic, elastomer sheaths, XLPE, high temperature cables. Separation from other services (and fire wall penetrations).	Critical	<p>NE173.1 Electrical wiring and equipment 2</p> <p>LO 1 Install single purpose or mixed final subcircuits supplying lighting, exhaust fans and socket outlets using flat TPS cables</p> <p>LO 2 Install final subcircuits supplying appliances using unenclosed flat TPS cable and TPI cables enclosed in non-metallic trunking and conduit.</p> <p>NUE407 Electrical wiring systems</p> <p>LO 1 Determine and apply the regulatory requirements in relation to the installation of TPS cables, and install TPS cables in a simulated installation.</p> <p>LO 2 Determine and apply the regulatory requirements for cable enclosures and in relation to the installation of TPI cables and install TPI cables in a simulated installation.</p> <p>LO 3 Determine and apply the regulatory requirements in relation to the installation of MIMS cables and install MIMS cables in a simulated non-domestic installation.</p>

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
			LO 4 Determine and apply the regulatory requirements in relation to the installation of armoured cables and install armoured cable in a simulated installation. NUE 505A Electrical systems safety <i>See Note 1</i> NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance
45. Demonstrate the knowledge and skills for the installation of wiring support systems	Steel conduit, PVC conduit, ladder/perforated tray, trough/duct, including ratings, space, etc.	Essential	NE17.1 Electrical wiring and equipment 2 LO 2 Install final subcircuits supplying appliances using unenclosed flat TPS cable and TPI cables enclosed in non-metallic trunking and conduit. NUE407 Electrical wiring systems LO 1 Determine and apply the regulatory requirements in relation to the installation of TPS cables, and install TPS cables in a simulated installation. LO 2 Determine and apply the regulatory requirements for cable enclosures and in relation to the installation of TPI cables and install TPI cables in a simulated installation. LO 5 Determine and apply the regulatory requirements in relation to the installation of catenary supported cable, pendant-type socket outlet and trailing cables and install catenary supported cables in a simulated installation NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance
46. Describe and perform the circuit tests required for electrical cables in a range of installations, with attention to the final subcircuit tests.	Earth continuity, insulation resistance, fault loop impedance, polarity and correct circuit connection tests.	Critical	NUE408 Electrical installations — testing and verification

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
			<p>LO 2 Demonstrate the ability to conduct the tests required to ensure an electrical installation is safe in accordance with regulatory requirements.</p> <p>NE173.1 Electrical wiring and equipment 2</p> <p>LO 1 Install single purpose or mixed final subcircuit supplying lighting, socket outlets, exhaust fans and other similar current-using equipment using flat TPS cable.</p> <p>LO 2 Install final subcircuits supplying fixed appliances using unenclosed flat TPS cable and TPI cable enclosed in non-metallic trunking and conduit.</p> <p>NUE407 Electrical wiring systems</p> <p>LO 1 Determine and apply the regulatory requirements in relation to the installation of TPS cables, and install TPS cables in a simulated installation.</p> <p>LO 2 Determine and apply the regulatory requirements for cable enclosures and in relation to the installation of TPI cables and install TPI cables in a simulated installation.</p> <p>LO 3 Determine and apply the regulatory requirements in relation to the installation of MIMS cables and install MIMS cables in a simulated non-domestic installation.</p> <p>LO 4 Determine and apply the regulatory requirements in relation to the installation of armoured cables and install armoured cable in a simulated installation.</p> <p>LO 5 Determine and apply the regulatory requirements in relation to the installation of catenary supported cable, pendant-type socket outlet and trailing cables and install catenary supported cables in a simulated installation</p> <p>NUE 505A Electrical systems safety</p>

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
			<p>LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use</p> <p>NEWP402b Test apparatus and circuits - <i>Electrical work performance</i></p>
47. Install final subcircuit wiring into switchboards and connect to switchboard equipment in accordance with AS/NZS 3000:2000 and local supply authority requirements.	Termination of subcircuit cabling at switchboards and connection to components.	Critical	<p>NE173.1 Electrical wiring and equipment 2</p> <p>LO 3 Install and connect final subcircuit wiring at switchboard equipment and prepare a switchboard for connection to the supply in accordance with Wiring Rules and local distributor's requirements.</p> <p>NUE 505A Electrical systems safety <i>See Note 1</i></p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance <i>See Note 2</i></p> <p>NEWP106b Install electrical/electronic apparatus - <i>Electrical work performance</i> <i>See Note 2</i></p>
48. Connect consumers mains to an installation, in accordance with AS/NZS 3000:2000 and local supply authority requirements.	Installation of consumers mains in buildings and underground. Termination at pillars, pits and mains connection boxes. Bonding of metallic meter enclosures.	Critical	<p>NE173.1 Electrical wiring and equipment 2</p> <p>LO 4 Connect consumers mains in an installation in accordance with the Wiring Rules and local distributor's requirements.</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance</p>

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
49. Determine and apply AS/NZS 3000:2000 and AS/NZS 3008 requirements for the installing, terminating and testing of MIMS and Armoured cables. This is to include the cable type selection to AS2381 (or other standards) requirements.	Assessment of cable ratings according to installation method and location. Installation and termination of MIMS and armoured cables and accessories and necessary tests.	Essential	<p>NUE407 Electrical wiring systems</p> <p>LO 3 Determine and apply the regulatory requirements in relation to the installation of MIMS cables and install MIMS cables in a simulated non-domestic installation.</p> <p>LO 4 Determine and apply the regulatory requirements in relation to the installation of armoured cables and install armoured cable in a simulated installation</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance <i>See Note 3</i></p> <p>NEWP402b Test apparatus and circuits - <i>Electrical work performance</i></p>
50. Determine and apply AS/NZS 3000:2000 requirements for the installing, terminating and testing of catenary supported cables, pendant-type socket outlets and trailing cables.	Assessment of the requirements for installation of cables and accessories supported by catenary wire, techniques of installing trailing cables.	Essential	<p>NUE407 Electrical wiring systems</p> <p>LO 5 Determine and apply the regulatory requirements in relation to the installation of catenary supported cable, pendant-type socket outlet and trailing cables and install catenary supported cables in a simulated installation</p> <p>NEWP105g Install and terminate wiring systems (<i>Cable/wiring Support and Protection</i>) Work performance</p> <p>NEWP105j Install and terminate wiring systems (<i>Power and control – Low Voltage</i>) Work performance <i>See Note 2</i></p>

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
51. Demonstrate ability to read, sketch and interpret electrical diagrams.	Purpose and characteristics of schematic, block and wiring diagrams, typical symbols used.	Critical	NUE062 Drawings and diagrams for electrical work
			LO 3 Demonstrate knowledge of standards and conventions used in Architectural drawings and interpret the information they contain.
			LO 5 Draw the location of points, current-using-equipment and distribution boards on an architectural plan using Electrical (location) drawing standards and conventions.
			LO 6 Develop a cable schedule for a given installation.
			LO 7 Demonstrate knowledge of standards and conventions used in electrical drawings and interpret the information they contain.
			LO 8 Draw freehand a basic electrical circuit using Electrical drawing standards and conventions
			NUE 505A Electrical systems safety <i>See Note 1</i>
			<i>Note: This capability is fundamental to all electrical work functions and is included in work performance module for each core competency standard unit. See Note 2</i>
52. Design and connect switching circuits, including via electronic logic controls, as per AS/NZS 3000.	Lighting and equipment control circuits. PLCs at basic level. Other types of logic controllers (eg C Bus).	Essential	NE32.1 Circuit development 1
			LO 2 Convert wiring diagrams into ladder and circuit diagrams.
			LO 4 Design and connect basic control circuits.
			NUE064 Electronic power and control 1
			LO 5 State the purpose and typical applications of microprocessor systems
			LO 6 Describe the application of PLC's when used in electrical control circuits to replace relay logic circuits.

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
53. Describe basic statutory occupational safety and health responsibilities for employers and employees, including supervisory requirements and employees' own "duty of care".	Occupational Safety and Health regulations and electrical safety regulations - legal requirements, safety committees and duty of care.	Critical	<p>NBB002.1 Occupational health and safety</p> <p>LO 1 Explain the basic legal requirements covering occupational health and safety</p> <p>NUE 505A Electrical systems safety</p> <p>LO 1 Demonstrate knowledge and skills for working safely with electricity</p> <p><i>Note: This capability is fundamental to safety and is included in Work Performance Module for each core competency standard unit. See Note 2</i></p>
54. Demonstrate understanding of the requirements for personal safety in the workplace including safe isolation and application of safety practices.	Adoption of safe working practices, incident reporting process and responsibility to co-workers. Reference to safe electrical work guidelines issued by regulators, including supervision requirements applying to apprentices and trainees.	Critical	<p>NE172.2 Electrical wiring and equipment 1</p> <p>LO 1 Demonstrate a knowledge of safe isolation, testing and tagging procedures.</p> <p>NBB002.1 Occupational health and safety</p> <p>LO 2 List the requirements for personal safety in the workplace</p> <p>LO 4 Demonstrate knowledge and skills essential to working safely with electrical tools and equipment</p> <p>NUE044 Electrical safe working practice</p> <p>LO1 Demonstrate an understanding of the principles of risk management and assessment of risk.</p> <p>LO 2 Demonstrate knowledge and skills in dealing with non-electrical hazards encountered in electrical work.</p>

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
			LO 3 Demonstrate knowledge and skills for dealing with hazards associated with low-voltage, extra-low voltage and high-currents. NUE505A Electrical systems safety LO 1 Demonstrate knowledge and skills for working safely with electricity <i>Note: This capability is fundamental to safety and is included in Work Performance Module for each core competency standard unit. See Note 2</i>
55. Describe a workplace safety check, identify potential workplace hazards and suggest measures for accident prevention.	Workplace safety inspections. Reference to guidelines issued by both electrical safety regulators and general workplace safety regulators including the supervision requirements applying to apprentices/trainees..	Essential	NBB002.1 Occupational health and safety. LO 3 Carry out workplace safety checks, identify hazards and suggest measures for accident prevention. NE172.2 Electrical wiring and equipment 1 LO 2 State the legislative requirements in relation to electrical safety and the associated standards. NUE 044 Electrical safe working practice LO1 Demonstrate an understanding of the principles of risk management and assessment of risk. LO 2 Demonstrate knowledge and skills in dealing with non-electrical hazards encountered in electrical work. LO 3 Demonstrate knowledge and skills for dealing with hazards associated with low-voltage, extra-low voltage and high-currents. <i>Note: This capability is fundamental to safety and is included in Work Performance Module for each core competency standard unit. See Note 2</i>

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
56. Demonstrate the knowledge and practices that are essential for working safely with electrical equipment and tools and knowledge of testing and tagging procedures to AS 3760.	Testing and tagging procedures, common causes and prevention of electric shocks and incidents . Safe use of hand and power tools , including power actuated fastening devices, ladders, elevated work platforms, etc	Essential	NBB002.1 Occupational health and safety
			<p>LO 4 Demonstrate knowledge and skills essential to working safely with electrical tools and equipment</p> <p>NUE408 Electrical installations — testing and verification</p> <p>LO 2 Demonstrate the ability to conduct the tests required to ensure an electrical installation is safe in accordance with regulatory requirements.</p> <p>NE172.2 Electrical wiring and equipment 1</p> <p>LO 7 Select and fix accessories, using appropriate fixing devices and methods for a given electrical/electronic installation</p> <p>NE175.1 Workshop practice</p> <p>LO 2 Demonstrate the safe use of hand and power tools used in installing, maintaining and repairing electrical, electronic or instrumentation work.</p> <p>NUE 044 Electrical safe working practice</p> <p>LO5 Demonstrate knowledge and skills in relation to safety, in selection, use maintenance and care of test equipment.</p> <p>NEWP402b Test apparatus and circuits - Electrical work performance</p>
57. Describe the method of rescuing a person in contact with live electrical conductors or equipment.	Fundamental principles of emergency procedures.	Critical	NBB002.1 Occupational health and safety

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
			LO 5 Describe the method of rescuing a person in contact with live electrical conductors or equipment. NUE 505A Electrical systems safety LO 1 Demonstrate knowledge and skills for working safely with electricity
58. Describe the emergency first aid requirements for an electric shock victim and demonstrate the knowledge and application skill of EAR and CPR.	Application and learning of EAR and CPR procedures to resuscitate and stabilise a victim. Use of fire extinguishers to control electrical fire at accident site.	Critical	NBB002.1 Occupational health and safety Describe essential requirements of emergency first aid for an electric shock victim and perform CPR on a mannequin NUE505A Electrical systems safety LO 1 Demonstrate knowledge and skills for working safely with electricity
59. Demonstrate knowledge and understanding of the significant dangers of High Voltage equipment and distribution systems.	Step and touch voltages, induced voltages, creepage and clearance requirements. Stored energy and earthing requirements. The use of safe working procedures.	Critical	NUE048.1 Single and three-phase transformers LO 9 Describe the safety aspects relating to the high voltage side of a power transformer and related switchgear NUE044 Electrical safe working practice LO4 Demonstrate an understanding of the risks and control measures associated with high-voltage. NUE505A Electrical systems safety LO 1 Demonstrate knowledge and skills for working safely with electricity
60. Describe the types of potential operational situations that may be encountered in various areas of industry, that will require assistance from more experienced industry personnel.	Eg 1. The need to isolate and earth an item of equipment supplied at High Voltage, for repair or maintenance work. Eg 2. The need to sequentially shutdown and isolate a gas fired boiler in preparation for electrical maintenance.	Essential	<i>Note: This capability is fundamental to safety and is included in Work Performance Module for each core competency standard unit. See Note 2</i> NUE044 Electrical safe working practice LO4 Demonstrate an understanding of the risks and control measures associated with high-voltage.

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
61. Describe the type of assistance that may be needed for operational situations that could be encountered in various areas of industry.	Continuing the above examples Eg 1.Consulting experienced local operational personnel to obtain advice on H V Switching procedure and earthing arrangements. Eg 2. Consulting experienced personnel for the advice to shut down the boiler in a safe manner.	Essential	<i>Note: This capability is fundamental to safety and is included in Work Performance Module for each core competency standard unit. See Note 2</i>
62. Describe methods of commissioning and/or decommissioning electrical equipment or an installation, using a systems approach.	Commissioning: Circuit voltage testing, phase rotation checks, systematic loading up, correct installation functioning and instrumentation/-control parameter checks. Decommissioning: Identification of all circuits, impact on other equipment, isolation, tagging, testing, securing and earthing where required, safe removal of equipment/ conductors.	Critical	NUE 505A Electrical systems safety LO 1 Demonstrate knowledge and skills for working safely with electricity LO 2 Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use. NEWP301b Undertake commissioning procedures of apparatus and associated circuits - <i>Electrical</i> work performance
63. Describe the functioning of basic electronic circuits used in common electrical power circuit applications including related hazards and safety requirements..	Basic theory and measurement. Common applications are motor starters, lighting dimmers, inverters, line conditioners, smoke alarms, backup supplies, etc. Hazards and safety requirements associated with Static Electricity Discharge from components.	Essential	NUE064 Electronic power and control LO 1 Explain the principle of operation and list typical applications for the following common semiconductor devices: rectifier diodes, zener diodes, transistors, SCRs, triacs, diacs and three terminal voltage regulator IC. LO 2 Describe the operating principle and characteristics for single phase half wave and full wave rectifiers, three phase rectifiers and low pass passive filters. LO 3 Describe the operating principles and safety precautions for low voltage inverter systems.

Summary of learning strategies supporting achievement of essential capabilities required of a "Licensed Electrician"

Capabilities			Learning and Assessment Strategies
Performance	Level	Status	National Modules
			LO 3 Demonstrate knowledge and skills in installing, diagnosing faults and repairing luminaires NUE046 Alternating current machines LO 9 Describe possible causes of malfunction of three phase and single phase induction motors and demonstrate the tests required for diagnosing faults NUE048.1 Single and three-phase transformers LO10 Describe possible causes of malfunction of transformers and demonstrate the tests required for diagnosing faults NUE505A Electrical systems safety LO 1 Demonstrate knowledge and skills for working safely with electricity LO 4 Demonstrate knowledge and skills for ensure electrical fault protection devices will operate as intended. NEWP501b Diagnose and rectify faults in apparatus and associated circuits - <i>Electrical</i> work performance

NOTES

- 1. The assessment criteria in **NUE 505A Electrical systems safety** subsumes knowledge and understanding of electrical safety, principles and circuits and the application of electrical principles to the safe operation of equipment*
- 2. The work performance module for each core competency standard unit includes in the assessment criteria “Applying **safety procedures, techniques, information and resources** relevant to performance”.*
- 3. The selection of cables for hazardous areas is at an **AQF level IV** competency and is included in the competency standard unit **NES 707A Design electrical installations in hazardous areas**, (See *AS/NZS4761.1 Clause 2.5.14*)*