Electrical Workers Registration Board

SAFETY | COMPETENCY | COMPLIANCE

Essential Capabilities for Electrical Registration

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1. Introduction

1.1 In its Gazette notice which was published on 27 April 2017 the Electrical Workers Registration Board (the Board) set out the requirements/standards for classes of registration and the limits of work applicable to those classes.

1.2 The process of becoming registered is primarily a qualifications based system. This system includes Trans-Tasman developed and recognised core competencies developed by ERAC, the Electrical Regulatory Authorities Council, an organisation formed to coordinate the activities of Australian and New Zealand electrical regulators. The system is also incorporated into the national qualification framework and the Board's pre-registration assessments and examinations.

1.3 A key aspect of the approach by the Board to the classes of registration is the opportunity for people to progress through the electrical registration competencies without the need to undertake a complete retraining when a person wishes to aspire to a different category of registration. This will be achieved by a series of stepping blocks that can be built upon at any time to advance a person's skills and competencies in electrical work.

1.4 The core competencies maintained by ERAC are a set of 55 competencies. In 2019 the Board worked with ERAC and New Zealand electrical industry stakeholders to develop an updated set of core competencies based on the ERAC 55 core competencies. The Australian regulators have not yet adopted the updated core competencies but the Board has.

1.5 The attached table shows the New Zealand core electrical competencies for installation based qualifications and registration.

2. Core competencies

2.1 The core competencies are attached.

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Electrical Worker Core Competencies

Contents:

Status of Competencies:

- Essential Knowledge – Electrical worker must show a high level of knowledge or understanding of the competency;
- General Understanding – Electrical worker must show a working knowledge or understanding of the competency; or
- Awareness – Electrical worker must show a basic level of knowledge or understanding of the competency.

Terms Used:

- **Apply**: integrate concepts and evidence to demonstrate a comprehensive understanding; can include a practical demonstration.
- **Define**: give a clear and concise meaning of the competency.
- **Demonstrate**: use clear thinking to show an understanding of a competency; can include a practical demonstration.
- **Describe**: give an account of the main points of the competency in a logical sequence.
- **Explain**: make clear in plain language the competency and/or the implications of it.

NB: the definitions used in AS/NZS 3000 should be used for terms that are not defined within this document

Notes

1. **Application of Standards:** electrical workers must be able to **Apply** any relevant Regulatory provisions and/or Joint Standards such (but not limited to) AS/NZS:3000 to the Core Competencies.
2. **Jurisdictional Variances:** the Core Competencies may be further developed to accommodate for specific requirements in the state, territory or country in which they are being applied.
3. **Standards and Jurisdictional Variances:** individual states, territories or countries may include a schedule of standards, codes of practice or other legislative instruments cited in or mandated by legislation.

No.	Category	Status	Title	Component	Evidence	Applies To
	Health and Safety					
1.	**Health and Safety** **Was: 42, 44**	**Essential Knowledge**	**Demonstrate** an understanding of fundamental workplace health and safety principles and practices. **Describe** basic statutory occupational health and safety responsibilities for employers and employees, including supervisory requirements and employees' own "duty of care". **Describe** a workplace safety check, identify potential workplace safety risks suggest measures for accident prevention.	Includes health and safety legislation; duties and rights in relation to health and safety; identifying and managing health and safety risks; undertaking workplace safety inspections.	• **Describe** the enabling Act and **Explain** its purpose; • **Describe** any primary regulations and **Explain** their purpose; • **Explain** the primary onsite health and safety duties and rights of employers and employees; • **Define** key principles and terms; • **Describe** common on-site health and safety risks; • **Describe** procedures for carrying out a workplace safety check both as an individual and as part of a group; • **Demonstrate** how to identify on site health and safety risks both as an individual and as part of a group; and • **Demonstrate** methods to minimise or isolate safety risks and hazards both as an individual and as part of a group.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
2.	**Health and Safety** **Was: 43, 31**	**Essential Knowledge**	**Demonstrate** an understanding of the requirements for personal safety in the workplace and the application of safety practices for electrical workers.	Includes adoption of safe working practices; incident and accident reporting; responsibilities to co- workers and persons under supervision; knowledge of specific Standards that apply to safety when	• **Describe** the purpose of and **Apply** Safe Work Method Statements and Job Safety Analysis; • **Describe** how to develop a safe work method; • **Describe** and **Apply** safe methods for identifying source of supply to be isolated;	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**

No.	Category	Status	Title	Component	Evidence	Applies To
				carrying out electrical work; effective safe isolation including lock out and tag out; circuit isolation; equipment testing and tag out procedures including for various sources of energy.	• **Describe** and **Apply** process for isolation, lock-out and tagging; • **Describe** and **Apply** safe methods for confirming effective and safe isolation. • **Describe** requirements for dealing with unused conductors and equipment; • **Define** when electrical incidents and accidents must be reported and why; • **Describe** the processes to report electrical incidents, notifiable incidents and accidents; • **Define** the legal limits of electrical work for apprentices, trainees and supervised persons; and • **Describe** the processes for the supervision of apprentices, trainees and others.	
3.	**Health and Safety** **Was: 10, 45**	**Essential Knowledge**	**Demonstrate** an understanding of fundamental electrical safety principles and practices. Demonstrate and understanding of safe work practices when working with electrical equipment and tools.	Includes legislative requirements and applicable Joint Standards; means of protection; design, selection and installation of electrical equipment for electrical safety; protection from direct and indirect contact with live parts; common causes and prevention of electric shocks and incidents; safe use of hand and power tools, actuated fastening	• **Describe** the appropriate personal protective equipment to be used when carrying out electrical work; • **Explain** the fundamental safety principles of protection against direct contact with live parts and indirect contact; • **Explain** thermal effects of current, overcurrent; • **Describe** earth faults and abnormal voltages; • **Describe** methods to prevent spread of fire; • **Describe** safe methods for use of tools;	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**

No.	Category	Status	Title	Component	Evidence	Applies To
				devices, working in confined spaces and working at heights; testing and tagging requirements.	• **Describe** safe methods for working in confined spaces; • **Describe** safe methods for working at heights; • **Describe** methods to prevent mechanical injury from external influences; and • **Describe** fundamental principles of design, selection and installation of equipment, means of compliance (including alterations, additions and repairs), and verification of compliance with legislative requirements.	
4.	**Health and Safety** **Was: 46, 47**	**Essential Knowledge**	**Describe** the method of rescuing a person in contact with live electrical conductors or equipment, first aid requirements for injuries and electric shocks, resuscitation and stabilisation of victims.	Includes the fundamental principles of emergency procedures; safe rescue of victims; application of first aid and resuscitation; use of fire extinguishers to control electrical fires.	• **Describe** the procedures for ensuring safety of the rescuer; • **Describe** the methods for establishing the source voltage level; • **Describe** the rescue process 'dos' and 'don'ts' including calling for help; • **Describe** and **Apply** appropriate first aid methods; • **Describe** and **Apply** cardiopulmonary resuscitation; • **Describe** and **Apply** methods of stabilising a patient; and • **Describe** the principles that apply to the selection and use of fire extinguishers to control an electrical fire at an accident site.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
	Fundamental Principles					
5.	**Fundamental Principles**	**General Understanding**	**Demonstrate** a knowledge of the	Includes demonstrating an understanding of the	• **Describe** the enabling Act and **Explain** its purpose;	• **E**

No.	Category	Status	Title	Component	Evidence	Applies To
	New		legislative framework for electrical work.	hierarchy of legislative instruments, safety requirements and restrictions on carrying out electrical work.	• **Describe** any primary regulations and **Explain** their purpose; • **Describe** the relationship between the Act, Regulations and cited standards; and • **Demonstrate** an understanding of what takes precedence regarding the Act, the Regulations, cited standards and other legislative instruments.	• **ENG** • **EI** • **EST** • **EAS** • **AT**
6.	**Fundamental Principles** **Was: 1**	**General Understanding**	**Demonstrate** a knowledge of basic electrical and energy concepts.	Includes the fundamentals of electrical and other forms of energy; voltage, current and resistance.	• **Explain** the relationship between power, work and energy; • **Explain** the different forms of electrical energy; and • **Explain** the concepts of charge, current and electromotive force; and • **Define** electrical and energy concepts.	• **E** • **EI** • **EST** • **EAS** • **AT**
7.	**Fundamental Principles** **Was: 4**	**Awareness**	**Demonstrate** a knowledge of the principles of various sources of electromotive force (EMF) and basic electronics, semi-conductor devices.	Includes how electrical energy is generated and/or produced from various forms of energy, including from batteries; basic understanding and use of semiconductor devices	• **Describe** the various sources of electricity; • **Explain** the principles by which electricity is produced from a magnetic field coupled with motion of conductors through that field, induction; • **Explain** the principles by which electricity is produced in batteries, solar cells and by static; and • **Explain** the function, characteristics and typical applications of types of semiconductors including but not limited to: Diodes, Silicone Controlled Rectifiers, Thyristors, Thermistors.	• **E** • **EI** • **EST** • **EAS** • **AT**
8.	**Fundamental Principles**	**Essential Knowledge**	**Demonstrate** a knowledge of the	Includes principles of electric current; physical	• **Explain** the physical effects of current;	• **E** • **EI**

No.	Category	Status	Title	Component	Evidence	Applies To
	Was: 2		various effects of electric current and voltage.	effects on humans and animals; physical effects on heating and other energy conversion effects and principles.	• **Explain** the principles by which an electric current can produce heat, light, motion and a chemical reaction; and • **Describe** the physiological effects of current on humans and animals.	• **EST** • **EAS** • **AT**
9.	**Fundamental Principles** **Was: 3**	**Essential Knowledge**	**Demonstrate** a knowledge of resistivity and resistors.	Ohm's law, material resistivity, resistor parameters and introduction to measuring methods.	• **Explain** and **Apply** the relationship between voltage, current and resistance (Ohm's Law); • **Explain** factors affecting resistance; • **Explain** linear and non-linear resistivity; and • **Describe** methods for measuring resistance.	• **E** • **EI** • **EST** • **EAS** • **AT**
10.	**Fundamental Principles** **Was: 6**	**Essential Knowledge**	**Demonstrate** a knowledge of the theory and application of capacitors and inductors and their effects.	Includes concepts and characteristics of capacitors and inductors and their application; units of measure; effects on V and I phase relationships; resonance and impedance.	• **Explain** the concepts of inductive and capacitive reactance, resonance and impedance; • **Describe** circuit arrangements; • **Explain** the phase relationship between voltage and current in resistive, inductive and capacitive reactive circuits; • **Explain** the relationship among the parameters of voltage, current, impedance and power dissipation in the whole or any part of a circuit; • **Describe** and **Apply** how to safely measure voltage, current and power dissipation for the whole or any part of a circuit; and • **Describe** and **Apply** methods of determining circuit behaviour for	• **E** • **EI** • **EST** • **EAS**

No.	Category	Status	Title	Component	Evidence	Applies To
					variation in any of the parameters from measured and calculated values.	
	Power Systems					
11.	**Power Systems** **Was: 7**	**Awareness**	**Demonstrate** a knowledge of permanent and electromagnetic induction and its applications.	Includes principles of EMF induced in a conductor and its application in electrical machines and devices.	• **Describe** field patterns around permanent magnets; • **Describe** field patterns produced by current-carrying conductors; • **Explain** self and mutual inductance; • **Explain** factors affecting the characteristic of inductive components and circuits; • **Explain** electromagnetic principles applied in transformers; • **Explain** motor action in a generator and generator action in a motor; and • **Explain** the application of electromagnetics in control and protective devices.	• **E** • **EI** • **EST** • **EAS**
12.	**Power Systems** **Was: 55**	**Essential Knowledge**	**Demonstrate** knowledge of generation systems including solar, wind and rotary. Methods of control and isolation for grid connect and stand alone. Basic knowledge of battery storage systems, inverters and charging systems including electric	Includes the requirements for safe installation, operation and repair with reference to applicable Standards.	• **Describe** types of batteries and how they work; • **Describe** types of charging systems and how they work; • **Explain** the importance of using DC rated switches and circuit breakers to open or isolate DC circuits; • **Describe** types of inverters and how they work; • **Describe** the appropriate uses for different types of generators, batteries, charging systems and inverters; • **Describe** the fundamental requirements for mechanical and electrical protection	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
			vehicle charging systems.		for generators, batteries, charging systems and inverters; • **Describe** DC polarity and inverter principles for generation, storage and the connection of DC systems to AC systems; and • **Describe** and **Apply** methods for safe isolation and testing of generator, battery, charging systems and inverters.	
13.	**Power Systems** **Was: 11**	**General Understanding**	**Demonstrate** a knowledge of power factor; power factor improvement principles, power harmonics; power measurement techniques to AC circuits in single, two and three phase installations.	Includes consequences of unity and low power factor; value of capacitance required for correction; measurement theory and methods to obtain real power, apparent power and Volt-Ampere Reactive (VAR) values.	• **Describe** power factor; • **Explain** the consequences of unity and non-unity power factor; • **Explain** the consequences of power harmonics; • **Describe** means of improving power factor; • **Describe** power measurement methods; • **Describe** methods to obtain real and apparent power values; and • **Describe** requirements for installation of capacitors and reactors including associated safety considerations.	• **E** • **EI** • **EST**
14.	**Power Systems** **Was: 9**	**General Understanding**	**Explain** Star and Delta three phase AC systems; **Explain** the reason why three-phase is used.	Includes multiphase systems; demonstrating their advantages including reduced current flow and equipment size.	• **Explain** the advantages of a three-phase system; • **Explain** Star connections and relationship between line and phase values of voltages and currents; • **Explain** Delta connections and relationship between line and phase values of voltages and currents;	• **E** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
					• **Describe** balanced and unbalanced loads; and • **Describe** and **Apply** methods of determining line and phase voltages and currents and neutral current in unbalanced loads.	
	Conductors					
15.	**Conductors** **Was: 32**	**General Knowledge**	**Describe** the construction, specifications, colour coding and application of various types of cords and cables.	Includes common conductor materials; stranding; colour coding; sheathing types; construction parameters and limitations of cords and cables; common application examples of various cable types; interpretation of cable manufacturer's data.	• **Describe** cable conductor materials and their configuration for common types of cords and cables; • **Describe** and **Apply** permitted cable core colours of conductors for installation wiring including International Electrotechnical Commission (IEC) specifications; • **Describe** and **Apply** permitted colour required to identify protective earthing and equipotential bonding conductors including IEC specifications; • **Describe** and **Apply** conductor colours permitted for conductors in flexible cords and equipment wiring, including IEC specifications; and • **Describe** and **Apply** the application of cables as defined by the properties of their insulation, sheathing, armouring and/or screening.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
16.	**Conductors** **Was: 33, 35, 36**	**General Understanding**	**Demonstrate** a knowledge of the requirements to install, joint and terminate a variety of	Includes the installation requirements for a wide range of typically used conductors in a variety of situations such as TPS	• **Describe** and **Apply** typical cable routes through installations; • **Describe** and **Apply** the use and application of flat TPS, circular TPS, steel	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
			conductors in a wide range of applications including mains, sub-mains, final sub circuits and to selection and installation of wiring support systems.	(Tough Plastic Sheath) thermoplastic sheathed, elastomer sheaths, XLPE, neutral screened and high temperature cables; separation from other services; fire barrier penetrations. Installation requirements for wiring enclosures and installations, spacing, environmental considerations.	wire or tape armoured, fire rated and flexible conductors; • **Describe** and **Apply**, for various types of conductors the types of termination devices that can be used, how they are used and their applications; • **Describe** and **Apply** the use and application of wiring accessories; • **Describe** and **Apply** methods for drawing-in, placing and fixing conductors; • **Describe** and **Apply** methods of conductor terminations; • **Explain** methods of maintaining fire rating integrity; • **Describe** considerations for the up-rating and de-rating of cable current-carrying capacity for various installation methods, including the spacing of cables and separation of cable supports and environmental factors; and • **Describe** and **Apply** sizing requirements for wiring enclosures based on space factor recommendations in applicable Standards and in manufacturer's specifications; • **Describe** and **Apply** the use and application of wiring enclosures and systems including non-metallic and metallic conduit, trunking and duct enclosures and cable ladder/trays.	• **EAS** • **AT**

No.	Category	Status	Title	Component	Evidence	Applies To
17.	**Conductors** **Was: 39**	**General Understanding**	**Demonstrate** a knowledge of the requirements to install, terminate and test catenary supported cables, pendant-type, accessories, electrical equipment, and trailing cables and underground.	Includes assessment of the requirements for installation of cables and accessories supported by catenary wire, techniques of installing trailing cables and underground.	• **Describe** and **Apply** the use and application of catenary support systems and underground systems. • **Describe** and **Apply** the use and application of accessories used with catenary support systems; and underground systems; and • **Describe** and **Apply** the requirements for the installation of pendant accessories, electrical equipment.	• **E** • **ENG** • **EI**
18.	**Conductors** **Was: 21**	**Essential Knowledge**	**Demonstrate** a knowledge of cables and the ability to select cables for mains and submains using appropriate Standards based on current carrying capacity, short circuit capacity, maximum demand, earth loop impedance and voltage drop for single, two and three phase installations including for multiple installations.	Includes determining maximum demand, voltage drop, fault currents, interpretation of cable supplier data tables and the impact of various installation methods; selection of the appropriate cable installation route and method.	• **Describe** and **Apply** methods of determining maximum demand on mains and submains cables for single, two and three phase installations; • **Describe** and **Apply** the method for mains and submains cable selection and installation for single, two and three phase installations for common installs based on: ▪ suitability of the cable insulation; ▪ installation methods and external influences affecting cable current-carrying capacity; ▪ voltage drop limitations; ▪ fault loop impedance; and • **Describe** the effects of harmonic current on cable current-carrying capacity; • **Describe** the conditions where short-circuit performance may need to be taken into consideration; and	• **E** • **ENG** • **EI**

No.	Category	Status	Title	Component	Evidence	Applies To
					• **Describe** and **Apply** the earthing requirements for mains and submains cables for single, two and three phase installations.	
19.	**Conductors** **Was: 22**	**Essential Knowledge**	**Demonstrate** a knowledge of cables and the ability to select cables for final sub-circuits using appropriate Standards based on current carrying capacity, short circuit capacity, maximum demand, earth loop impedance and voltage drop.	Includes determining maximum demand, voltage drop, interpretation of cable supplier data tables and the impact of various installation methods; selection of the appropriate cable installation route and method; consequences for protection; fault loop impedance testing.	• **Describe** and **Apply** the method for determining maximum demand of final sub circuits; • **Describe** and **Apply** the method for cable selection and installation based on: ▪ suitability of the cable insulation; ▪ installation methods and external influences affecting cable current-carrying capacity; ▪ voltage drop limitations; ▪ fault loop impedance; ▪ short circuit current; and • **Describe** and **Apply** earthing requirements.	• **E** • **ENG** • **EI**
20.	**Conductors** **Was: 27**	**Essential Knowledge**	**Demonstrate** a knowledge of Standards and applicable regulatory requirements for the installation of aerial conductors, underground wiring and other specialist cables.	Includes selecting various types of conductors suitable for the purpose and environment in which they are to be installed including MIMS cable; conductor ratings; installation methods and systems.	• **Describe** the situations when aerial conductors, underground conductors and MIMs cable and other specialist cables would be appropriate; • **Describe** and **Apply** the method for selecting types of specialist cables including aerial conductors, underground conductors and MIMs cable; • **Describe** the limitations applying to aerial conductors, underground conductors and MIMs cable; • **Describe** and **Apply** specific requirements that apply to the installation of aerial	• **E** • **ENG** • **EI**

No.	Category	Status	Title	Component	Evidence	Applies To
					conductors including aerial span limitations, required clearances and the selection of aerial supporting poles/post and struts for a given application; • **Describe** and **Apply** the correct use of and requirements for catenary support systems; • **Describe** the acceptable cable types and protection methods for underground wiring categories; • **Describe** and **Apply** the requirements for underground wiring to be buried at depth and the required protection methods; • **Describe** the requirements for underground wiring clearances from other services.	
21.	**Conductors** **Was: 38**	**General Understanding**	**Explain** the requirements for connecting consumers' mains to an installation, in accordance with applicable standards and Electricity Distributor requirements.	Includes installation of consumer mains in installations and underground; termination at pillars, pits and mains connection boxes; bonding and earthing.	• **Describe** the planning process for connection to an Electricity Distributor; • **Describe** the correct preparations for connection of Electricity Distributor's equipment; • **Describe** and **Apply** methods and requirements for installing underground and overhead consumer mains; • **Describe** and **Apply** methods of terminating consumer mains at pillars, pits, mains connection boxes and consumer's switchboard(s); and • **Describe** and **Apply** methods of bonding and earthing metallic enclosures.	• **E** • **ENG** • **EI**
	Circuits					

No.	Category	Status	Title	Component	Evidence	Applies To
22.	**Circuits** **Was: 5, 51**	**Essential Knowledge**	**Explain** the operation of a simple practical Direct Current (DC) circuit. **Demonstrate** how to determine the resistance, voltage, current and power in any part of a DC circuit using theory and actual measurement methods.	Includes the concepts of current path; circuit control and load; series and/or parallel circuit analysis; EMF source and conductors; measuring voltage, current and resistance power dissipation.	• **Describe** circuit configuration and connection of energy source, protection device, switch and load in a circuit; • **Explain** the purpose of each component in the circuit; • **Describe** the consequences of an open circuit, a closed circuit and a short circuit; • **Explain** the relationship among parameters of voltage, current, resistance power and dissipation in the whole or any part of a circuit; • **Describe** and **Apply** methods of measurement to determine and calculate the above parameters of the whole or any part of the circuit.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
23.	**Circuits** **Was: 8**	**Essential Knowledge**	**Explain** the operation of a simple practical Alternating Current (AC) circuit. **Demonstrate** a knowledge of alternating voltage and current generation, phase relationships, energy in an AC circuit, and actual measurement methods.	Includes sinusoidal voltage generation and resultant current flow; calculating and apply measuring techniques to derive required parameters such as power factor.	• **Explain** sinusoidal voltage generation and resulting current in single, two and three phase installations; • **Explain** the terms period: maximum value; peak-to-peak value; instantaneous value; average value; root-mean-square value; and frequency; • **Describe** three-phase generation; • **Explain** the relationship among the phase and line voltages generated in a three-phase alternator and the conventions for identifying each; • **Describe** and **Apply** the method of determining the phase sequence or phase rotation of a three-phase supply and its application to motors; and	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**

No.	Category	Status	Title	Component	Evidence	Applies To
					• **Describe** and **Apply** methods of determining power and energy supplied by three phase circuits.	
24.	**Circuits** **Was: 20**	**Essential Knowledge**	**Demonstrate** a knowledge of Isolated supplies, Safety Extra Low Voltage (SELV) and Protected Extra Low Voltage (PELV) systems and their application.	Includes protection against direct and indirect contact with live parts using Isolated, SELV and PELV systems.	• **Explain** the purpose of Isolated, PELV and SELV circuits; • **Explain** when Isolated, SELV and PELV circuits should be used and why; • **Describe** the electrical configurations used for Isolated, SELV and PELV circuits; • **Describe** and **Apply** the earthing requirements for Isolated, SELV and PELV circuits; and • **Describe** and **Apply** the testing of Isolated, SELV and PELV circuits.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
25.	**Circuits** **Was: 50**	**Essential Knowledge**	**Demonstrate** methods of commissioning and/or decommissioning electrical equipment or an installation, using a systems approach.	Includes safety checks and procedures for the 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.	• **Describe** and **Apply** the requirements for testing prior to energisation; • **Describe** isolation testing and procedural requirements applying to removal of equipment and termination of unused cables; • **Describe** the risks associated with mechanical damage to cables and equipment; • **Describe** when and how, in commissioning and decommissioning circuits, to use: ▪ check sheets; ▪ test sheets; and • **Describe** what records/documentation are required for commissioning and decommissioning installations or parts of,	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
					equipment, circuits and other electrical components; and • **Describe** acceptable methods of disposing of hazardous materials.	
	Switches and Switchboards					
26.	**Switches and Switchboards** **Was: 24**	**Essential Knowledge**	**Demonstrate** an understanding of the types of switchboards and distribution boards and their use; regulatory requirements for the location of switchboards and distribution boards and the arrangement of switchboard and distribution board equipment in installations.	Includes determining suitable locations taking environmental factors into account and personnel access requirements; requirements for metering; equipment positions; identification of switchboards and distribution boards and of installed equipment.	▪ **Describe** and **Apply** the requirements for accessibility of and the restricted locations of switchboards and distribution boards; ▪ **Describe** the construction requirements of switchboards and distribution boards; ▪ **Describe** and **Apply** the requirements for the identification of main switchboards and distribution boards; and ▪ **Describe** and **Apply** the requirements for the: ▪ arrangement and installation of metering equipment; ▪ identification of main switchboards and distribution board equipment; and ▪ wiring and fire-protection measures for switchboards and distribution boards.	• **E** • **ENG** • **EI**
27.	**Switches and Switchboards** **Was: 23**	**Essential Knowledge**	**Demonstrate** the control and protection requirements for installations and equipment; select suitable equipment and switchgear for an	Includes main board controls, distribution board controls and submain/final sub circuit controls; assessment of the prospective short circuit current and operating current;	• **Define** minimum and maximum fault levels specified by an Electricity Distributor; • **Describe** and **Apply** methods and arrangement for protection against short-circuit currents, overload currents and earth fault;	• **E** • **ENG** • **EI**

No.	Category	Status	Title	Component	Evidence	Applies To
			installation or part installation.	selection of equipment and suitable protection equipment to protect conductors and installed equipment, selection and installation of residual current devices (RCDs) and arc fault detection devices (AFDD).	• **Describe** and **Apply** coordination: ▪ of overload and short-circuit protection devices; ▪ between conductor current ratings and overload protection devices; and • **Explain** causes of over and under voltage; • **Describe** and **Apply** device requirements for protection against switchboard: ▪ over and under voltage; ▪ internal arc faults; ▪ fault current; ▪ surges; and • **Describe** and **Apply** the requirements for the installation of RCDs and AFDDs.	
28.	**Switches and Switchboards** **Was: 37**	**Essential Knowledge**	**Demonstrate** the knowledge to install final sub circuit wiring into switchboards and connect to switchboards and distribution boards.	Includes planning the install; termination of sub circuit conductors at switchboards and distribution boards; connection of conductors to switchboard and distribution board equipment.	• **Describe** the correct interconnection between switchgear, protection devices and links; and • **Describe** and **Apply** the requirements to ensure: ▪ conductor sizes are adequate; ▪ neutral conductors are clearly identified; ▪ correct polarity; and ▪ earthing systems.	• **E** • **ENG** • **EI**
	Accessories					
29.	**Accessories** **Was: 34**	**Awareness**	**Demonstrate** the knowledge and skills for selection and attachment of electrical accessories,	Includes various fixing devices, methods and the tools which may be used; maintaining and achieve	• **Describe** the types of accessories and their intended use; • **Describe** the requirements for the selection and application of devices for	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
			using appropriate fixing devices and methods.	required fire rating and protection.	fixing to timber, metal, hollow structures and masonry/concrete; • **Describe** and **Apply** the risks and safety measures when working with adhesives and chemical fixing devices; • **Describe** and **Apply** the fire rating and protection requirements for accessories; • **Define** the requirements for following manufacturer's instructions; and • **Demonstrate** the ability to recognise designed building fire protection systems.	• **EAS** • **AT**
30.	**Accessories** **Was: 53**	**Awareness**	**Demonstrate** an understanding of the basic operation and energy efficiency rating of various types of luminaires.	Includes discharge; fluorescent; filament and LED luminaires together with their respective ancillary equipment.	• **Explain** the operating concepts and parameters of common luminaire types and associated control gear; • **Explain** the typical applications of luminaire types; • **Describe** the Rules requirements for the installation of luminaires and luminaires and associated control gear; • **Explain** building code requirements for energy efficiency; and • **Explain** Electricity Distributor requirements for maintaining the correct power factor.	• **E** • **ENG** • **EI** • **EST**
	Earthing					
31.	**Earthing** **Was: 16**	**Essential Knowledge**	**Describe** types of earthing systems, their functions and the advantages and/or disadvantages of each.	Includes basic methods of earthing – MEN, TT, TNS and TNCS; earthing arrangements for protective and functional purposes; earthing	• **Describe** the common types of low voltage supply earthing systems, including MEN, TT, TNS and TNSC; • **Explain** the circumstances in which where the use of one of the above earthing systems would be the more appropriate;	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
			Describe the requirements in relation to MEN earthing arrangements and fault loop impedance calculations.	connections and conductor selection; calculation of the correct cable size for an installation to achieve protection; cable co-ordination.	• **Explain** the purposes of protective and functional earthing; and • **Describe** the parts of a protective earthing systems; • **Describe** the types of earthing equipment and equipotential bonding available and when they would be used; • **Define** the types and sizes of conductors used in earthing; • **Describe** and **Apply** methods of determining the maximum earth-fault loop impedance for a circuit; and • **Describe and Apply** acceptable earthing methods for common installations.	
32.	**Earthing** **Was: 17**	**Essential Knowledge**	**Demonstrate** knowledge of the MEN system and its application including on main circuits; testing of a MEN system.	Multiple Earthed Neutral arrangement, resultant fault current path and magnitude, operation of protective devices and implication of MEN link absence during fault condition.	• **Describe** the roles of the protective earthing (PE) and neutral (N) conductors in an installation and their relationship to the protective earth neutral (PEN) conductor in the Electricity Distributor's system or submain to an outbuilding; • **Explain** the requirements for the installation of a MEN link in an installation and its application to distribution board configurations including to an outbuilding; • **Describe** the importance of the MEN link when a fault occurs; • **Describe** the likely consequences of the absence of the MEN link or high impedance in the PEN conductor during various fault conditions; and	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**

No.	Category	Status	Title	Component	Evidence	Applies To
					• **Describe** and **Apply** methods of testing and earthing system.	
	Motors					
33.	**Motors** **Was: 52**	**General Understanding**	**Describe** basic control techniques and diagnostic methods for simple DC motor control circuits and applications including variable speed drives.	Includes an understanding of the concepts and basic applications in modern plant systems including machine safety.	• **Describe** Operating principle and components of common D.C. motors; • **Explain** Power, torque and speed relationships; • **Describe** Types of faults affecting motor performance; • **Describe** Symptoms and likely causes of supply, field, armature and mechanical faults; • **Explain** Starting and control circuits and safety interlock methods; and • **Explain** Safe testing methods for determining supply, starting, control, field and armature faults affecting motor performance.	• **E** • **ENG** • **EI** • **EST** • **EAS**
34.	**Motors** **Single Phase** **Was: 13, 15**	**General Understanding**	**Describe** the operating principles characteristics and suitability of typical control methods for single-phase motors and their key components. **Demonstrate** a knowledge of methods of electric motor selection, starting, connection and protection.	Includes 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; reduced current starting, methods of starting (star-delta etc.); typical motor lead terminations and protection (including by	• **Describe** the concept of a rotating magnetic field; • **Describe** the principles by which each type of motor produces starting and running torque; • **Explain** the construction and key component of each type of motor; • **Explain** the application of each type of motor to the load/torque required; • **Describe** requirements for motor circuit operation, control and protection, isolation, automatic starting and emergency stopping;	• **E** • **ENG** • **EI** • **EST** • **EAS**

No.	Category	Status	Title	Component	Evidence	Applies To
				electronic devices) of the motor from environmental, overload; internal faults and supply variation conditions.	• **Describe** the types of faults affecting motor performance; • **Describe** the symptoms and likely causes of faults in single phase motors and circuits; • **Describe** and **Apply** safe testing methods for determining single phase motor and circuit faults; • **Describe** criteria for selecting motor starters and overload protection; • **Describe** the types of and connection arrangements for direct-on-line and reduced voltage starters; • **Describe** thermal, magnetic and thermistor overload protection methods; and • **Describe** soft starters and variable speed drives including the advantages and consequences on an electricity supply.	
35.	**Motors** **Three Phase** **Was: 12, 14**	**General Understanding**	**Demonstrate** the rationale and operating principles and characteristics of three phase induction motors. **Describe** requirements and knowledge of supply authority requirements for three phase motor	Includes design of motor circuits for operator control; isolation; automatic starting and emergency stopping; starting methods required by supply authority to limit transient current; power, torque and speed relationships; common causes of malfunction; starting equipment failure; insulation	• **Describe** stator and rotor construction of three phase induction motors; • **Define** power, torque and speed relationships of three phase induction motors; and • **Describe** starting methods required to limit the transient current as specified by supply authority requirements for reduced voltage and current starters; • **Describe** types of faults affecting three phase motor performance;	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
			installations and starters. **Demonstrate** knowledge of possible causes of malfunction of three phase induction motors and tests required for diagnosing faults.	deterioration; water ingress; common testing methods for voltage, amperes and insulation resistance.	• **Describe** symptoms and likely causes of supply, stator, rotor and mechanical faults; • **Describe** and **Apply** safe testing methods for determining supply, stator and rotor faults affecting motor performance; and **Explain** wiring diagrams for three phase motors.	
	Testing					
36.	**Testing** **Was: 54**	**Essential Knowledge**	**Demonstrate** the knowledge required for finding, diagnosing and rectifying faults in electrical installations, equipment and associated circuits.	Includes safe working practices with electrical systems and installations; carrying out repairs that are compliant with the applicable Standards; fault finding and rectification.	• **Explain** the symptoms of the following faults/failures: ▪ open circuit; ▪ short circuit; ▪ earth fault; ▪ incorrect connections; ▪ transpositions; ▪ insulation failure; ▪ unsafe condition; ▪ apparatus/component failure; and ▪ related mechanical failure; • **Describe** and **Apply** methods and tests to identify faults in circuits and/or equipment; and • **Describe** regulatory requirements and Standards that apply to fault finding, rectification and repairs.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
37.	**Testing** **Was: 30**	**Essential Knowledge**	**Demonstrate** the requirements in accordance with the legislative	Includes the tests to ensure the requirements of the appropriate Standards have been met	• **Define** the standards that apply to testing:	• **E** • **ENG** • **EI**

No.	Category	Status	Title	Component	Evidence	Applies To
			instruments and Standards, the electrical checks and tests required to ensure safety and compliance of electrical installations, appliances, equipment, fittings.	including visual checks, testing energised and de energised circuits, earth continuity, insulation resistance, polarity test, fault loop impedance tests, RCD tests; recording, reading and interpreting test results; completing required certification and documentation.	• **Demonstrate** the requirements to determine whether an installation, appliance, equipment or fitting complies and is safe in respect of: ▪ visual inspection; and ▪ electrical tests mandated by regulation or Standards; • **Demonstrate** the test results for both compliant and noncompliant installations, appliances, equipment or fittings and the reasons why they are compliant or noncompliant; and • **Demonstrate** the documentation or certification required for an installation that has been tested and is safe to connect.	• **EST** • **EAS** • **AT**
	Transformers					
38.	**Transformers** **Was: 18, 19**	**General Understanding**	**Describe** the typical applications of various types of transformers and key safety issues.	Includes basic principles of construction and operation of main types of transformers for: electricity distribution and transmission systems, large consumer installations, within electrical equipment and appliances including welders, autotransformers and instrument transformers; safe working procedures when connecting to and testing transformers.	• **Describe** the requirements for and restrictions on the installation and use of transformers; • **Describe** the safe working procedures when connecting and testing transformers; • **Describe** methods of cooling and protection for transformers; • **Define** and **Apply** the turns ratio of a transformer; • **Describe** the performance characteristics of transformers including but not limited to percentage regulation;	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**

No.	Category	Status	Title	Component	Evidence	Applies To
					• **Describe** the safety risks and **Apply** the safety control measures associated with the connection and disconnection of transformers (including but not limited to voltage and current transformers) including any possible back-feeds from live circuits; and • **Describe** applications for instrument transformers**.**	
	Hazardous and Specialist Areas					
39.	**Hazardous and Specialist Areas:** **Safety Risks** **Was: 49**	**General Understanding**	**Describe** the types of potential operational situations that carry increased safety risks and may be encountered in various areas of industry and the type of assistance that may be needed from more experienced industry personnel.	Includes knowing an individual's personal limits and when to seek assistance including from other specialist trades such as gas fitters.	• **Define** who is authorised to: ▪ to disconnect electrical supply to an installation; circuit, appliance, equipment or fitting; ▪ undertake High Voltage switching and isolation earthing procedures; ▪ safely shutdown and start up plant and equipment; and • **Describe** the processes for consulting with experienced personnel to establish the natures of reported electrical fault in plant or equipment; and • **Describe** the process to obtain assistance from an experience or authorised person.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
40.	**Hazardous and Specialist Areas** **Was: 28, 29**	**Essential Knowledge**	**Demonstrate** a knowledge of hazardous areas and special electrical installations as defined in applicable Standards and the requirements for	Includes basics awareness of concepts and practices in Standards including Standards that specifically apply to Hazardous Areas and Special Electrical	• **Define** areas classified as Hazardous; • **Define** installations classified as Special; • **Define** the Standards with which the selection, installation, inspection and maintenance of electrical equipment and installations must comply in Hazardous and Special areas; and	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
			electrical installations in Hazardous Areas and Special Electrical Installations with reference to applicable Standards.	Installations; particular reference to movable premises, caravan parks, shows and carnivals and electrical vehicle charging.	• **Define** the Standards that apply to: ▪ transportable structures; ▪ caravan parks; ▪ shows and carnivals; ▪ electrical vehicle charging; and • **Explain** the training, experience and safety requirements needed to work in Hazardous and Special areas	
41.	**Hazardous and Specialist Areas:** **Construction and Demolition Sites** **Was: 26**	**General Understanding**	**Demonstrate** the appropriate methods for the installation, modification and testing of electrical installations and equipment for construction and demolition sites.	Includes the assessment of supply requirements, final circuit protection and socket outlet requirements and complying with applicable Standards and workplace safety legislation.	• **Describe** the supply requirements for construction sites; • **Describe** and **Apply** the types of switchboards required for of construction and demolition; • **Describe** and **Apply** the methods of protection and control of circuits; • **Describe** and **Apply** the requirements for construction wiring and lighting; • **Describe** the requirements for circuits for lifts; and • **Describe** and **Apply** the requirements and methods for Initial and periodic inspection and testing.	• **E** • **ENG** • **EI** • **EST**
42.	**Hazardous and Specialist Areas:** **Damp Zones** **Was: 25**	**Essential Knowledge**	**Demonstrate** an understanding of regulatory requirements for the installation of electrical equipment in damp situations and wet areas.	Includes damp zones and related equipment requirements; assessment of the earthing requirements and wiring systems for damp and wet areas; IP Rating of electrical equipment; other	• **Define** areas specified as damp situation classified zones; • **Describe** the limitations applying to installation of equipment in classified zones; • **Describe** and **Apply** the applicable selection and location of equipment suitable for installation in given classified zones;	• **E** • **ENG** • **EI** • **EST**

No.	Category	Status	Title	Component	Evidence	Applies To
				methods of protecting equipment.	• **Define** when use of RCD, SELV, PELV and isolated supply is required for damp situations; • **Define** when equipotential bonding required in damp zones including showers, bathrooms, swimming and spa pools; • **Describe** other methods of protecting equipment from moisture including using IP rated equipment; • **Describe** how to maintain the IP rating of accessories and equipment.	
43.	**Hazardous and Specialist Areas:** **High Voltage** **Was: 48**	**Essential Knowledge**	**Demonstrate** knowledge and understanding of the significant dangers of High Voltage equipment and distribution systems.	Includes step and touch voltages; induced voltages; creepage and clearance requirements; stored energy; earthing requirements; use of safe working procedures.	• **Describe** Electricity Distributor requirements as regards working on or near High Voltage (HV); • **Describe** step, touch and induced voltages; • **Describe** sources of induced voltage and stored energy. • Describe creepage and clearance requirements; and • **Describe** and **Apply** safe working procedures in the vicinity of HV conductors and equipment.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**
	Design					
44.	**Design** **Was: 40**	**Essential Knowledge**	**Demonstrate** ability to read, sketch and interpret electrical diagrams.	Includes the purpose and characteristics of schematic, block and wiring diagrams and typical symbols used.	• **Describe** the conventions used in documenting electrical information in drawings and diagrams; • **Define** electrical schematic, block and wiring diagrams, plans and schedules by reference to the designs; and	• **E** • **ENG** • **EI** • **EST** • **EAS**

No.	Category	Status	Title	Component	Evidence	Applies To
					• **Demonstrate** an ability to sketch and mark up electrical drawings and diagrams.	• **AT**
45.	**Design** **Was: 40**	**General Understanding**	**Demonstrate** the knowledge and skills to design and connect switching circuits, including via electronic logic controls.	Includes designs for simple two-way lighting control circuits and motor control safety interlocks.	• **Describe** lighting and equipment control circuits using diagrams; • **Describe** safety interlocking methods using diagrams; • **Demonstrate** an ability to draw programmable relays and integrated control systems using diagrams; and • **Describe** motor control and braking circuits.	• **E** • **ENG** • **EI** • **EST** • **EAS** • **AT**