WAIHANGA ARA RAU
Construction and Infrastructure
Workforce Development Council

New Zealand Certificate in Electrical Trade (Level 4) [Ref: 4204] Curriculum

15 October 2022

Prepared by a group of industry representatives facilitated by The Skills Organisation.

Transferred to Waihanga Ara Rau Construction and Infrastructure Workforce Development Council on 4 October 2021.

Contents

Purpose and background

This curriculum has been designed pro-actively in response to calls from industry for improvement. The direction taken was to first and foremost find out the needs of the apprentice and work back to a supporting curriculum from there. Industry research and consultation was undertaken to identify apprentice needs, and this curriculum was developed with the students' needs firmly at the forefront.

Competency framework

The timing of the curriculum content was derived with guidance from the competency framework document, a document developed in consultation with industry as to the timing of competency expectations on general electrical apprentices throughout their training. Theory and practical have been aligned and developed together with corresponding theory for each practical. The theory is timed to provide background content to support the practical on-job modules.

Curriculum structure

The theory portion of this curriculum is deliberately structured to divide difficult subjects into blocks of learning that build on each other. The practical portion is structured to be sympathetic to the practical skills journey the average apprentice will follow on the job.

A subject may be visited more than once throughout the curriculum, the subsequent visitations at a higher level of understanding. The curriculum is designed to give a foundational understanding of a subject first, so as not to overwhelm a new student. The subject is then revisited later to build on that foundation, when a student has not only had time to practice and mature in their study, but has also gained more background knowledge, practical skills, and understanding of general electrical theory.

As the structure of this curriculum enables the return to a subject, it allows the student to bring to mind what they have previously learnt, look back over their resources and put that knowledge to use while advancing their understanding of a subject to the next level.

Levels of complexity

As this curriculum adopts a 'stair-cased' learning approach, the language used in the modules identifies four levels of complexity. The language levels are intended to help define the extent of knowledge the student is required to have of a topic at that point of time in their study. Any teaching content and assessment needs to be appropriate for the level of knowledge expected. There may be some small crossover of terms between the levels, in particular, between the first three months and the rest of year one.

Generally, the levels are associated with the advance of time through the study being undertaken, but not always. A subject may be visited later in the curriculum because it is to a student's advantage to be exposed to the subject after they have gained other electrical knowledge, but the curriculum may only require the student to gain foundational knowledge of that subject.

- **Introductory knowledge (getting started)** – an introduction to a subject for someone new to the industry, who may not have been exposed to a particular subject before. This is to start building an awareness of a subject, a basic overview rather than a working knowledge. Getting started is generally associated with the first three months of study for work. An example of this might be that a student is made aware of an AS/NZS standard, its title and what subject material the standard covers, but is not required to receive teaching on the detail of the content.
- **Foundation knowledge** – this is more than just an introduction; it is the beginning of a working knowledge of a subject. The student is starting to learn some facts and have a little practical knowledge associated with a subject, but generally only at an entry-level of understanding.
- **Working (intermediate) knowledge** – an understanding that is more advanced than foundational. The student is now to become conversant with the subject or practice. The exercises and learning are becoming more complex, building on prior foundational learning. The student is to gain a working understanding of a subject and use the information and skills practically in industry.
- **Sound working knowledge** - a student is now expected to become very conversant with a subject and be confident to be able to apply their knowledge and or practical skills in examinations and in industry. This is a level of understanding suitable for someone entering the electrical industry as a qualified tradesperson.

Terminology associated with knowledge levels

Getting started	Foundational knowledge	Working (intermediate) knowledge	Sound working knowledge
Awareness Introduction Introductory Overview Simple Rudimentary	Basic Foundation Foundational Fundamental	Familiarity Good (knowledge/understanding)	Conversant Complete Sound/solid Proficient

Teaching and the teaching guide
The teaching content guide column holds the subject details and guidance as to what is required to be taught to satisfy the requirements of the EWRB essential capabilities for electrical registration and Electrical Appliance Serviceperson Endorsed to Disconnect and Connect (EASQ).

The teaching content guide as presented in this edition is intended to give guidance for developing a teaching programme; it awaits further development. The guide includes references to where the EWRB essential capabilities for electrical registration and EASQ content.

Assessment
Assessment is based on the learning outcomes. To reduce the time consumed by excessive assessment and to increase time for quality teaching, the assessment portion of this curriculum is a departure from the traditional and onerous practice of assessing the entire subject teaching content.

Summative assessment is to be done at learning outcome level. Obviously, further formative assessment can be done at any time if there is a need. The language of the assessment is deliberately flexible. Where possible, the intention is to allow for some variation due to local conditions and local industry needs.

On-job assessment
The assessments identified as on-job are to be assessed practically in a place of work. However, there are a few exceptions that are identified as problematic to achieve in all industry settings. The assessments that are recognised as being difficult to achieve for a significant number of apprentices can still be assessed on-job but may also be assessed in a classroom, workshop, or simulated work environment.

Standards
Strong emphasis has been put on electrical standards throughout the curriculum, as the lack of knowledge of standards has been identified as a significant issue in industry. Students are expected to own their own copy of AS/NZS 3000 from the start of their apprenticeship as this is a crucial document to their study and their daily work. They must also have access to other relevant standards referenced in this curriculum. It is intended that tutors interweave references and awareness of the electrical standards, appropriate to each subject, into the daily study routine. The intention is to make study and awareness of the standards more palatable, relevant, spread out across the curriculum and to normalise the use of standards as part of the student's daily life as it should be in industry. Students are required to locate and reference the relevant clauses in the Standards relating to practical tasks.

Expectations of practical performance

During practical activities, apprentices are to use safe and sound working practices. As with any electrical work, the practical assessment must be carried out under appropriate supervision as set out in the EWRB supervision guidelines. The work must also be done in a way that follows the apprentice's employer health and safety policies, including the use of any appropriate personal protective equipment.

All activities and evidence presented for all outcomes in this curriculum must be in accordance with appropriate legislation, policies and procedures, ethical codes, Standards (may include but are not limited to those listed in Schedule 2 of the Electricity (Safety) Regulations 2010, applicable site, enterprise, and industry practice, manufacturers' instructions, specifications, and data sheets (where necessary).

Because the practical assessments in this curriculum are deliberately focused on the specific skills to be assessed, the assessment requirements may not necessarily be a complete task guide and are not designed as such. Regardless of the limits of the content being assessed, any prescribed electrical work carried out must fulfil all legal requirements, including health and safety, any testing and documentation as required by legislation and all steps carried out as necessary to complete the tasks in a safe and sound manner.

Unless specified, the electrical circuits and equipment referred to in this curriculum are to be rated above extra-low voltage.

Trainee limited certificate (TLC)

The first two modules of this curriculum are intended to be completed within the first three months of an apprenticeship. They are not only designed as an introduction for new apprentices starting work in the electrical industry but are also designed to satisfy the requirements of the Electrical Workers Registration Board (EWRB) for the issue of a Trainee limited certificate (TLC) to apprentices.

Apprentices are to be issued with a TLC to be able to commence work in the electrical industry and are required to have completed the associated theory for the certificate within three months of its issue. The completion of the first two modules of this curriculum satisfies the training and theory associated with the EWRB TLC (associated unit standards 6401, 6402, 32605 and 32607).

Curriculum structure and progression

Year 1				
	0-3 months	3-6 months	6-9 months	9-12 months
Module 1.1 Credits 13	On-line: First 3 months			
Module 1.2 Credits 15	On-job: First 3 months			
Module 1.3 Credits 19		Off-job		
Module 1.4 Credits 14			Off-job	
Module 1.5 Credits 11		On-job (ongoing across the year)		
Module 1.6 Credits 8		On-job (ongoing across the year)		
Module 1.7 Credits 1	Capstone assessment year 1			
Total credits: 81				
Year 2				
	0-3 months	3-6 months	6-9 months	9-12 months
Module 2.1 Credits 10	Off-job			
Module 2.2 Credits 17		Off-job		
Module 2.3 Credits 15			Off-job	
Module 2.4 Credits 11	On-job (ongoing across the year)			
Module 2.5 Credits 13	On-job (ongoing across the year)			
Module 2.6 Credits 14	On-job (ongoing across the year)			
Module 2.7 Credits 1	Capstone assessment year 2			
Total credits: 81				
Year 3				
	0-3 months	3-6 months	6-9 months	9-12 months
Module 3.1 Credits 10	Off-job			
Module 3.2 Credits 9		Off-job		
Module 3.3 Credits 14			Off-job	
Module 3.4 Credits 13	On-job (ongoing across the year)			
Module 3.5 Credits 20	On-job (ongoing across the year)			
Module 3.6 Credits 11	On-job (ongoing across the year)			
Total credits: 77				
Year 4				
	0-3 months	3-6 months	6-9 months	9-12 months
Module 3.7 Credits 11	Off-job			
Total credits: 11				
Total credits: 250				

Industry sector skills, capabilities, competencies, and attributes

Understanding of professionalism and industry expectations:
Take and follow instructions. Ask questions to ensure understanding. Be willing to learn. Respect others and treat them fairly. Be aware of own limitations and the need for supervision when appropriate (yet show initiative). Complete assigned tasks (to expected standard). Maintain a safe and tidy workplace. Manage time well, prioritise tasks; display reliable and responsible behaviours at work. Teamwork Year 1: Participate at work & be a team player. Year 2: Work with or support others to complete work. Year 3: Train and mentor other staff to complete work. Customer service: Develop customer service skills: written and oral communication skills, interpersonal skills. Take care with presentation and grooming. Create customer confidence: communication skills, liaise with customers and ask questions to diagnose problems (year 3). Understand business needs (years 2 & 3). Professional development: Develop and manage skills for learning including seeking help where necessary (year 1). Keep up-to-date technically and be aware of industry changes (year 2). Keep up-to-date technically and apply new knowledge on the job; be self-motivated; build on past experience (year 3). Be responsible for self-progress and attendance at all required training and assessments.
Developing technical theory and practical competencies:
Year 1: Acquire introductory knowledge of a portion of electrical technical theory and complete basic electrical industry tasks under *direct* supervision. Year 2: Acquire knowledge of a portion of electrical technical theory and complete a range of electrical industry tasks under *indirect* supervision. Year 3: Acquire knowledge of a portion of electrical technical theory and complete a range of electrical industry tasks under *remote* supervision.
Developing knowledge of relevant legislation and standards:
Gain understanding of applicable legislation and standards during study of each topic.

Soft skills will be assessed through a combination of observation, interaction with work colleagues and customers, and adherence to workplace policies and procedures. Assessment may include assignments; software e.g. “game” or online activity; on-job observation; on-job verification; attendance and assessment at an off-job course; controlled / supervised assessment; open or closed book assessment; professional conversation (to re-sit a minor portion); attendance and participation in required assessments.

1st Three months:

Electrician Module 1.1

Getting started in first aid, working safely, circuit isolation, tools, fittings and plans

An introduction to the requirements of first aid, working safely, circuit isolation, tools, fittings and plans for people starting work in the electrical industry.

Credits: 13

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: None

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
1.1.1: Demonstrate fundamental knowledge of first aid and CPR for the electrical trade.	1.1 Demonstrate basic CPR and first aid.	Fundamental knowledge of: – Cardiac pulmonary resuscitation (CPR) training in New Zealand Resuscitation Council approved methods. – Basic first aid training. – First aid for electrical workers and methods of stabilising a patient.	EASQ P1, CC 4E EASQ P18 CC 4E	L2 2 Credits Maps to US 6401 and 6402 Part of trainee limited certificate (TLC) requirements
1.1.2: Demonstrate knowledge of legislative requirements for working safely in the electrical industry.	2.1 Identify the purpose of the Health and Safety at Work Act. 2.2 Define key terms according to the Health and Safety at Work Act. Range: at least three terms. 2.3 Define Health and Safety duties according to the Health & Safety at Work Act. Range: at least three duties. 2.4 Outline requirements for working safely in the electrical industry according to the Electricity (Safety) Regulations and AS/NZS 4836. 2.5 Define terms used in the electrical industry and their relevance to electrical workers. Range: terms must include but are not limited to – Trainee	Introductory knowledge of: – Awareness of employee employment rights and support systems. – Work ethics. – The Health & Safety at Work Act including its purpose, key principles and terms, employers' and employees' onsite health and safety duties and rights. Explain that it is essential to identify hazards and potential hazards and take appropriate steps to eliminate or minimise the hazard risk by observing safety measures at all times to ensure the safety of: – electrical workers or electrical trainees – other workers in the area – members of the public – equipment and property. Introductory awareness of the requirements for working safely in the electrical industry as laid out in the Electricity (Safety) Regulations, Explain that electrical appliance servicepersons are required to be conversant with the Electricity (Safety) Regulations to be competent. Understanding of what prescribed electrical work (PEW) is. Trainee limited certificate. Safety limitations and legal limitations for work attempted by trainees and the necessary supervision levels as set out by the EWRB supervision guidelines for apprentices and trainees.	CC 1E EASQ 8.16a CC 1E, 2E, 3E EASQ 8.16b CC 2E CC 2E CC 39G	L3 2 credits Maps to US 32605 Part of TLC requirements Related practical 1.2 LO1

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Limited Certificate (TLC), prescribed electrical work (PEW), limits of work, supervision for electrical workers.	Awareness of where experienced personal need to be consulted. Describe the types of assistance that may be required and the process of getting assistance. AS/NZS 4836.	CC 2E	
1.1.3: Demonstrate knowledge of workplace dangers, hazards, risk, and its control.	3.1 Explain the dangers of electricity, the physiological effects of current on humans. 3.2 Explain the dangers, precautions, and a safe procedure for rescuing someone in contact with electricity. 3.3 Explain the dangers and appropriate control measures for hazards within workplace situations. Range: evidence of two situations with three hazards per situation. 3.4 Describe typical work site health and safety procedures. Range two procedures; may include but is not limited to – site inductions, accident and incident reporting, emergency, and notifiable event procedures.	Demonstrate knowledge of the physiological effects of electricity on humans and animals The danger of simultaneously contacting active (phase) and neutral or active (phase) and earth conductors] or competing a circuit such as across a disconnected neutral. Explain the effects that varying values of voltages, current, duration of contact and other conditions (wet or punctured skin, etc) have on the severity of electric shock received by the victim. AS/NZS 60479.1. Explain that electrical arcing exposes the victims of electric shock to additional hazards such as: arc eye and serious burns. Common on-site health and safety risks. Understand that when good housekeeping and tidy work habits are practiced it promotes a safety culture in the workplace. General site induction processes. When incidents and accidents must be reported and why, the processes to report electrical incidents, notifiable incidents and accidents. Emergency procedures. Explain the procedures when a fire is discovered including: – Detail the types of fire extinguishers that are suitable for use on electrical fires and explain how each type is used. – Detail the requirements and the need for the presence of a second competent person, in situations where a danger or a potential risk exists. The dangers and appropriate control measures for (including but not limited to)	EASQ 8.12, CC 8E EASQ 8.12 EASQ 8.12b EASQ 8.16s CC 1E EASQ 8.16e CC 2E EASQ 8.16l EASQ 8.16n, CC 3E, 4E EASQ 8.16 (q)	L3 2 credits Maps to US 32605 Part of TLC requirements Related practical 1.2 LO1, LO2

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	3.5 Describe the requirements to be completed in a risk management form. Range: one from SWMS, JSA, alternative system.	– carrying out electrical work – manual handling, – loud noise, – working at height. Explain the importance of preliminary safety checks and observing proven safety rules when working at height and when ladders and scaffolding are involved. – working in confined spaces. Explain the dangers of working in explosive atmospheres and stress the importance of ensuring that all electrical equipment is correctly isolated before removing any covers, etc. Awareness of the dangers of asbestos in the workplace. The dangers and causes of silicosis. Explain the procedures for rescue of a person or persons in contact with live conductors or equipment. The do's and don'ts of rescuing someone in contact with electricity including but not limited to: – turning off the electricity supply, – ensuring the safety of the rescuer, establishing the shock voltage level and possibility of successful extraction, – use of extreme care – awareness of rescuers own contact with conductive substances – awareness and use of any available live rescue equipment – choosing of improvised rescue aids, the objective and – accomplishing the safe removal of victim from the energy source – making the area safe and administration of CPR and appropriate first aid measures.	CC 2E CC 3E EASQ 8.16d CC 3E EASQ 8.16k EASQ 8.16m CC 4E CC 4E CC 4E	

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
		Basic introduction into how to develop safe work methods, Safe Work Method Statements (SWMS) and Job Safety Analysis (JSA) and awareness of the possibility of other alternative systems. How to identify on site health and safety risks as an individual and as part of a group, Procedures for carrying out a workplace safety check both as an individual and as part of a group, Methods to minimise or isolate safety risks both as an individual and as part of a group.	CC 2E CC 1E	
1.1.4: Demonstrate knowledge of testing for voltage and isolating circuits.	4.1 Explain how to store and check a multimeter before use. 4.2 Describe the procedures for the safe use of a voltmeter. Range: must include – identifying live AC and DC supplies, testing for voltage, testing to confirm circuit isolation. 4.3 Outline a procedure for safely re-livening simple circuits.	Foundation knowledge of: – The need for careful storage, correct selection and safe use of test instruments. – Safety and functional checks for multimeters. – Correct voltage (AC vs DC) selection, meter ranges and correct test lead connections. – Reading and interpreting the numbers/scales on digital meters. – Reading an analogue meter. – Safe use of a voltmeter to identify live AC and DC supplies and to test for isolation. Identify the difference between switching off and isolating. Explain the SAFETY TAGGING system. State the benefits of using the safety tagging system to promote safety in the workplace. Explain methods employed to isolate and “lock off” equipment. The importance of using danger tags when working on equipment which may become live. Explain the importance of the PROVE TEST PROVE safety rule and, the benefits of TESTING before touch to prevent electric shock. Explain the conditions covering the use of SAFETY TAGS, their correct placement and removal procedures. Detail written isolation procedures including:	CC 2E EASQ 8.14a, CC 2E EASQ 8.14b, CC 2E EASQ 8.14c, CC 2E EASQ 8.14d, CC 2E EASQ 8.14e, CC 2E	L3 2 credits Maps to US 32605 Part of TLC requirements

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
		– effective communication with circuit users and other workers before isolating or re-livening circuits and correct permissions where required – removal of significant (arc) loads before isolating, – the thrice rule for confirming the correct isolation device – prove-test-prove – lock out and tag out (and or works management systems) – test before touch (all conductors). Explain the precautions necessary when working on circuits which have capacitors connected or other sources of stored energy. Fundamental requirements of AS/NZS 4836 Fundamental safety procedures for re-livening circuits after work, i.e. – communication with other people on site – confirmation that required tests have been carried out – Safety checks before livening: o checking and dealing with equipment that may inadvertently start o other possible safety impacts on site when re-livening o all people clear of circuits and equipment and aware that the circuit is about to be livened o that it is safe to liven the circuit.	EASQ 8.14f, CC 2E CC 2E CC 2E CC 2E CC 2E EASQ 8.16p CC 2E CC 25E	
1.1.5: Demonstrate knowledge of maintenance and safe use of hand and power tools.	5.1 Identify hand and power tools used for common electrical jobs, and describe the care and the possible dangers associated with their use.	Introductory knowledge of: – Identification of typical hand and power tools used for common jobs. – The safe and correct use, care and maintenance of common day to day hand tools, power tools, and associated equipment. – Safe use of actuated fastening devices.	 CC 3E CC 3E CC 3E	L3 2 credits Maps to US 32606 Related practical 1.2 LO4, 1.5 LO6.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	Range: three different hand tools, two different power tools; hand tools may include but is not limited to — side cutters, pliers, screwdrivers, strippers, spanners; power tools may include but not limited to — drills, impact drivers, saws, grinders. 5.2 Identify appropriate PPE and electrical safeguards to use with power tools for common electrical jobs. Range: two power tools. 5.3 Describe the purpose of AS/NZS 3760. 5.4 Explain the reasons for testing and tagging of electrical equipment. Guidance information: PPE – Personal protective clothing and equipment includes but is not limited to – overalls, safety footwear, gloves, gauntlets, waterproof gear, eye protectors, head	– Class I and class II construction of appliances and power tools. – Introductory understanding of AS/NZS 3760 with reference to safety testing and tagging of power tools. Explain why it is necessary to use insulated tools of an approved type when working on electrical fittings. Explain the importance of using the correct tools, clothing and equipment that is appropriate for the job and trained to competently use any specialised equipment required. Possible restrictions and certification requirements on the use of specialised tools and equipment in industry. Explain that regular checks are required to retain the integrity of the safety equipment. Understand that employers are required by legislation to provide and maintain equipment and PPE supplied for employees use in a safe condition. Understand that employees must use the PPE supplied by the employer and also comply with all safety procedures established. Correct selection, care and use of personal protective equipment (PPE) while using power tools, doing electrical and associated work. Detail the dangers when working with metal ladders, tape, tools and the like on or near electrical supplies or equipment. Understand and apply the principles relating to protection for safety in AS/NZS 3000 and the role RCDs can play in protection for additional safety in damp situations. Explain that when working in outdoor or damp situations it is important to supply electrical appliances from either an isolating transformer or from an RCD. Understand and apply the requirements regarding the use of RCDs with hand- held electrical appliances. Understand that RCDs provide supplementary protection to users of electrical appliances and equipment.	CC 3E EASQ 8.16h EASQ 8.16c EASQ 8.16g EASQ 8.14a EASQ 8.14b CC 3E CC 3E EASQ 8.16j EASQ 8.13d EASQ 8.16i EASQ 8.13e EASQ 8.13a	

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	protectors, hearing protectors, breathing apparatus.	Understand that the isolating transformer may be used in conjunction with other approved safeguards for extra protection where considered desirable. Explain that personal protective equipment (PPE) such as covers, mats, gloves, safety harnesses, insulated tools and glasses or goggles, etc, are required to be manufactured to an approved safety standard.	EASQ 8.13i EASQ 8.16f	
1.1.6: Demonstrate knowledge of common electrical fittings and/or accessories.	6.1 Identify common electrical fittings and/or accessories and a suitable application for each. Range: a total of ten different electrical items. (refer to next column). 6.2 Identify the ratings and environmental suitability of electrical fittings and/or accessories. Range: a total of three different electrical items. 6.3 Identify fastenings and installation tools suitable to install fittings and/or accessories onto a variety of substrates. Range: at least three different substrates; substrates may include but not limited to — gib/plaster board, hollow	Introductory knowledge of the need for electrical fittings to meet appropriate standards for sale and use in New Zealand. Identify a range of common electrical fittings and accessories that a new electrical worker should know about from physical or photographic examples such as: a switch, a socket outlet, a permanent connection unit, a mechanism grid plate, cable (pin) clips, cable ties, an earth rod, an earth clamp, an earth label, a circuit breaker, fitting with a specific IP rating, cord grip plug and socket, flush box, surface enclosure, junction box, cable connector, cable gland, line tap. Describe their ratings, suitability and intended use. IP ratings of fittings and equipment Fire rated fittings Select suitable fastenings (and tools needed for those fastenings) for fittings on a variety of substrates: – gib/plaster board, – hollow structures – masonry and concrete – metal surfaces. Awareness of risks and safety measures when working with adhesives and chemical fixing devices.	 CC 16G CC 42E CC 29A CC 29A CC 29A	L3 2 credits Maps to US 32606 Related practical 1.2 LO5, 1.5 LO6.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	structures, masonry and concrete, metal surfaces, fibre cement, glass, tiles.			
1.1.7: Demonstrate knowledge of electrical plans.	7.1 Describe the function and use of plan legends, plan specifications and scales. 7.2 Identify typical electrical symbols, contact positions and configurations. Range: at least eight in total. 7.3 Identify the function of circuits on entry level electrical construction plans. Range: layout plan, schematic diagram.	Introductory knowledge of: Typical electrical construction/layout and schematic plans: – drawing conventions, symbols, – Symbols in AS/NZS 3000, – legends, drawing scales, – function of circuits. Contact terminology: – energised/ de-energised, – normal position, – make/break, – normally open, – normally closed. Relating plans to reality using measurements and scales. Taking measurements in metres and millimetres and explain: – the reasons for different units of measure, – appropriate rounding, – how to take dimensional measurements.	CC 44E CC 44E CC 44E	L3 1 credit Maps to US 32606 Related practical 1.2 LO6

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3760:2010, In-service safety inspection and testing of electrical equipment AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment AS/NZS 60479.1:2010, Effects of current on human beings and livestock - General aspects Electricity (Safety) Regulations 2010, EWRB Supervision Guidelines, available at https://www.ewrb.govt.nz; Health and Safety at Work Act 2015.

1st Three months:

Electrician Module 1.2

Getting started with practicing working safely, isolating circuits, electrical fittings and plans

An introduction to practicing working safely, isolating circuits, electrical fittings and plans for people who are new to the electrical industry.

Credits: 15

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: None

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
1.2.1: Apply health and safety measures in the workplace.	1.1 Record and action health and safety measures required in the workplace. Range: six health and safety measures taken from three safety briefings. Guidance information: Safety briefings - refers to health and safety inductions, health and safety briefings, toolbox meetings, or similar.	The Health & Safety at Work Act employees' onsite health and safety duties and rights The processes to report electrical incidents, notifiable incidents and accidents. Understanding of what prescribed electrical work (PEW) is. Safety limitations and legal limitations for work attempted by trainees and the necessary supervision levels as set out by the EWRB supervision guidelines for apprentices and trainees. Awareness of where experienced personal need to be consulted. Describe the types of assistance that may be required and the process of getting assistance Awareness of employee employment rights and support systems.	CC 1E CC 2E CC 2E CC 2E CC 39G CC 39G	L4 3 credits Maps to US 32607 On-job Related theory 1.1 LO2, LO3 Part of TLC requirements
1.2.2: Identify health and safety procedures and identify risks on a worksite.	2.1 Find and record the location of workplace-specific health and safety procedure documents. Range: includes — emergency procedure, incident or accident reporting procedure. 2.2 Use risk management forms to identify electrical risks for workplace activities. Range: forms may include but are not limited to – SWMS, JSA or alternative system; evidence of three different workplace activities is required.	Apply appropriate control measures used for identified risks – carrying out electrical work – manual handling – loud noise – working at height – working in confined spaces Demonstrate good housekeeping and tidy work habits in the workplace. Find and record the procedures when a fire is discovered. Use Safe Work Method Statements (SWMS) and or Job Safety Analysis (JSA)} or other alternative systems {to identify worksite risks for work activity. Apply procedures for carrying out a workplace safety check both as an individual and as part of a group. Identify on site health and safety risks as an individual and as part of a group. Apply methods to minimise or isolate safety risks both as an individual and as part of a group. Identify and list specific site emergency procedures.	 CC 2E CC 3E CC 3E CC 2E CC 1E CC 1E CC 1E	L4 3 credits Maps to US 32607 On-job Related theory 1.1 LO2, LO3 Part of TLC requirements

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	2.3 Record appropriate control measures for different identified risks in the workplace. Range: risks from three different workplace activities.			
1.2.3: Use a voltmeter to safely and correctly test for voltage and to test for isolation.	3.1 Identify live AC and DC supplies. Range: three AC supplies, two DC supplies. 3.2 Isolate circuits and test for circuit isolation safely. Range: three different types of circuits. 3.3 Re-liven circuits safely. Range: three different types of circuits. Guidance information: A non-contact 'volt stick' type voltage indicator is not suitable for use in this assessment.	Carry out safety and functional checks for multimeters. Correctly and safely use a voltmeter to identify live AC and DC supplies and to test for circuit isolation. Correctly select voltage type (AC vs DC), ranges and correct test lead connections on multimeters. Read and interpret the numbers/scales on digital meters. Use a voltmeter safely to identify live circuits and to test for isolation. Use isolation procedures including: – effective communication with circuit users and other workers before isolating or re-livening circuits and correct permissions where required – removal of significant (arc) loads before isolating – the thrice rule for confirming the correct isolation device – prove-test-prove – lock out and tag out (and or works management systems) – test before touch (all conductors). Apply the fundamental requirements of AS/NZS 4836. Apply the fundamental safety procedures for re-livening circuits after work i.e. – communication with other people on site – confirmation that required tests have been carried out – Safety checks before livening:	CC 2E CC 2E CC 2E CC 2E CC 2E CC 2E CC 2E CC 2E CC 25E	L4 2 credits Maps to US 32607 On-job Related theory 1.1 LO4 Part of TLC requirements

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
		○ checking and dealing with equipment that may inadvertently start ○ other possible safety impacts on site when re-livening ○ all people clear of circuits and equipment and aware that the circuit is about to be livened ○ that it is safe to liven the circuit.		
1.2.4: Use and maintain hand tools, power tools, and PPE safely and correctly.	4.1 Use and maintain common hand and power tools correctly and safely. Range: five hand tools, three power tools. 4.2 Select, check, use and maintain appropriate PPE and safeguards. Range: three different situations. Guidance information: Different situations – are workplace activities that require different PPE, safeguards, or combinations of PPE and safeguards for each activity. PPE – Personal protective clothing and equipment – overalls, safety footwear,	Identify the correct hand and power tools used for common jobs. Safely and correctly use, care for and maintain common day to day hand tools, power tools, and associated equipment. Correctly select, care for, and use personal protective equipment (PPE) while using power tools, doing electrical and associated work. Use of appropriate electrical safeguards for power tools Check for current test and tags on power tools AS/NZS 3760. Adherence to the training and certification requirements to use power tools and equipment depending on the industry setting and in varying health and safety regimes. Choose and use the correct protective equipment (PPE) for a range of tasks such as, but not limited to: – using power tools, – creating dust, – handling sharp objects, – danger of falling objects, – working at heights, – exposure to electricity, – exposure to chemicals.	CC 3E CC 3E CC 3E CC 3E	L4 2 credits Maps to US 32608 On-job Related theory 1.1 LO5

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	gloves, gauntlets, waterproof gear, eye protectors, head protectors, hearing protectors, breathing apparatus.			
1.2.5: Identify and record common electrical fittings and/or accessories in the workplace. Range: at least five electrical fittings and/or accessories.	5.1 Identify electrical fittings and/or accessories in the workplace. 5.2 Record the ratings and environmental suitability of identified electrical fittings and/or accessories. 5.3 Record the application of identified electrical fitting and/or accessory.	Identify a range of standard electrical fittings and accessories used on the job. Record the basic ratings and describe the workplace application of the fittings. Select appropriate fittings with correct features and ratings including fire rating if necessary	CC 29A CC 29A CC 27E, 29A	L4 3 credits On-job Related theory 1.1 LO6 Maps to US 32608
1.2.6: Use plans in the workplace.	6.1 Read and use information from plans to complete fundamental workplace activities. Range: three different workplace activities. 6.2 Use measurements to position or confirm the position of fittings or equipment according to plans. Range: three fittings or pieces of equipment.	Read and interpret simple plans, drawings and drawing scales on the job. Take measurements in metres and millimetres, use appropriate rounding and explain the reasons for different units of measure. Relate plans to reality using measurements and scales. Take dimensional measurements. Use plans to correctly position and install electrical fittings.	CC 44E	L4 2 credits On-job Related theory 1.1 LO7 Maps to US 32608

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3760:2010, In-service safety inspection and testing of electrical equipment AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment Electricity Act 1992 Electricity (Safety) Regulations 2010 EWRB Supervision Guidelines, available at https://www.ewrb.govt.nz Health and Safety at Work Act 2015 or any current subsequent amendments and replacements.

Rest of Year One:

Electrician Module 1.3

Foundation electrical theory

For an electrical industry student to gain a foundational understanding of the principles of mathematics and electricity.

Credits: 19

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.1

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
1.3.1: Demonstrate knowledge of mathematical principles used in electrical work.	1.1 Transpose mathematical formulas. Range: three mathematical formulas each with three unknowns or variables. 1.2 Use calculators to calculate answers to mathematical problems. Range: includes but not limited to — Ohms law, Pythagoras, Trigonometry. 1.3 Demonstrate the use of calculator functions. Range: must include at least two of — square, square root, sine, cosine, tangent, brackets.	Foundation knowledge of: – addition – subtraction – multiplication – division – rules for solving equations – Pythagoras – multiples and submultiples – transposition – trigonometry – area and volume – SI units – Appropriate rounding of values – Using basic calculator functions		L3 2 credits Maps to US 32609
1.3.2: Demonstrate knowledge of conductors, insulators, current, and resistance.	2.1 Identify the characteristics of conductors, insulators, semiconductors and their use in the electrical industry. 2.2 Describe the fundamental principles of voltage, current, resistance and two effects of electrical energy.	Foundation knowledge of: Basic atomic theory to understand: – conductors – semiconductors – insulators Voltage (EMF, charge) Demonstrate knowledge of how electrical energy is produced from various forms of energy i.e. – chemical reaction including batteries – magnetism – friction, static – heat	 CC 7A CC 7A, EASQ 8.1 d CC 7A CC 7A	L3 5 credits Maps to US 32609

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	Range: may include but is not limited to — heat, light, motion, chemical reaction. 2.3 Define conventional current flow with reference to electron flow.	– light – pressure Current – electron flow – conventional. Resistance Factors affecting resistance and their effect on both conductors and insulators Demonstrate knowledge of material resistivity Demonstrate knowledge of resistor parameters e.g. – linear and non-linear resistance – NTC, PTC – foundational understanding of resistor markings and resistor charts The effects and principles of different types of energy produced from electricity i.e. heat, light, motion, chemical reaction. State the purpose for which insulating materials are used, e.g. – protection against accidental personnel contact with live conductors – protection against short circuits between conductors – protection against leakage to earth Describe the properties of an ideal insulator for: – use on a flexible cord conductor or as a sheathing – rigid use, e.g supports for electrical elements, framework for portable electrical appliances, separation barriers between live and earthed components. Compare the practical advantages and disadvantages of commonly used insulators when exposed to heat, moisture, corrosive materials and chemicals, dusts, gases, tension, compression, vibration. Insulators include glass, mica, oils, ceramics, rubber, plastics (various). State the importance of “insulation resistance” as an indicator of an insulator’s condition.	CC 7A CC 8E CC 9E EASQ 8.1 c CC 9E CC 8E EASQ 8.5 a EASQ 8.5 b EASQ 8.5 c EASQ 8.5 d	

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
		Identify suitable insulators for various practical purposes. Describe the properties of commonly used conductors for: – use in flexible cord or flexible cable – rigid use, e.g. contacts, terminals, heating elements, lamp filaments. Identify suitable conductors for various practical applications. Compare the practical advantages and disadvantages of commonly used conductors when exposed to: heat, moisture, corrosive materials and chemicals, dust, gases, tension, compression, vibration. Conductors include copper, silver, aluminium, tungsten, carbon, nichrome, brass, bimetals.	EASQ 8.5 e EASQ 8.4 a EASQ 8.4 d EASQ 8.4 b	
1.3.3: Demonstrate knowledge of voltage, power, and energy.	3.1 State Ohms law and the formulae associated with it. Range: $V = I \times R$, $I = V \div R$, $R = V \div I$. 3.2 State the formulae for power. Range $P = V2 \div R$, $P = I2 \times R$, $P = V \times I$. 3.3 Explain the relationship between power and energy. 3.4 Calculate electrical values with given parameters. Range: current, voltage, resistance, power, energy.	Foundation knowledge of: Demonstrate knowledge of ohms law Understand the relationship between voltage, resistance, current and power. State the formulae for power where: $P=V^2/R$, $P=I^2R$, $P=VxI$. Transpose the power formulae and perform simple calculations to obtain an unknown value. State the units in which power is measured. Understand the relationship between voltage, current, time and energy. The relationships between power, work, and energy. State the units in which energy is measured. Describe how to safely measure voltage, resistance, current and power dissipation for the whole or any part of a circuit.	 EASQ 8.1 c, CC 9E EASQ 8.1 a, CC 9E EASQ 8.1 c EASQ 8.1 d EASQ 8.1 b EASQ 8.1 e CC 6G EASQ 8.1 f CC 10E	L3 3 credits Maps to US 32610 Related practical 1.6 LO1

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	3.5 Calculate resistance, voltage, current and power and compare with measured values. Range: parallel, series, series-parallel.			
1.3.4: Demonstrate knowledge of DC circuits.	4.1 Explain the purpose and configuration of electric circuit components. Range: conductors, switches, protection, load. 4.2 Describe how to connect instruments into a circuit to take electrical measurements. Range: two different instrument connections; measurements may include — voltage, resistance, current, power. 4.3 Explain the operation and characteristics of DC circuits. Range: parallel, series, series-parallel.	Foundation knowledge of: Describe the elements, purpose and configuration of circuit components of an electric circuit, i.e.: – source (battery, generator, AC mains, etc) – conductors (positive, negative, phase, neutral, earth), active, line, live. – insulation (to contain the conductors within defined limits). – control (switches, thermostats, energy regulators, etc), – protection (fuses, circuit breakers, etc), – metering (voltmeter, ammeter, watt-hour meter, etc) – load (current using devices). Recognise and use the correct standard symbols for circuit components. (Recommend - IEC symbol standards) Indicate on the diagrams the correct connections for the voltmeter, ammeter and ohmmeter. Explain the operation of a simple practical circuit including current path, circuit control, load, EMF source and conductors. Describe a series circuit. State the characteristics of a series circuit. Draw and label series circuit diagrams incorporating commonly used components. Describe a parallel circuit. State the characteristics of a parallel circuit. Draw and label diagrams of simple parallel and series-parallel circuits incorporating commonly used components.	EASQ 8.1 a CC 22E EASQ 8.2 d EASQ 8.2 h EASQ 8.1 e EASQ 8.2 a EASQ 8.2 b EASQ 8.2 c EASQ 8.2 e EASQ 8.2 f EASQ 8.2 g	L3 3 credits Maps to US 32610 Related practical 1.6 LO1

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
		Explain why electrical appliances are normally parallel connected rather than series connected. Parallel and series resistance. Kirchhoff's laws for voltage and current. Voltage across series and parallel components. Introduction to (resistance) measuring methods. Determine the resistance, voltage, and power in any part of a DC series and/or parallel circuit using practical knowledge and safe use of measuring instruments. Describe methods of determining circuit behaviour for variation in any of the parameters from measured and calculated values.	EASQ 8.2 i EASQ 8.1 c EASQ 8.1 g CC 22E CC 10 E	
1.3.5: Demonstrate knowledge of magnetism.	5.1 Describe magnets, magnetic fields and three magnetic terms. 5.2 Describe the construction and operating principles of common electromagnets used in the electrical industry. Range: includes but is not limited to — one control, one protection device. 5.3 Briefly outline how magnetism is used in generators, electric motors, and transformers. Guidance information: Magnetic terms – as described in next column.	Foundation knowledge of magnetic terms – magnetic field strength – lines of force – magnetic poles and polarity – magnetic flux – flux density – permanent magnet – temporary magnet. Magnetic fields around permanent magnets, current carrying conductors and electromagnets. Rules for determining magnetic polarity and force. – Flemings hand rules – right hand screw rule Self and mutual induction - magnetic field + movement Introduction to electromagnetic principles used in motors, generators and transformers. Applications for magnets in the electrical industry including: control and protective devices.	 CC 11A CC 7A, 11A CC 11A	L3 3 credits Maps to US 32611

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
1.3.6: Demonstrate knowledge of AC generation.	6.1 Describe the essential differences between AC and DC. 6.2 Define common AC terms. Range: three AC terms. 6.2 Describe the operation and output waveforms of a simple single-loop, two-pole alternator with sliprings and brushes. 6.3 Perform simple AC calculations with reference to impedance. Range: I = V ÷ Z. Guidance information: AC terms as in next column.	Foundation knowledge of: Describe the essential differences between AC and DC current and voltage. Generation of sinusoidal voltage and the resulting current flow. AC terms: sine wave, period, frequency, peak, peak-to-peak value, root mean square (RMS), instantaneous value, average value. Why peak voltages are an important consideration in respect to insulation resistance values providing protection from exposure to electric shock. Understand that the total opposition to current flow in an AC circuit is impedance (Z). State the formulae Z = V/I and perform simple calculations to obtain a value for I when the supply voltage and impedance values are known. Transpose the formula for impedance Z=V/I and perform simple calculations to obtain unknown values of V or I.	 EASQ 8.2 j CC 23E CC 23E EASQ 8.12 a EASQ 8.1 g, CC 10E EASQ 8.1 h EASQ 8.2 k	L3 3 credits Maps to US 32611

Rest of Year One:

Electrician Module 1.4

Legislation, cables, circuit protection, faults and commissioning

For an electrical industry student to gain an introductory understanding of legislation for the electrical industry and foundational knowledge of circuit protection, simple electrical fault finding and commissioning.

Credits: 14

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.1

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
1.4.1: Demonstrate knowledge of electrical legislation and industry governance bodies.	1.1 Identify the industry governance bodies and agencies relevant to the electrical industry and their roles in the electrical industry. Range: at least three governance bodies and agencies. 1.2 Outline where, and how, to access legislation and standards appropriate to the electrical industry. 1.3 List the Acts, Regulations, Standards and Codes applicable to the electrical industry in order of legal hierarchy and state briefly their overall purpose and how each impacts work in the electrical industry. Range: four electrical standards, one Electrical Code of Practice; must include but is not limited to — Electricity Act, Electricity (Safety) Regulations. 1.4 Describe low, general and high-risk electrical work and the inspection and certification required for each level of risk.	Introductory knowledge of: – Electrical Regulatory Authorities Board (ERAC). – Electrical Workers Registration Board (EWRB). – WorkSafe (Energy safety) New Zealand – Ministry of Business, Innovation and Employment (MBIE). – Electricity retailers (Energy suppliers). – Electricity Engineers' Association (supply industry self-governance). Where and how to access appropriate legislation and standards for the electrical industry. The list of cited standards, Brief introduction to legislation and standards, the purpose and how it impacts work in the electrical industry. Including, but not limited to: – Electricity Act – Electricity (Safety) Regulations – AS/NZS 3000 – AS/NZS 3008.1.2 – AS/NZS 3017 – AS/NZS 3760 – AS/NZS 4836 – AS/NZS 5761 – AS/NZS 5762 – New Zealand Electrical Codes of Practice (NZECP). – New Zealand Building code. The relationship between the Electricity Act, the Electricity (Safety) Regulations, cited standards and ECPs and what takes precedence in deciding courses of action. Electricity (Safety) Regulations: – risk definitions: low, general, high – situations requiring independent inspection. – electrical certification requirements for levels of risk: Electrical Safety Certificate.	CC 5E CC 5E	L3 2 credits Maps to US 32612

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	Range: Risk classifications as defined in the Electricity (Safety) Regulations. Guidance information: Industry governance bodies as listed in the next column.	Certificate of Compliance, Record of Inspection.		
1.4.2: Demonstrate knowledge of AS/NZS 3000.	2.1 Explain the importance of AS/NZS 3000 to electricians. 2.2 Explain the purpose of AS/NZS 3000. Range: Part 1, Part 2. 2.3 Describe the general layout of AS/NZS3000. 2.4 Outline the fundamental design principles for all electrical work according to AS/NZS 3000, Part 1, section 1.5. Range: three principles.	Fundamental knowledge of: Awareness of the relevance and importance of AS/NZS 3000 to the work of electricians and its influence on most electrical tasks carried out. AS/NZS 3000: – Preface, in particular, information on Part 1 vs Part 2 – Content vs Index pages – Forward (explanation page) – introduction to definition of terms (1.4) – awareness of the 14 fundamental principles of (1.5) including: o basic protection (protection against direct contact with live parts) o fault protection (indirect contact with live parts) o protection against mechanical injury o protection against external influences – Awareness of the fundamental principles of installation: o installation design (1.6) o selection and installation of equipment (1.7) – Awareness of {Verification of compliance (1.8) – Awareness of means of compliance (1.9) for alterations, additions, repairs. – Awareness of the wealth of useful information found in the appendixes of AS/NZS 3000.	CC 3E CC 3E CC 3E CC 3E	L3 2 credits Maps to US 32612

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
1.4.3: Demonstrate knowledge of cords and cables.	3.1 Describe the construction, configuration, core colours and typical ratings of common cords and cables. Range: three common cords or cables; may include but is not limited to — conductor materials, construction, configuration, conductor type, insulation, armouring, screening, sheathing, permitted colours. 3.2 Explain the factors to be considered when choosing cables for different situations. Range: two situations; situations may include but are not limited to — chemicals, oil or petrol, excessive weight or strain, high or low temperature, mechanical damage. 3.3 Identify the environmental suitability and typical applications for common cords or cables. Range: three common cords or cables.	Foundation knowledge of: Introduction to common cord and cable types, including: conductor materials, construction, configuration, conductor type, insulation, armouring, screening and sheathing. Permitted colours for fixed wiring and flexible cords including IEC colour specifications, earth conductor and equipotential conductor colours. State the New Zealand approved distinguishing colours by which each core in a flexible cord and cable may be identified. How to identify common cable conductor sizes. Understand that flexible cords are conductors up to and including 4 mm^2 cross sectional area. Understand that flexible cables are conductors having a cross sectional area greater than 4 mm^2 cross sectional area. Provide typical applications where each of the following types of cables are likely to be encountered: – TPS and TRS cables – flexible cables and cords – copper braided sheath flexible cords and cables – neutral screen cables – round TPS – flat TPS – sheathed (double insulated) cable – unsheathed cable – stranded core – solid core – fire rated – Cable suitable for polystyrene. – steel wire or tape armoured cables Describe commonly used types of flexible cord and list typical applications for each, e.g. – twin and three core – twisted, parallel and circular construction	CC 15G CC 15G EASQ 8.6 c EASQ 8.6 h EASQ 8.6 i EASQ 8.7 b, CC 16G CC 16G CC 16G CC 16G CC 16G CC 16G EASQ 8.6 a	L3 2 credits Maps to US 32613 Related practical 1.5 LO4

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	3.4 Outline the scope and contents of AS/NZS 3008.1. Range: purpose, two main section headings.	– TRS and TPS sheathing – PCP, HO-FR and PVC sheathings for oil and petrol contact. Explain environmental considerations for cables. Understand and explain the effects that oils, petrol, excessive weight or strain, and extremes of temperature have on the insulation and sheathing of commonly used flexible cords and cables. State the types of sheathing suitable for use in high temperature environments and give typical applications for each type. Understand and explain that the selection of a flexible cord for an electrical appliance may be dependent on environmental conditions prevailing at cord entry point and temperature within the electrical appliance where the conductors are terminated.	CC 16G EASQ 8.6 e EASQ 8.6 b EASQ 8.6 f	
1.4.4: Demonstrate knowledge of cable installation and handling techniques.	4.1 Identify common cable installation methods for different situations. Range: two situations; installation methods may include but are not limited to — secured to surface, enclosed in conduit or trunking, on cable rack, on catenary, on insulators, underground. 4.2 Identify installation requirements for cables in AS/NZS 3000. Range: three installation requirements. 4.3 Outline appropriate cable handling techniques.	Introductory knowledge to: Introductory cable handling techniques, drawing in, running/placing, fixing. Introductory awareness of cable installation requirements found in: – AS/NZS 3000 – AS/NZS 3008.1.2 Introductory installation requirements for cables: – clipped to surface – run through timber – run through sharp material – requiring mechanical protection – segregation of services – typical cable routes in installations – Prohibited locations. – Awareness that the NZ building code has requirements that apply to electricians drilling/cutting holes in framing and bracing walls and the weather tightness of cable penetrations – Awareness of fire rated structures In some circumstances, it is the fitting position and not strictly the cable that needs to be compliant. However, the decision about placement is often made when the circuit is pre-wired and the cable run to the correct position for the fitting to be compliant.	CC 16G CC 16G CC 16G CC 16G CC 16G	L3 2 credits Maps to US 32613 Related practical 1.5 LO1, LO2, LO3, LO4, LO5.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	Range: two cable handling techniques. May include but not limited to — techniques for drawing in, running/placing, fixing, terminating.	*Examples of where cable installation techniques will need to be compliant:* – *Holes made for cables in timber framing.* – *Placement of holes for fittings in building bracing elements.* – *Watertight/weatherproof cable penetrations.* – *Placement of holes for fittings in fire rated structures.* – *Fire proofing of cable penetrations.* Understand and explain the methods by which electrical equipment and fittings may be connected to the fixed wired supply including: – by flexible cord using various approved plugs and sockets – by flexible cord or flexible cable from a permanent connection unit – by flexible cord or flexible cable using suitable connectors housed in an approved enclosure, switch or terminal unit. Understand the importance of secure, well-made connections in prolonging the service life of a conductor. – termination devices and techniques for secure well-made connections and terminations on various conductors – checks for termination quality and soundness after terminating cable cores Awareness of manufacturer torque requirements for terminations in equipment. Understand and apply the general requirements of AS/NZS 3000 in relation to the termination of cables. Understand and explain connection methods listed in above and offer reasons for the selection of one or another in the following circumstances – portability of the electrical appliance – effects of moisture or vibration – special tariff circuits – loading involved Foundation principles for cable jointing. Jointing systems for interior and exterior joints in TPS cable.	EASQ 8.8 a EASQ 8.4 c CC 16G CC 16G EASQ 8.7 c EASQ 8.8 b	

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
1.4.5: Demonstrate knowledge of electrical faults, their dangers, and electrical testing.	5.1 Describe basic electrical faults, their symptoms and causes. Range: two different faults; may include but is not limited to — open circuits, overcurrent/overloads, short circuits, earth faults, earth leakage, arc faults, under/over voltage. 5.2 Explain the importance of secure, well-made cable terminations and connections. 5.3 Identify the correct test instruments to take electrical measurements and describe how to use them. Range: two test instruments; test instruments may include but are not limited to — an ohmmeter, insulation resistance tester, voltmeter, ammeter, RCD tester; may include a multimeter set to the correct function; electrical tests may include but are not limited to — conductor continuity, resistance, insulation	Foundation knowledge of: Selection of correct meters, check suitability and condition: – meter category – meter condition – on job meter verification checks – suitable meter ranges. Specific precautions required when using the instruments. How to compare measured results with calculations for validation of expected results. Explain the purpose and give typical applications of the following types of test instruments: – ohmmeter – insulation resistance tester – voltmeter – ammeter – RCD tester List the usual functions available in a multi-meter and understand the relationship existing between different ranges of the same function. Explain how the above types of test instruments should be connected to test a circuit. Explain the importance of ensuring that the correct connections, functions and range are selected on the test instrument before it is used to test a circuit. Detail any specific precautions required when using the above instruments. Identify the correct instrument to measure – voltage – current – resistance – insulation resistance – earth continuity – power. Types of faults, their symptoms and consequences i.e. – open circuits	CC 37E EASQ 8.17 b EASQ 8.17 f EASQ 8.17 d EASQ 8.17 e EASQ 8.17 c EASQ 8.17 a CC 22E CC 37E CC 36E	L3 2 credits Maps to US 32614 Related practical 1.6 LO1, LO2, LO4.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	resistance, voltage, current, RCD performance. 5.4 Explain the dangers associated with testing of solar installations. Range: increased dangers of DC over AC, dangers of continuous PV outputs in daylight, danger of stored energy in large batteries. Guidance information: Large batteries – batteries such as used in PV and UPS systems.	– overcurrent/overloads – short circuits – earth faults – earth leakage – arc faults – under/over voltage. Testing (appliances) – open circuit (flex, switch, fusible (heat) link), – internal circuit fault – short circuit Causes of faults i.e. – incorrect connections – transpositions – insulation failure – equipment/component failure – mechanical failure – unsafe condition of equipment Awareness of the increased dangers of DC over AC. Awareness of the inability to stop the output of PV panels and the danger of stored energy in large batteries. Explain the DANGERS and HAZARDS associated with SHORT CIRCUITS and where potentially high PROSPECTIVE SHORT CIRCUIT CURRENTS could be present. Describe the danger of excess current to cables and equipment.	CC 36E CC 36E CC 12E CC 12E EASQ 8.16 r EASQ 8.11 b	
1.4.6: Demonstrate knowledge of circuit protection.	6.1 Describe terms applicable to circuit protection. Range: three terms; may include but is not limited to — close excess current protection, coarse excess current protection, voltage rating,	Foundation knowledge of: State what is meant by the terms rated current and excess current protection. State forms of excess current protection – close excess current protection – coarse excess current protection. Explain the following terms applicable to sub-circuit protection: – voltage rating – current rating	EASQ 8.11 a EASQ 8.11 c EASQ 8.11 d	L3 2 credits Maps to US 32614

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	current rating, utilisation categories that replace fusing factors, breaking capacity and kA rating. 6.2 Describe the construction, operating principles, typical ratings and applications of common circuit protection devices. Range: may include but is not limited to — semi-enclosed rewirable fuse, HRC fuse, miniature circuit breaker, fusible link, RCD, AFDD; evidence of three is required. 6.3 Describe the ratings, and applications of different types of commonly used RCDs. Range: three different RCDs; may include but is not limited to — 10 MA, 30 MA, Type A.	– utilisation categories – that replace fusing factors – breaking (rupturing) capacity and kA rating. Describe, with the aid of labelled diagrams the construction, operation, principles, applications, of the following protective devices: – semi-enclosed rewireable fuses (installed in existing installations – HRC fuses labelling in accordance with BS88:1998, IEC and AS/NZS 60269 – miniature circuit breakers – HRC fuse cartridge fuses – fusible links – AFDDs. Explain with the aid of a labelled diagram the operating principles of an RCD used for personal protection Understand different types of RCDs include: – socket-residual current protection devices (SRCD) – portable residual current protection devices (PRCD) – RCBOs verses RCCBs – RCDs functionally independent of line voltage (used in residential type switchboards and SRCDs – RCDs functionally dependent on line or auxiliary voltage (used in PRCDs) – typical residual current ratings for personal protection are 10 mA and 30 mA – classification of RCDs according to the presence of DC components and other types available – load leakage currents.	EASQ 8.11 e CC 27E EASQ 8.13 b EASQ 8.13 c	
1.4.7: Demonstrate knowledge of de-commissioning and commissioning	7.1 Describe the process for safe de-commissioning of electrical fittings or equipment. 7.2 Identify the testing required before livening circuits or putting appliances into service.	Foundation knowledge of: Introduction to: – Section 8 of AS/NZS 3000 – testing and tagging of appliances to AS/NZS 3760 – AS NZS 5761 and AS/NZS 5762 – safety while testing live/operating equipment, AS/NZS 4836	CC 3E, 37E CC 25E	L3 2 credits Maps to US 32614 Related practical 1.6 LO3, LO4.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
of basic electrical fittings or electrical equipment. Range: one electrical fitting or one piece of electrical equipment; may include but is not limited to — lighting, socket outlets, fixed appliances.	7.3 Describe the process for safe commissioning of electrical fittings or equipment. Guidance information: Commissioning – for the purposes of this assessment, refers to the safety testing, livening and functional testing of circuits and equipment ready to handover to the customer for use. De-commissioning – for the purposes of this assessment, refers to the removal of fittings and equipment (rather than replacement) and the necessary steps to make the resulting exposed energy supply system safe. Basic electrical fittings or equipment – a circuit, electrical fitting, or electrical equipment that has a single type of function that can be de-commissioned simply by removing the electrical supply, and does not require more than foundation electrical knowledge	Systematic approach to de-commissioning and commissioning basic electrical fittings and equipment. Understand the precautions that must be taken when disconnecting and reconnecting conductors from enclosures and fittings including: – flexible cables and cords – copper braided sheath flexible cords and cables. Describe procedures for disconnecting conductors at an electrical appliance or at permanent connection unit terminating points] and electrical fittings including: – attaching safety tags – isolation methods – checking isolation (“prove – test – prove”) – securing isolation (lock off) – identification of conductors and terminals as disconnection proceeds – making all exposed conductor ends safe – ensuring disconnected cables are protected from mechanical damage or interference. Describe procedures for reconnecting conductors at an electrical appliance or at permanent connection unit terminating points and electrical fittings including: – checking safety tags that are in place – checking isolation is still effective (“prove – test – prove”) – reconnecting conductors to terminals, – ensuring correct direction of rotation of motors – carrying out prescribed tests including earthing, polarity and insulation resistance – replacing all covers, screens and guards. Understand and explain the importance of ensuring all conductors are correctly identified and correctly terminated to maintain the correct polarity. Understand and explain what would occur if the following conductors were accidentally interchanged on the supply to a single-phase 230 volt single-phase appliance: – the active (phase) and neutral conductors	EASQ 8.1 c EASQ 8.1 a CC 2E EASQ 8.1 b CC 2E CC 25E, 37E EASQ 8.1 d EASQ 8.1 e	

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	to commission. Examples include a lighting or socket outlet circuit, a fixed wired appliance, fixed wired electrical plant, other non-complex electrical equipment.	– the neutral and earth conductors – the active (phase) and earth conductors. Appropriate documentation of test results.	CC 25E, 37E	

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3008.1.2:2017, Electrical installations - Selection of cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand conditions AS/NZS 3017:2007, Electrical installations - Verification guidelines AS/NZS 3760:2010, In-service safety inspection and testing of electrical equipment AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment AS/NZS 5761:2011, In-service safety inspection and testing - Second-hand equipment prior to sale AS/NZS 5762:2011, In-service safety inspection and testing - Repaired electrical equipment Electricity Act 1992 Electricity (Safety) Regulations 2010 Health and Safety at Work Act 2015 New Zealand Building Code New Zealand Electrical Codes of Practice (NZECP) as cited in the Electricity (Safety) Regulations, available at https://www.worksafe.govt.nz or any current subsequent amendments and replacements.

Rest of Year One:

Electrician Module 1.5

Cables, cable handling and prewiring circuits

For an electrical industry student to gain a foundational understanding of cables and prewiring, terminating and fitting off circuits.

Credits: 11

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.2

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
1.5.1: Demonstrate appropriate cable handling and fixing techniques.	1.1 Use appropriate cable handling techniques to install cables. Range: three different situations; may include but is not limited to — leaving enough length, observing minimum cable bend radius, protection at sharp corners, labelling cable ends, no damage to cable. 1.2 Use suitable fixings to secure cables in place. Range: three different installations; suitable fixings may include but is not limited to — cable clips, staples, saddles, cable ties. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Apply cable handling techniques for drawing cables in, running/placing and fixing cables. Cable handling to avoid: – twists, – tangles, – kinks, – burning, – cuts – squashing and other damage. Other cable handling requirements such as: – leaving enough length, – cable bend radius and sharp corners. – Labelling/identification of cable ends.	CC 16G	L4 2 credits Maps to US 32615 On-job Related theory 1.4 LO4
1.5.2: Pre-wire electrical circuits.	2.1 Pre-wire electric circuits in different situations. Range: two different situations; may include but not limited to — timber structures, metal structures, concrete structures, in concrete, underground.	Follow instructions and or plans to prewire circuits and equipotential bonding conductors. Correctly install simple cable runs using common installation fittings such as pin clips or cable ties. Apply typical cable routes through installations. Awareness that the NZ building code has requirements that apply to electricians drilling/cutting holes in framing and bracing walls and the weather tightness of cable penetrations.	CC 44E CC 16G CC 16G CC 16G	L4 2 credits Maps to US 32615 On-job Related theory 1.4 LO4

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	2.2 Install cables in structures to comply with the requirements of the NZ building code. Range: two different installations. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken. Different situations – are situations that have different techniques for running the cables.	Awareness of fire rated structures.		
1.5.3: Join and test TPS cables. Range: one indoor or interior, one underground or exterior.	3.1 Select and use an appropriate joining system for TPS cables. 3.2 Carry out subsequent cable tests on jointed cables. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Join TPS cable Joint systems suitable for – Enclosed/interior, – Exterior/underground. Terminate and join various types of cable cores	CC 16G CC 16G	L4 1 credit Maps to US 32615 On-job, but may be assessed in a classroom, workshop, or a simulated work environment. Related theory 1.4 LO4

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
1.5.4: Identify and describe common types of cords and cables. Range: five cords and cables in total.	4.1 Identify examples of common cords and cables. 4.2 Describe the construction, characteristics and applications for identified cords and cables. 4.3 Identify common cable sizes used in the workplace and state their standard ratings. Guidance information: Characteristics – refers to the type, size, and standard current rating of cords and/or cables. Construction – refers to the material and configuration of cords and/or cables. Standard current rating – refers to the current rating of the cable unenclosed in free air at a standard air ambient temperature of 30°C. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Find and record ratings and applications for cables on site such as: – conductor materials – construction – configuration – conductor type – Insulation, armouring, screening and sheathing. Use techniques for confirming sizes. Sizes such as: – 0.5 mm^2, – 0.75 mm^2, – 1.0 mm^2, – 1.5 mm^2, – 2.5 mm^2, – 4.0 mm^2, – 6.0 mm2, – 10.0 mm^2, – 16.0 mm^2, – 25.0 mm^2. Research and identify the standard ambient temperature current rating, voltage rating and temperature rating of cables used in the workplace.	CC 15G, 16G CC 15G	L4 2 credits Maps to US 32616 Related theory 1.4 LO3
1.5.5: Prepare and terminate	5.1 Prepare cable ends and use appropriate terminations to	Select and use appropriate terminations for flat TPS, round TPS, and flex 16G}. Terminate various types of cable cores to:	CC 16G	L4 2 credits On-job

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
common cords and cables. Range: at least two cable sizes, at least two cable types; terminations at two different appliances and six different types of low voltage electrical fittings.	terminate common cords and cables into appliances and electrical fittings. 5.2 Check terminations for soundness and correct connections. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	– manufacturer's instructions, – industry standards, – AS/NZS 3000. Apply checks for termination quality and soundness.		Related theory 1.4 LO4 Maps to US 32616
1.5.6: Install electrical fittings using appropriate tools and fixings.	6.1 Select and install common electrical fittings. Range: six different fittings; must include — interior and exterior fittings 6.2 Fit off common electrical fittings. Range: total of six different types of low voltage fittings required including interior, and exterior fittings. 6.3 Select and use appropriate fixings and tools to correctly install	Select appropriate fittings with correct features and ratings including fire rating. Use appropriate fixings and tools correctly to install equipment onto timber, metal, gib board/plaster board, hollow structures, masonry and concrete to meet the requirements of manufacturer's instructions, the building code and AS/NZS 3000. Identify any hazards and apply necessary safety measures for adhesives and chemical fixings. Use wiring accessories.	CC 27E, 29A	L4 2 credits On-job Related theory 1.1 LO5, LO6. Maps to US 32616

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	electrical fittings or equipment to common building materials. Range: three different building materials. Guidance information: Electrical fittings – electrical accessories and light fittings. Considerations for selection of fittings may include but not limited to – current rating, voltage rating, environmental suitability. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.			

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3008.1.2:2017, Electrical installations - Selection of cables, Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand conditions AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment New Zealand Building Code or any current subsequent amended or replacement versions.

Rest of Year One:

Electrician Module 1.6

Electrical fittings, cable terminations, testing and faults

For an electrical industry student to gain a foundational understanding of testing, fault finding, de-commissioning and commissioning.

Credits: 8

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.2

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
1.6.1: Select and use appropriate instruments to carry out fundamental electrical tests.	1.1 Select the correct test instruments and test electrical circuits. Range: must include — two of each of: conductor continuity, resistance, insulation resistance, voltage, current. 1.2 Calculate expected results and compare to measured results. Range: one each for resistance, current, and power. Guidance information: Fundamental tests – are basic or entry level tests appropriate for new electrical trainees. Fundamental tests include conductor continuity, resistance, insulation resistance, voltage, current. The calculated results should be sufficiently close to the measured results to confirm that calculations can be used to anticipate measurement results or check their validity.	Select correct meters, check suitability and condition: – meter category, – meter condition, – on job meter verification checks, – suitable meter ranges. Specific precautions required when using the instruments. – 230V or 400V circuit tests, test for voltage, current, circuit resistance, insulation resistance – AS/NZS 3000 section 8 Use simple calculations to anticipate and help affirm measured results. Take measurements to confirm calculated values of voltage, current, resistance. Apply how to safely measure voltage, resistance, current and power dissipation for the whole or any part of a circuit.	CC 37E CC 37E CC 37E CC 22E CC 10E	L4 2 credits Maps to US 32617 On-job Related theory 1.3 LO3, LO4, 1.4 LO5
1.6.2: Identify and repair	2.1 Fault find appliances to identify electrical faults.	Tests – open circuit, flex, switch, fusible (heat) link – internal circuit fault	CC 36E	L4 2 credits Maps to US 32617

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
electrical faults in basic appliances. Range: three appliances.	2.2 Repair electrical faults in appliances. 2.3 Test and tag appliances where appropriate in accordance with either AS/NZS 3760, AS NZS 5761, or AS/NZS 5762. Guidance information: Basic appliance – an appliance which is not complicated in its construction or operation, such as a heated towel rail, hairdryer, skill saw, electric jug.	– short circuit. Possible causes of faults i.e. – incorrect connections – transpositions – insulation failure – equipment/component failure – mechanical failure – unsafe condition of equipment. Test and tag in accordance with AS/NZS 376 Requirements of AS NZS 5761 and AS/NZS 5762.	CC 36E CC 3E, 36E, 37E CC 36E, 37E	On-job – but may be assessed in a classroom, workshop, or a simulated work environment. Related theory 1.4 LO5
1.6.3: De-commission electrical fittings and basic electrical equipment. Range: two different fittings, two different pieces of equipment.	3.1 Safely de-commission fittings and equipment. Guidance information: Basic electrical circuit and equipment – a circuit or electrical equipment that has a single type of function that can be de-commissioned simply by removing the electrical supply, and does not require more than foundation electrical knowledge to commission. Examples include a lighting or socket outlet circuit, a fixed wired appliance, fixed wired electrical plant, other non-complex electrical equipment.	Systematic plan for de-commissioning equipment – Use of check sheets – Test sheets. Taking precautions when disconnecting and reconnecting conductors from enclosures] and fittings. Following procedures for disconnecting conductors at an electrical appliance or at permanent connection unit terminating points and electrical fittings including: – attaching safety tags – isolation methods – checking isolation (“prove – test – prove”) – securing isolation (lock off) – identification of conductors and terminals as disconnection proceeds – making all exposed conductor ends safe – ensuring disconnected cables are protected from mechanical damage or interference.	CC 25E CC 2E	L4 2 credits Maps to US 32618 On-job Related theory 1.4 LO7

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	De-commissioning – for the purposes of this assessment, refers to the removal of fittings and equipment (rather than replacement) and the necessary steps to make the resulting exposed energy supply system safe.			
1.6.4: Test and commission basic electrical circuits and electrical equipment. Range: two different circuits, two different pieces of electrical equipment.	4.1 Carry out testing before livening circuits or putting equipment into service and record the results. Range: testing as applicable to AS/NZS 3000, AS/NZS 3760, AS/NZS 5761, AS/NZS 5762. 4.2 Safely and correctly commission circuits and equipment, complete appropriate live safety and functional tests to be ready for use. Guidance information: Basic electrical circuit and equipment – a circuit or electrical equipment that has a single type of function that can be de-commissioned simply by removing the electrical supply, and does not require more than foundation electrical knowledge to commission. Examples include a lighting or socket outlet circuit, a fixed wired appliance, fixed wired electrical	Simple 230V or 400V circuits such as a socket outlet circuit, light circuit. Test as per AS/NZS 3000. Standard maintenance and installation tests for portable and fixed wired RCDs as required by AS/NZS 3760 and AS/NZS 3000. Test and tag appliances as required by AS/NZS 3760, AS NZS 5761 and AS/NZS 5762. Follow procedures for reconnecting conductors at an electrical appliance or at permanent connection unit terminating points and electrical fittings including: – checking safety tags that are in place – checking isolation is still effective (“prove – test – prove”) – reconnecting conductors to terminals – ensuring correct direction of rotation of motors – carrying out prescribed tests including earthing, polarity and insulation resistance – replacing all covers, screens and guards. Appropriate documentation of test results.	CC 25E, 37E CC 37E CC 3E CC 25E CC 2E CC 25E CC 25E CC 23E CC 37E CC 25E CC 37E	L4 2 credits Maps to US 32618 On-job Related theory 1.4 LO5, LO7.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	plant, other non-complex electrical equipment. Commissioning – for the purposes of this assessment, refers to the safety testing, livening and functional testing of circuits and equipment ready to hand over to the customer for use. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.			

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3760:2010, In-service safety inspection and testing of electrical equipment AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment AS/NZS 5761:2011, In-service safety inspection and testing - Second-hand equipment prior to sale AS/NZS 5762:2011, In-service safety inspection and testing - Repaired electrical equipment or any current subsequent amended or replacement versions.

Rest of Year One:

Electrician Module 1.7

Summative assessment for year 1

Credits: 1

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: None

Learning outcomes	Performance criteria	Teaching content guide	Notes
1.7.1: Demonstrate fundamental knowledge for working in electrical trades.	1.1 Present answers in response to questions related to working in electrical trades. Range: may include but is not limited to – legislation, electrical theory, electrical practice.	The content of this capstone assessment includes coverage of electrical knowledge associated with year one theory modules of this curriculum document. This capstone assessment content includes coverage of electrical theory and application found in electrician modules 1.1 to 1.6. It is expected that the student will spend time studying and preparing to pass the capstone assessment.	L3 1 credit Maps to US 32619

Guidance Information:
This unit standard covers the capstone assessment of fundamental knowledge of legislation, electrical theory and its application and is expected to be assessed towards the end of the first year of training in electrical trades. For example, people enrolled in the New Zealand Certificate in Electrical Pre-Trade (Level 3) [Ref: 4316] and the New Zealand Certificate in Electrical Trade (Level 4) with strands in General Electrical, and Electricity Supply [Ref: 4204].
For the purposes of this unit standard, fundamental knowledge is associated with these theory unit standards, assessed in year one of the New Zealand Certificate in Electrical Trade (Level 4) with strand in General Electrical [Ref: 4204-1]: Unit 32605, *Demonstrate knowledge for working safely in the electrical industry;* Unit 32606, *Demonstrate knowledge of tools, fittings, and plans in the electrical industry; Unit* 32609, *Demonstrate knowledge of mathematical principles, conductors and insulators;* Unit 32610, *Demonstrate knowledge of voltage, power and energy, and DC circuits; Unit* 32611, *Demonstrate knowledge of magnetism and AC generation;*
Unit 32612, *Demonstrate knowledge of legislation, industry governance bodies, and AS/NZS 3000 for the electrical industry;* Unit 32613, *Demonstrate knowledge of cords, cables, and cable installation;* Unit 32614, *Demonstrate knowledge of electrical faults, circuit protection, decommissioning, and commissioning.*
To achieve this unit standard, candidates must pass the capstone assessment, which is not an Electrical Workers Registration Board (EWRB) assessment. It is set and moderated by the Workforce Development Council (WDC), or as delegated by the WDC. The WDC capstone assessment is the only valid assessment tool for this unit standard, and credit for this unit standard may only be awarded on evidence of passing the assessment.
Achievement of this unit standard does not entitle trainees to legally perform prescribed electrical work without supervision. Until registered and licensed under the Electricity Act 1992, trainees are assisting, and must work under supervision when carrying out prescribed electrical work.

Year Two:

Electrician Module 2.1

Plans, circuits, lighting and cable installation

To build working knowledge of the part 1 of AS/NZS 3000, plans, switching circuits, lighting and cable installation for an electrical industry student.

Credits: 10

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.1.1: Describe and interpret diagrams and plans for electrical work.	1.1 Describe the purpose and drawing conventions of electrical diagrams. Range: two diagrams; may include but is not limited to — schematic diagram, block diagram, wiring diagram, location diagram, single line diagram. 1.2 Identify the appropriate details for preparing electrical work from a building detail plan and a plan schedule. Range: may include but is not limited to — floor plan, elevation, site plan.	Knowledge of: Reading a variety of electrical diagrams The creation of drawings and diagrams suitable to be used in the electrical industry The purpose and drawing conventions for: – schematic diagrams – block diagrams – (installation) location diagrams – wiring diagrams – single line diagrams Building detail plans i.e. floor plans, elevations, site plans Plan schedules Use plans to identify and select suitable electrical fittings taking into consideration: – any specified features – general fitting features – voltage and current ratings – environmental considerations e.g. IP rating and fire ratings	CC 44E CC 29A	L3 2 credits Maps to US 32620 Related practical 2.4 LO2
2.1.2: Demonstrate knowledge of switching circuits.	2.1 Explain the design and function of low voltage switching circuits. Range: three circuits; circuits may include but is not limited to — three or more-way lighting control switching circuit, start-stop control, safety interlocking circuit, water heating control, basic building services or industrial control or similar.	Foundational knowledge of: Designing control circuits. May include but not limited to lighting and equipment control circuits e.g. – two-way or intermediate switching circuits – lighting control – 3 heat control – start-stop control – safety interlocking circuits – water heating control – basic building services control or similar Circuits for electronic logic controllers, i.e. programmable relays and integrated control systems.	CC 45G	L4 2 credits Maps to US 32620 Related practical 2.5 LO1, LO2

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	2.2 Explain the design and function of an entry level control program for switching and controlling loads. Range: may include but is not limited to — programmable logic controller, programmable relay, programmable control system. Guidance information: Low voltage switching circuits – may include extra low voltage portions that control a low voltage switching device.			
2.1.3: Demonstrate knowledge of lighting systems.	3.1 Describe the operation and typical applications of luminaire types. Range: two luminaire types; may include but is not limited to — discharge luminaires, fluorescent luminaires, filament luminaires, LED luminaires, any associated control equipment where required. 3.2 Describe the basic planning process for a simple lighting layout. Range: must include but is not limited to — ascertaining light fitting	Awareness of: The operating concepts and parameters of common luminaire types and associated control gear including discharge luminaires, fluorescent luminaires, filament luminaires, LED luminaires. Fundamental rule requirements for the installation of luminaires and luminaires and associated control gear. Building code requirements for energy efficiency and installation requirements. Electricity distributor requirements for maintaining the correct power factor. Explain the stroboscopic effect of discharge lamps and LEDs and how this effect can be minimised.	CC 30A	L3 1 credit Maps to US 32620 Related practical 2.5 LO3

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	spread angle, the shape and use of the area, basic layout of light fittings. 3.3 Identify requirements for installation of lighting systems from AS/NZS 3000. Range: three requirements.			
2.1.4: Demonstrate knowledge of wiring support systems.	4.1 Outline the selection and installation requirements of common cable support systems. Range: three support systems; may include but is not limited to — steel, rigid and flexible PVC conduit, trunking/trough/ducting, cable ladder/tray, underground systems, catenary support systems, pendant type accessory systems, trailing cables. 4.2 Outline the general principles of moisture and fire barrier ratings for cable penetrations in installations. Range: installing cables, maintaining existing ratings when adding cables. 4.3 Explain and calculate the effects on cord and cable current carrying capacity.	Knowledge of: The requirements for cable supports found in AS/NZS 3000. Selection and installation requirements for wiring support systems and associated accessories: – steel, rigid and flexible PVC conduit – trunking/trough/ducting – cable ladder/tray – underground systems – catenary support systems – pendant type accessory systems – trailing cables Methods for achieving and/or maintaining moisture and fire barrier penetration ratings/integrity. Explain the effects of conductor length, cross sectional area and ambient temperature on the current carrying capacity of flexible cords and cables. Describe considerations for the up-rating and de-rating of cable current-carrying capacity for various installation methods, including: – the spacing and or grouping of cables – separation of cable supports – environmental factors	CC 16G CC 17G, 20E CC 16G EASQ 8.6 d CC 16G	L3 3 credits Maps to US 32621 Related practical 2.4 LO3

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	Range: must include but is not limited to — grouping, length, cross sectional area, ambient temperature. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards relating to this learning outcome.	Demonstrate the use of Cable Manufactures' Tables and AS/NZS 3008.1.2 relating to current ratings, voltage drop and temperature rating factors for various sizes and types of cables, flexible cords. Describe the installation requirements for a wide range of typical cables such as: – TPS (Tough Plastic Sheath) – thermoplastic sheathed – elastomer sheaths – XLPE – neutral screened – high temperature cables Behaviour in flame or fire Operating temperature range Bending radius – Suitability for installation conditions – Chemical resistance – Mechanical impact – Exposure to water – Exposure to weather and solar radiation	EASQ 8.6 g CC 16G	
2.1.5: Demonstrate knowledge of cable installation.	2.1 Identify suitable applications and any specific installation considerations or requirements for cable types. Range: two cable types; may include but is not limited to — TPS, elastomer sheathed (rubber), XLPE, neutral screen, high temperature cables.	Knowledge of: Installation requirements for a wide range of typical cables such as: – thermo-plastic /tough plastic sheathed, (TPS) – elastomer sheaths (rubber) – XLPE – neutral screened – high temperature cables. The typical requirements to join and terminate a variety of conductors in a wide range of applications including for mains and sub-mains.	CC 16G	L3 2 credits Maps to US 32621 Related practical 2.4 LO3, LO4.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	2.2 Identify and describe the appropriate types of connections required when jointing and terminating conductors. Range: two different conductors; may include but is not limited to — copper conductors, aluminium conductors, earthing conductors, aerial conductors. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards relating to this learning outcome.	Types of termination devices that can be used for various types of conductors, how they are used and their applications. Use and application of wiring accessories. The requirements for conductor terminations and joints in AS/NZS 3000.		

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3008.1.2:2017, Electrical installations - Selection of cables, Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand conditions New Zealand Building Code or any current subsequent amendments and replacements.

Year Two:

Electrician Module 2.2

NZ Supply system, earthing, circuit protection, testing and fault finding

To build working knowledge of the NZ Supply system, earthing, circuit protection, testing and fault finding for an electrical industry student.

Credits: 17

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.2.1: Demonstrate knowledge of the national supply grid and safety with high voltage equipment.	1.1 Describe multiphase power. Range: reasons for use, advantages, star and delta connections. 1.2 Describe the NZ national electrical supply system. Range: generation, transmission, distribution system. 1.3 Outline dangers of high voltage. Range: two dangers. 1.4 Outline the foundational safety principles for working in the vicinity of high voltage. Range: may include but not limited to — safe working procedures near high voltage, step, touch and induced voltages, sources of induced voltages and stored energy, creepage and clearance requirements, who is authorised to undertake High Voltage switching and isolation earthing procedures, the use of safe working procedures, approach distances.	Introductory knowledge of: The reasons for use of high voltage AC for transmission. Reasons and advantages for use of multiphase power. Multiphase power supply connection options. Illustrate with labelled diagrams the New Zealand electrical supply system showing the generation, transmission and distribution systems. Star and delta connections Multiphase identification conventions Draw and label the three phase four wire New Zealand distribution system to show how it can be used to supply: – a three-phase consumer – a two-phase consumer – a single-phase consumer State the typical voltages involved in each of the above supply areas]. Voltages between phases and to neutral/earth. Awareness of the possibility of coming across a multiphase supply and testing to identify presence of a multiphase supply. Detail the dangers/hazards involved when working on high voltage fittings. Awareness of electricity distributor requirements for working on or near High Voltage: – safe working procedures near high voltage – step, touch and induced voltages – sources of induced voltages and stored energy – creepage and clearance requirements – who is authorised to undertake High Voltage switching and isolation earthing procedures – the use of safe working procedures	 CC 14G EASQ 8.9 a CC 14G CC 23E EASQ 8.9 c EASQ 8.9 b CC 23E EASQ 8.16 o CC 43E CC 39G CC 43E	L3 2 credits Maps to US 32622

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
		ECP34 and ECP46.		
2.2.2: Demonstrate knowledge of the MEN system.	2.1 Describe the configuration and reasons for the MEN system of supply used in New Zealand.	Explain how the MEN system of supply in New Zealand is configured. Explain reasons why the neutral is earthed at multiple points in the supply system. Understand and explain the principal purpose of the multiple earth neutral (MEN) system used in New Zealand including: – maintaining a low neutral/earth parallel return circuit impedance to the distribution transformer – rapid disconnection of the supply under fault conditions – ensuring that the voltage cannot rise above 230V to earth	EASQ 8.10 a EASQ 8.10 b CC 31E, 32E EASQ 8.10 c CC 31E	L3 1 credit Maps to US 32622
2.2.3: Demonstrate knowledge of earthing and equipotential bonding.	3.1 Describe common earthing and equipotential bonding components. Range: three components; must include — purpose and arrangement of each component. 3.2 Describe the relationship between earth continuity and the disconnection times of protective devices and the importance of fast disconnection times. Range: the importance of low earth circuit resistance, dangers of high earth circuit resistance.	Knowledge of: Purpose and arrangement of the parts of an earthing system and earth conductors. The purpose of protective earthing and functional earthing. Types and sizes of conductors used in earthing Acceptable methods of earthing common installations Earth fault current path and magnitude Operation of protective devices and required disconnection times Understand and explain the importance of maintaining reliable low resistance earth circuit values for both protective earth and bonding conductors. Understand and explain the danger high resistance protective earth conductor or bonding conductor connections would present under fault conditions.	CC 31E CC 32E EASQ 8.10 d EASQ 8.10 e	L3 3 credits Maps to US 32622 Related practical 2.5 LO4, 2.6 LO2

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	3.3 Identify requirements on installation and testing requirements for earthing and equipotential bonding from AS/NZS 3000. Range: three installations, two testing requirements.	Equipotential bonding of metallic fittings, enclosures, structures, equipment and concrete reinforcing Equipotential bonding equipment available and its application Fundamental knowledge of the applicable earthing and equipotential bonding requirements of AS/NZS 3000. Awareness of ECP35 as used in the supply industry. Identification of earthed situations. Values and testing of earth continuity resistance.	CC 31E CC 32E	
2.2.4: Demonstrate knowledge of circuit protection for electrical installations.	4.1 Define circuit protection device terms. Range: three terms; may include but is not limited to — current rating, voltage type and rating, fusing/tripping current, utilisation category, tripping factor, time verses current characteristic, category of duty, back-up protection, rupturing capacity, prospective short-circuit current. 4.2 Describe the fundamental design and layout of circuit protection throughout an electrical installation. Range: must include — main switchboard, sub-board, sub-circuits, disconnection times for circuit protection devices, co-ordination of protection devices.	Understand and explain the following terms as related to protective devices: – current rating – voltage type and rating – fusing/tripping current – utilisation category – tripping factor – time verses current characteristic – category of duty – back-up protection – rupturing capacity – prospective short-circuit current Earth fault loop impedance The required fault protection for: – main switchboards – sub boards – final sub circuits Protection, such as: – over/under voltage – arc faults – surge protection – short circuits	EASQ 8.11 f CC 27E CC 27E	L4 3 credits Maps to US 32623 Related practical 2.6 LO1, LO2

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	4.3 Identify the installation requirements for electrical fault protection from AS/NZS 3000. Range: three requirements.	– overloads – earth faults Requirements for circuit protection in AS/NZS 3000 including the requirements for the installation of RCDs and AFDDs. Design arrangement and co-ordination (discrimination) of circuit protection/cables. Explain the importance of using DC rated switches and circuit breakers to open and isolate DC circuits.	CC 27E CC 12E	
2.2.5: Demonstrate knowledge of distribution board wiring.	5.1 Explain the design of circuit protection and wiring for a medium complexity distribution switchboard. 5.2 Identify general requirements for distribution boards from AS/NZS 3000. Range: three requirements. Guidance information: Medium complexity switchboard – A switchboard supplying a submain, cooker, an externally controlled circuit such as controlled hot water or heating and at least eight other RCD protected subcircuits or similar.	Understand the basic wiring design of distribution boards. The fundamental requirements of AS/NZS 3000 for switchboard wiring. Design of distribution board and components to ensure: – conductor sizes are adequate – neutral conductors are clearly identified – correct interconnection between switchgear, protection devices and links – correct polarity – correct earthing.	CC 26E CC 28E	L4 2 credits Maps to US 32623 Related practical 2.6 LO1, LO2
2.2.6: Demonstrate knowledge of electrical	6.1 Identify requirements for electrical testing from AS/NZS 3000. Range: three requirements.	Knowledge of: Electrical testing requirements in: – AS/NZS 3000, – AS/NZS 3017.		L4 4 credits Maps to US 32624 Related practical 2.6 LO2, LO3, LO4

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
installation testing.	6.2 Explain the purpose of AS/NZS 3017. 6.3 Identify instruments to test circuits to meet the requirements of section 8 of AS/NZS 3000. Range: de-energised, energised circuits. 6.4 Interpret test results, and explain the reasons for compliance or non-compliance. Range: two compliant results, two non-compliant results.	Identify equipment which may be damaged by test voltages. Choosing the correct test instruments to appropriately and safely check and test both de-energised and energised circuits to confirm the standards are met: – visual inspection – earth continuity – insulation resistance – polarity – correct circuit connections – fault loop impedance – operation of RCDs. Interpreting the results - the reasons for compliance or non-compliance. Documentation and/or certification of results.	 CC 25E CC 37E CC 37E	
2.2.7: Demonstrate knowledge of fault-finding and rectification of discovered faults.	7.1 Describe the process of gaining information from customers about the symptoms of faults. 7.2 Explain methods of testing circuits or equipment to identify faults safely. Range: two de-energised, one energised circuit. 7.3 Describe methods and actions to rectify commonly discovered faults in electric circuits or equipment. Range: three faults.	Knowledge of: The process of gaining information from customers about the symptoms of faults. The processes for consulting with experienced personnel to establish the natures of reported electrical fault in plant or equipment. Safe methods and tests to identify faults in circuits and/or equipment Actions to rectify discovered faults Regulatory requirements and Standards that apply to fault finding, rectification and repairs. The required documentation and/or certification as a result of fault rectification.	 CC 39G CC 39E CC 36E	L4 2 credits Maps to US 32624 Related practical 2.6 LO4

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3017:2007, Electrical installations – Verification guidelines AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment New Zealand Electrical Codes of Practice (NZECP) as cited by the Electricity (Safety) Regulations, available at https://www.worksafe.govt.nz or any current subsequent amendments and replacements.

Year Two:

Electrician Module 2.3

Damp situations, capacitors, inductors, transformers and motors

To build working knowledge of damp situations, separated power supplies, capacitors, inductors, transformers and motors for an electrical industry student.

Credits: 15

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.3.1: Demonstrate knowledge of damp situations.	1.1 Identify location boundaries of damp zones. Range: three boundary identifications. 1.2 Identify the limitations of electrical equipment and fittings in damp zones. Range: two different damp zones. 1.3 Identify the appropriate circuit protection and IP ratings required for the location of electrical equipment in damp situations. Range: two different damp situations. 1.4 Identify equipotential bonding requirements for a room containing a shower or a bath.	Define a damp situation. Damp zones. Understand and explain {international protection ratings (IP code) in Appendix G of AS/NZS3000 and specifically what the respective numbers represent, i.e. the first and second digits. Maintaining IP ratings of fittings and equipment. Understand that when an electrical appliance is repaired or components are replaced, that the correct components are used to ensure the appliance retains the correct safety standard (for damp situations). Limitations for installation of equipment in zones, suitable equipment for zones and acceptable location for equipment. Other methods of protection of equipment in damp zones, RCDs, separated supply, SELV or PELV protection and when they are required. Equipotential bonding requirements for bathrooms and showers. The requirements of the Regulations, AS/NZS 3000 in relation to damp situations and wet areas.	EASQ 8.21 a CC 42E EASQ 8.21 c CC 42E CC 42E EASQ 8.21 d CC 42E CC 37E	L3 2 credits Maps to US 32625 Related practical 2.5 LO5
2.3.2: Demonstrate knowledge of SELV and PELV systems.	2.1 Describe SELV and PELV systems and their applications. 2.2 Identify requirements for SELV and PELV installations from AS/NZS 3000. Range: one SELV, one PELV installation.	Foundation knowledge of: Separated circuits, SELV and PELV – purpose – applications – configuration, earthing requirements, and testing Applicable requirements of AS/NZS 3000.	CC 24E	L3 1 credit Maps to US 32625

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.3.3: Demonstrate knowledge of single-phase transformers.	3.1 Describe the construction of a single-phase transformer. Range: double wound, auto transformer. Construction must include — core, windings, winding connections. 3.2 Explain the operating principles of a single-phase transformer. Range: one of double wound, auto transformers. 3.3 Describe the features, applications, and restrictions of single-phase transformers Range: one of double wound, auto or instrument transformers. 3.4 Explain the operating principles, and safety precautions for using isolating transformers.	Key components and basic transformer construction: – double wound, – auto, – instrument, – isolation, Principles of operation of transformers: – step up/step down – turns ratio Transformers within electrical equipment i.e. welders. General requirements and or restrictions on the installation and use of transformers. Explain with the aid of a labelled diagram the basic operating principle of an isolating transformer. Explain why the isolating transformer provides maximum safety when used with only one electrical appliance connected. Explain why it is necessary, when two or more electrical appliances are connected simultaneously to one isolating transformer, their earth continuity conductors are bonded together at the transformer but must not be earthed. Explain in simple terms why transformers are rated in kVA and not watts. Explain that the kVA rating of a transformer is limited by the temperature of the core and windings.	CC 38G CC 38G EASQ 8.13 f EASQ 8.13 g EASQ 8.13 h EASQ 8.13 j	L3 2 credits Maps to US 32625
2.3.4: Demonstrate knowledge of capacitors and inductors.	4.1 Describe the operation of capacitors and inductors. Range: must include but is not limited to construction — operation, factors affecting the characteristics.	Capacitors and inductors – basic construction – units of measure – ratings – characteristics – factors affecting the characteristics – common simple applications – series and parallel circuit arrangements	CC 10E	L3 3 credits Maps to US 32626

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	4.2 Define the phase relationships between voltage and current in inductive and capacitive circuits. 4.3 Outline the effects of the phase relationship between voltage and current on power and power factor. 4.4 Describe the safety requirements and handling techniques for capacitors. Range: handling, installing, testing. 4.5 Identify AS/NZS 3000 requirements for capacitors. Range: two requirements.	– reactance – impedance Phase relationships between voltage and current in resistive, inductive and capacitive circuits. Calculation and measurement of the relationship between voltage, current, impedance and power dissipation in the whole or any part of a circuit. Safety while handling, installing, testing. Polychlorinated biphenyl (PCB): – awareness of the types of equipment likely to contain PCBs, – handling, – disposal of PCBs. Requirements for capacitors in AS/NZS 3000 for: – equipment ratings – discharge paths – installation requirements	CC 10E CC 10E CC 13G CC 13G	
2.3.5: Demonstrate knowledge of electronics in the electrical trade.	5.1 Explain using semiconductor theory, the function, operation and applications of common electronic components. Range: three components; may include but is not limited to — diodes, SCRs (thyristors), thermistors, transistors, diacs, triacs. 5.2 Explain the operation and function of capacitors used in simple electronic circuits.	Foundation knowledge: Simple semiconductor theory including: – P and N junctions – forward and reverse bias. Diodes: – types of diodes – function – common uses including simple rectifiers. Diode testing. Basic functions and applications of: – SCRs, – Thyristors – Thermistors.		L3 2 credits Maps to US 32626

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Range non-polarised, polarised (electrolytic) 5.3 Describe how to take measurements within simple electronic circuits. Range: measurements from two circuits; simple circuits may include but are not limited to — half wave rectifier, full wave rectifier, simple DC power supply, simple speed control, simple dimmer circuit. 5.4 Describe general precautions for the safe handling and testing of electronic components and circuitry.	Awareness of common types of DC power supplies. Measurement of functions in basic electronic control circuits. Safe installation and testing including: – following manufacturer's instructions, – hazard management, – safety requirements including preventing static discharge damage and heat damage. – precautions for electronic devices in general electrical installations such as AFDDs and RCDs. Requirements of AS/NZS 3000 and AS/NZS 3760.		
2.3.6: Demonstrate knowledge of DC motors.	6.1 Identify the key components of a DC motor. Range: three components; may include but is not limited to — stator, rotor, magnets, windings, commutator, controller, case, bearings; evidence of three components is required. 6.2 Describe how the components of a DC motor fit together.	Modern DC motors: – key components – construction – operating principles – power, torque and speed relationships – reversal.	CC 33G	L4 1 credit Maps to US 32629

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	6.3 Explain the operating principles of a DC motor.			
2.3.7: Demonstrate knowledge of three-phase alternators and induction motors.	7.1 Identify the key components of a three-phase alternator and an induction motor. Range: three components; may include but is not limited to — stator, rotor, windings, sliprings, brushes, bearings, fan, foot, case, end shields. 7.2 Describe how the components of a three-phase alternator and an induction motor fit together. 7.3 Explain the operating principles of a three-phase alternator and an induction motor. 7.4 Describe star and delta motor connections. 7.5 Explain phase sequence and how to reverse a three-phase induction motor.	Foundation knowledge of: Three phase alternators and induction motors key components and construction. Principles of operation: – transformer action between rotor/stator – poles/frequency/speed – power, torque and speed relationships – synchronous speed – slip speed (expressed as % of synchronous speed) – full load speed – difference between starting current and run current. Motor connection and reversal: – wiring diagrams for three phase motors – star and delta configurations – determining and changing phase sequence/direction of rotation. Purpose and use of phase rotation meters. Convert horsepower to watts.	CC 35G CC 35G CC 35G CC 14G CC 23E	L4 2 credits Maps to US 32629
2.3.8: Demonstrate knowledge of single-phase	8.1 Identify the key components of a single-phase induction motor. Range: three components; may include but not limited to — stator,	Foundation knowledge of: Describe the operation and construction of single-phase induction motor types including key components, characteristics, advantages, disadvantages and applications for each type: – split phase (resistance start)	EASQ 8.19 c CC 34G	L4 2 credits Maps to US 32629

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
AC induction motors.	rotor, windings, centrifugal switch, capacitor, bearings, fan, foot, case, end shields. 8.2 Describe how the components of a single-phase induction motor fit together. 8.3 Explain the operating principles of a common single-phase induction motor. 8.4 Compare single phase induction motors. Range: two each of — advantages, disadvantages, applications; may include but is not limited to — split phase motor, capacitor start motor, permanently split capacitor motor, capacitor start capacitor run motor. 8.5 Explain how to connect and reverse a single-phase motor.	– capacitor start – permanently split capacitor (capacitor start and capacitor run) – capacitor start capacitor run (dual value capacitor). Explain how a single-phase supply can be used to provide a simulated rotating magnetic field in motor windings. Explain how phase splitting can be used to provide starting torque in a single-phase motor. Explain with the aid of labelled diagrams the winding connections and how connections can be changed to reverse direction of rotation on each type of motor (listed above). Explain with the aid of labelled diagrams how external start relays may be used to start single phase induction motors. Include advantages, and disadvantages of external relays]. Explain the operation and construction of additional single-phase motor types: – universal – shaded pole – synchronous. State the advantages and disadvantages, applications, and how reversal of rotation can be achieved for each type. Explain methods of speed control for universal motors and state typical applications where universal motor speed control is employed.	EASQ 8.19 a EASQ 8.19 b CC 34G EASQ 8.19 d CC34G EASQ 8.19 e EASQ 8.19 f EASQ 8.19 g	

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment Health and Safety at Work Act 2015; or any current subsequent amendments and replacements.

Year Two:

Electrician Module 2.4

Establishing worksites, electrical plans, cable installation, joins and termination

To build practical working knowledge of establishing worksites, electrical plans, cable installation, joints and terminations.

Credits: 11

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.4.1: Establish new worksites ready for safe and efficient work. Range: three different worksites.	1.1 Scope worksites, create and use safe work method statements (SWMS), Job safety analysis (JSA) or similar for work tasks. 1.2 Prepare worksites ready for safe and efficient work. 1.3 Communicate with stakeholders to ensure the worksite is ready for work. Range: two stakeholders at each worksite Guidance information: Preparing for a worksite – may include but not limited to: PPE and other equipment required for the work tasks, obtaining required site-specific permissions, completing site-specific paperwork, submitting permit applications where needed, planning and preparation of staff, vehicles, tools, equipment, any required products and moving onto the worksite ready to start work. Stakeholders – refers to clients, installation owners, management, public, other trades people on site,	Establish communication with customers, public, or other trades/workers already on site or who will be affected by the work. Get any necessary required site-specific permissions. Carry out Safe Work Method Statements (SWMS), Job Safety Analysis (JSA) or similar. Scope the jobsite for other site-specific work challenges and special requirements. Complete site-specific paperwork/permit applications where necessary. Organise appropriate personal protective equipment, work tools and associated equipment ready for work to begin. Organise any other equipment/activities necessary to meet the requirements of the Health and Safety at Work Act. Meet the requirements of the Electricity (Safety) Regulations, Health and Safety Legislation and AS/NZS 4836. Communicate worksite requirements with work team.	CC 1E CC 2E CC 1E CC 3E CC 1E, 2E, 3E	L4 2 credits Maps to US 32630 On-job Related theory 1.1 LO2, LO3.

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	candidate's work team, and any other people affected by work on site and/or the outcome of that work.			
2.4.2: Create plans for electrical work. Range: two plans.	2.1 Create electrical plans to industry standards from given schedules and/or customer specifications. Guidance information: Plans – may include but are not limited to schematic diagrams, block diagrams, location diagrams, single line diagrams, floor plans, elevations, site plans. Plans may be drawn by hand or computer, as long as they are a produced to a high standard and are of a quality suitable for use with customers in industry.	Read a variety of electrical diagrams such as: – schematic diagrams – block diagrams – (installation) location diagrams – wiring diagrams – single line diagrams – plan schedules. Building detail plans i.e. – floor plans – elevations – site plans.	CC 44E	L4 1 credits Maps to US 32630 On-job Related theory 2.1 LO1
2.4.3: Interpret plans to carry out electrical tasks.	3.1 Interpret a plan to create a job inventory list of electrical gear for a job. 3.2 Carry out electrical tasks according to a plan. Range: two plans.	Use plans to prepare for electrical work. Make electrical fitting inventory lists from plans and select suitable electrical fittings taking into consideration: – any specified features – general fitting features – voltage and current ratings – environmental considerations e.g. IP rating and fire ratings	CC 29A	L4 1 credits Maps to US 32630 On-job Related theory 2.1 LO1
2.4.4: Install cables using cable support systems.	4.1 Select and install cable support systems and cables. Range: three different cable systems; may include but is not limited to —	Demonstrate the use of Cable Manufactures' Tables and AS/NZS3008.1.2 relating to current ratings, voltage drop and temperature rating factors for various sizes and types of cords and cables.		L4 4 credits Maps to US 32631 On-job

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	metal conduit, PVC conduit, cable ladder, perforated tray, trough, ducting, catenary. 4.2 Determine whether fire and/or moisture barriers are required to be created or maintained for the cable installation in 4.1. 4.3 Calculate cable current carrying capacity adjustments using current de-rating factors due to the installation environment. Range: two different installation environments; installation factors affecting the cable current rating may include but are not limited to — installation method, grouping/bunching of cables, environmental conditions. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Selection and installation requirements for wiring support systems and associated accessories: – steel, rigid and flexible PVC conduit – trunking/trough/ducting – cable ladder/tray – underground systems – catenary support systems – pendant type accessory systems – trailing cables Methods for achieving and/or maintaining moisture and fire barrier penetration ratings/integrity. Considerations for the up-rating and de-rating of cable current-carrying capacity for various installation methods, including: – the spacing and or grouping of cables – separation of cable supports – environmental factors.	CC 16G CC 17G CC 20G CC 16G CC 16G	Related theory 2.1 LO4, LO5
2.4.5: Join and terminate cables.	5.1 Join cables using suitable jointing systems. Range: joins in two different size cables.	Join and terminate a variety of conductors in a wide range of applications including for mains and sub-mains. Use termination devices for various types of conductors.	CC 16G	L4 3 credits Maps to US 32631

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	5.2 Terminate mains and submains cables. Range: two mains, two submains. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.			On-job – but may be assessed in a classroom, workshop, or a simulated work environment. Related theory 2.1 LO5

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3008.1.2:2017, Electrical installations - Selection of cables (Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand conditions) AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment Electricity (Safety) Regulations 2010 New Zealand Building Code Health and Safety at Work Act 2015 New Zealand Building Code or any current subsequent amended or replacement versions.

Year Two:

Electrician Module 2.5

Switching circuits and lighting, earthing and damp situations

To build practical working knowledge of switching circuits and lighting, installing and testing earthing, damp situations.

Credits: 13

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.5.1: Design and install switching circuits. Range: two different circuits; circuits may include but are not limited to — three-or-more way switching, automated lighting control switching circuit, start-stop control, safety interlocking circuit, water heating control, basic building services control, industrial	1.1 Design low voltage switching circuits. 1.2 Install designed circuits. Guidance information: Low voltage switching circuits – circuits that have more switching complexity than a simple on/off circuit. They may include semi-automated/automated or relay/contactor control of loads. It is acceptable for the low voltage switching circuit to include extra low voltage portions that control a low voltage switching device. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Install switching circuits. May include but not limited to lighting and equipment control circuits e.g. – two-way/intermediate switching circuits – lighting control – start-stop control – safety interlocking circuits – water heating control – basic building services control – industrial control or similar. Circuits for electronic logic controllers, i.e. programmable relays and integrated control systems.	CC 45G	L4 2 credits Maps to US 32632 On-job – but may be assessed in a classroom, workshop, or a simulated work environment. Related theory 2.1 LO2

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
control, or similar.				
2.5.2: Design a PLC programme.	2.1 Design a PLC control programme. 2.2 Install a PLC control programme. 2.3 Test a PLC control programme for correct function. Guidance information: The PLC programme must have at least six different control functions. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.			L4 2 credits Maps to US 32632 On-job – but may be assessed in a classroom, workshop, or a simulated work environment. Related theory 2.1 LO2
2.5.3: Install lighting.	3.1 Install lighting. Range: three different installations, each with more than three light fittings. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Install lighting Apply the rule requirements for the installation of luminaires and luminaires and associated control gear.	CC 30A	L4 3 credits Maps to US 32633 On-job Related theory 2.1 LO3

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.5.4: Install and test earthing and equipotential bonding.	4.1 Install and test an electrical installation earthing system. 4.2 Install and test the equipotential bonding of an electrical installation. Guidance information: Earthing system – includes an earth electrode, main earthing conductor, neutral and earth busbars, MEN link, and equipotential bonding conductors. Some variation in the components of the earthing system is acceptable if an alternative system is installed. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Apply acceptable methods of earthing common installations. Satisfy requirements as per AS/NZS 3000 Equipotential bonding of: – metallic fittings – enclosures – structures – equipment – concrete reinforcing Apply available equipotential bonding equipment. Earthing tests.	CC 31E CC 31E CC 21E CC 25E, 32E, 37E	L4 3 credits Maps to US 32633 On-job Related theory 2.2 LO3
2.5.5: Install electrical fittings and equipment in damp situations. Range: six fittings and two pieces of	5.1 Plan the placement of fittings and equipment in damp zones. 5.2 Select appropriate types of electrical protection and IP ratings for fittings and equipment to be used in damp situations. 5.3 Install fittings and equipment in damp situations.	Maintain IP ratings of fittings and equipment, Apply limitations for installation of equipment in zones, suitable equipment for zones and acceptable location for equipment. Application of other methods of protection of equipment in damp zones, when RCD, separated supply, SELV or PELV protection and they are required. Apply equipotential bonding requirements for bathrooms and showers. Apply the requirements of the Regulations, AS/NZS 3000 in relation to damp situations and wet areas.	CC 42E	L4 3 credits Maps to US 32633 On-job Related theory 2.3 LO1

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
electrical equipment required across two or more installations.	Guidance information: Electrical equipment – electrical apparatus or fixed wired appliance. Electrical fittings – electrical accessories and light fittings. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.		CC 37E	

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment New Zealand Electrical Codes of Practice (NZECP) as cited by the Electricity (Safety) Regulations, available at https://www.worksafe.govt.nz New Zealand Building Code or any current subsequent amended or replacement versions.

Year Two:

Electrician Module 2.6

Circuit protection and distribution boards, testing and fault finding

To build practical working knowledge of circuit protection, distribution boards, fault finding and rectification

Credits: 14

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.6.1: Plan circuit protection co-ordination for an electrical installation.	1.1 Plan circuit protection arrangements to achieve co-ordination for an electrical installation. Range: may include but is not limited to — co-ordination of circuit protection between mains supply protection, submain cable and final sub-circuits. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Design and apply the arrangement and co-ordination (discrimination) of circuit protection/cables. Apply methods and arrangement for protection against short-circuit currents, overload currents and earth fault. The required fault protection for: – main switchboards – sub boards – final sub circuits. Protection, such as: – over/under voltage – arc faults – surge protection – short circuit – overloads – earth faults. Apply the requirements for the installation of RCDs and AFDDs. Use DC rated switches and circuit breakers to open and isolate DC circuits where necessary.	CC 31E CC 27E CC 27E CC 27E CC 27E CC 12E	L4 3 credits Maps to US 32634 On-job Related theory 2.2 LO4, LO5.
2.6.2: Install and wire a distribution board and connect sub-circuits.	2.1 Install and wire a distribution board and connect sub-circuits. Range: minimum of six sub-circuits. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Wire medium complexity distribution switchboard as per the requirements of AS/NZS 3000. Wire distribution board and components to ensure: – conductor sizes are adequate – neutral conductors are clearly identified – correct interconnection between switchgear, protection devices and links – correct polarity – correct earthing	CC 26E CC 28E	L4 3 credits Maps to US 32634 On-job Related theory 2.2 LO3, LO4, LO5, LO6

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
2.6.3: Perform installation testing to AS/NZS 3000 and with reference to AS/NZS 3017.	3.1 Perform testing for the installation of a distribution board with subcircuits and document the results. Range: Testing to AS/NZS 3000 and with reference to AS/NZS 3017. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Installations with sub circuits. Medium complexity installations. Electrical testing requirements in: – AS/NZS 3000, – AS/NZS 3017. Choose the correct test instruments to appropriately and safely check and test both de-energised and energised circuits to confirm the standards are met i.e.: – visual inspection – earth continuity – insulation resistance – polarity – correct circuit connections – fault loop impedance – operation of RCDs. Interpret the results – giving reasons for compliance or non-compliance Documentation and/or certification of results.	CC 25E, 37E	L4 4 credits Maps to US 32634 On-job Related theory 2.2 LO6
2.6.4: Use fault-finding and fault rectification techniques on electrical installations. Range: three different faults.	4.1 Communicate with stakeholder(s) to establish and meet job requirements. 4.2 Use safe fault-finding techniques to identify faults in electrical installations. 4.3 Repair faults and test for correct function. Guidance information:	Apply the process of gaining information from customers about the symptoms of faults. Apply where necessary the processes for consulting with experienced personnel to establish the natures of reported electrical fault in plant or equipment. Use safe methods and tests to identify faults in circuits and/or equipment Apply actions to rectify discovered faults. Apply regulatory requirements and Standards that apply to fault finding, rectification and repairs. Complete documentation and/or certification.	CC 39G CC 39E CC 36E	L4 4 credits Maps to US 32635 On-job Related theory 2.2 LO6, LO7

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	Stakeholders – refers to clients, installation owners, management, public, other trades people on site, candidate's work team, and any other people affected by work on site and/or the outcome of that work.			

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3017:2007, Electrical installations - Verification guidelines AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment

Year Two:

Electrician Module 2.7

Summative assessment for year 2

Credits: 1

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 1.7

Learning outcomes	Performance criteria	Teaching content guide	Notes
2.7.1: Demonstrate intermediate knowledge for working in electrical trades.	1.1 Present answers in response to questions relating to working in electrical trades. Range may include but is not limited to – legislation, electrical theory, electrical practice.	The content of this capstone assessment includes coverage of electrical knowledge associated with year one and two theory modules of this curriculum document and should be assessed near the end of their second-year tuition or apprenticeship in the electrical trade. It is expected that the student will spend time studying and preparing to pass the capstone assessment.	L4 1 credit Maps to US 29484

Guidance Information:

This unit standard covers the capstone assessment of intermediate knowledge of legislation, electrical theory and its application and is expected to be assessed towards the end of the second year of training in electrical trades. For example, people enrolled in the New Zealand Certificate in Electrical Engineering Theory and Practice (Trade) (Level 4) [Ref: 2388] and the New Zealand Certificate in Electrical Trade (Level 4) with strands in General Electrical, and Electricity Supply [Ref: 4204], or people enrolled in the New Zealand Certificate in Electrical Engineering Theory (Level 3) [Ref: 2387].

For the purposes of this unit standard, *intermediate knowledge* is associated with the theory unit standards assessed in years one and two of the New Zealand Certificate in Electrical Trade (Level 4) with strand in General Electrical [Ref: 4204]. For a list of unit standards assessed in year one, refer to Unit 32619, *Demonstrate fundamental knowledge for working in electrical trades*. Unit standards assessed in year two are: Unit 32620, *Demonstrate knowledge of electrical plans, switching circuits, and lighting systems;* Unit 32621*, Demonstrate knowledge of wiring support systems and cable installation;* Unit 32622, *Demonstrate knowledge of the national supply grid, MEN system, and earthing;* Unit 32623, *Demonstrate knowledge of circuit protection and distribution board wiring;* Unit 32624, *Demonstrate knowledge of electrical installation testing, fault finding, and rectification of discovered faults;* Unit 32625*, Demonstrate knowledge of damp situations, SELV and PELV systems, and single-phase transformers;* Unit 32626*, Demonstrate knowledge of capacitors, inductors, and electronics in the electrical trade*.

To achieve this unit standard, candidates must pass the Workforce Development Council (WDC) capstone assessment, which is not an Electrical Workers Registration Board (EWRB) assessment. It is set and moderated by the WDC, or as delegated by the WDC. The WDC capstone assessment is the only valid assessment tool for this unit standard, and credit for this unit standard may only be awarded on evidence of passing the assessment.

Achievement of this unit standard does not entitle trainees to legally perform prescribed electrical work without supervision. Until registered and licensed under the Electricity Act 1992, trainees are assisting, and must work under supervision when carrying out prescribed electrical work.

Year Three:

Electrician Module 3.1

Earthing systems, switchboards, and cable selection

To advance an electrical industry student to a sound working knowledge of earthing systems, switchboards and cable selection in readiness for trade examinations.

Credits: 10

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 2.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.1.1: Demonstrate knowledge of earthing systems.	1.1 Describe alternative earthing systems. Range: includes but is not limited to — TT, TNS and TNSC; description to include the situations where each would be used, advantages, and disadvantages. 1.2 Explain the roles and design of MEN conductors in an installation. Range: two conductors; may include but is not limited to — protective earthing (PE) and neutral conductors (N), protective earth neutral conductor (PEN), MEN link. 1.3 Explain the consequences of MEN system failures during fault conditions. Range: must include but is not limited to — absence of the MEN link, high impedance of the PEN conductor. 1.4 Identify requirements for earthing and equipotential bonding from AS/NZS 3000.	Awareness of alternative earthing systems and where these systems would be more appropriate, advantages and disadvantages: TT, TNS and TNSC The MEN earthing system: – determination of earth fault loop impedance – cable sizing for protective device co-ordination – 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 – the requirements for the installation of a MEN link in an installation and its application to distribution board configurations including to an outbuilding – the likely consequences of the absence of the MEN link or high impedance in the PEN conductor during various fault conditions i.e. line voltage to earth, fault current path, earth loop impedance and operation of protective devices. – Testing of earthing. Awareness of legacy earthing systems that are still in use and the consequences of any alterations made to them. Earthing and equipotential bonding of pool and spa structures. Applicable requirements for earthing in AS/NZS 3000.	CC 31E CC 31E CC 32E CC 32E CC 32E CC 32E CC 42E	L4 3 credits Maps to US 32638 Related practical 3.4 LO3, 3.5 LO3, LO4

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Range: one pool, one spa structure.			
3.1.2: Demonstrate knowledge of the design, construction, and connections of switchboards.	2.1 Describe the design, placement, and configuration of switchboards, associated control and protection devices, cables and metering equipment. 2.2 Identify requirements for switchboards from AS/NZS 3000. Range: four requirements. 2.3 Explain the testing procedure and documentation required for a new switchboard. 2.4 Explain the testing procedure to ensure correct mains polarity.	Knowledge of: The requirements in AS/NZS 3000 for main switchboards. Planning and design for switchboards: – suitable switchboard locations and accessibility – restricted locations – the planning process for connection to an electricity distributors equipment – acceptable arrangements and preparation for installation of metering equipment – design to ensure adequate conductor sizes – construction requirements and fire-protection measures – requirements for protection against switchboard: o over and under voltage o internal arc faults o fault current o surges – the correct interconnection between switchgear – correct installation of earthing – identification of switchboards and neutral conductors – determination of prospective short circuit current, electricity distributor minimum and maximum fault levels – selection, co-ordination and arrangement of suitable protection devices and cables for: o short circuits o overloads o earth faults o earth leakage o arcing – Installation of final sub circuits into switchboards.	CC 26E, 28E CC 26E, 27E, 28E	L4 3 credits Maps to US 32638 Related practical 3.4 LO3, 3.5 LO3

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
		– Testing of work including tests to ensure correct polarity.		
3.1.3: Demonstrate knowledge of cables for installation.	3.1 Describe the factors that influence cable rating and selection. Range: must include but is not limited to — installation methods and environment. 3.2 Explain the method of calculating maximum demand. 3.3 Identify appropriate cables using technical information. Range: Size and type of one single-phase mains cable, one multiphase mains cable. Guidance information: Selection of cables – is influenced by volt drop, current carrying capacity, short circuit current, environmental conditions. Technical information – refers to cable manufacturers data, AS/NZS 3000, and AS/NZS 3008.1.2.	Cable selection for: – single phase and multiphase mains – submains – sub circuits. Understand and make cable selections based where appropriate on: – manufacturers data and cable ratings – current carrying capacity – short circuit capacity – installation methods, harmonics and external influences on capacity – maximum allowable length – maximum demand calculations – Determine the maximum demand for domestic and non domestic mains and sub-mains in accordance with AS/NZS3000. – fault loop impedance – voltage drop – cable insulation type – AS/NZS 3000 and AS/NZS 3008.1.2	CC 18E, 19E	L4 2 credits Maps to US 32639 Related practical 3.4 LO1, LO2, 3.5 LO3

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Candidates are expected to locate and reference the relevant clauses in the electrical Standards relating to this learning outcome.			
3.1.4: Demonstrate knowledge of cable systems for use underground. Range: two cable systems.	4.1 Identify appropriate cables for underground situations. 4.2 Identify general requirements for underground cables from AS/NZS 3000 4.3 Describe the types of cable protection and installation systems for cables underground as per AS/NZS 3000. Guidance information: Candidates are expected to locate and reference the relevant clauses in the electrical Standards relating to this learning outcome.	Knowledge of underground cables: – acceptable cable types – installation methods – depth and underground cable protection requirements – clearances to other services – ratings and selection Requirements for underground cables in AS/NZS 3000 and effects on cable ratings in AS/NZS 3008.1.2.	CC 20E	L4 1 credit Maps to US 32639 Related practical 3.4 LO2, 3.5 LO3
3.1.5: Demonstrate knowledge of specialised cables.	5.1 Briefly describe the construction, general characteristics and applications of specialised cables. Range: two specialised cables; may include but is not limited to — aerial conductors, MIMS cables.	Awareness of aerial conductors used in the electrical trade: – AS/NZS 3000 requirements – types and applications – limitations including span limitations and clearances. – installation methods – selection of poles/posts and struts for given applications – use and requirements of catenary systems. Awareness of MIMS cables: – types and applications	CC 20E	L4 1 credit Maps to US 32639 Related practical 3.4 LO2, 3.5 LO3

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	5.2 Briefly describe the construction of support systems for aerial conductors. Range: two support systems; may include but is not limited to — power poles, aerial conductors terminating at buildings.	– limitations. Awareness of fire rated cables Methods of selecting and situations influencing the choice between: – aerial conductors and underground conductors – MIMS cable and other specialist cables ECP 34	CC 16G CC 20E	
Guidance information: Candidates are expected to locate and reference the relevant clauses in the electrical Standards relating to this learning outcome.				

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3008.1.2:2017, Electrical installations - Selection of cables (Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand conditions) New Zealand Electrical Codes of Practice (NZECP) as cited in the Electricity (Safety) Regulations, available at https://www.worksafe.govt.nz or any current subsequent amendments and replacements.

Year Three:

Electrician Module 3.2

Power factor, three phase power, transformer performance, electronics and motor control

To advance an electrical industry student to a sound working knowledge of power factor improvement, three phase power, transformer performance, basic electronics, motor control and fault finding in readiness for trade examinations.

Credits: 9

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 2.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.2.1: Demonstrate knowledge of power, power factor and power factor improvement.	1.1 Explain real power, apparent power and power factor. 1.2 Describe the consequences of power factor issues and methods of power factor correction. Range: too high power factor, too low power factor. 1.3 Perform calculations to determine real power and apparent power.	Knowledge of: Power factor – Explain how capacitors are connected to inductive loads (i.e. motors) to correct the power factor and to reduce line current. Calculations and measurements of: – power factor – real power – apparent power. Types and means of power factor correction. Consequences of: – low power factor – over correction – unity and non-unity.	CC 13G	L4 2 credits Maps to US 32640
3.2.2: Demonstrate knowledge of three-phase AC power.	2.1 Describe the winding connections of three-phase transformers and the reasons for their use. Range Star/Star, Star/Delta, Delta/Star, Delta/Delta. 2.2 Calculate line and phase values of voltage and current. Range: Star, Delta. 2.3 Perform three phase calculations.	Knowledge of: Three phase AC generation and alternators: – advantages of three phase systems – star and delta connections ○ determination of line and phase values of voltage and current for star and delta systems ○ determination of phase sequence – determination of three phase power and energy – balanced and unbalanced loads – methods of determining unbalanced neutral current including using phasors.	CC 14G, 23E	L4 2 credits Maps to US 32640

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Range: includes but is not limited to — power, energy, determination of neutral current. 2.4 Explain balanced and unbalanced three-phase loads and the implications for generation and distribution systems.			
3.2.3: Demonstrate knowledge of transformer safety and performance.	3.1 Explain the performance characteristics of transformers. Range: includes but is not limited to — percentage regulation, VA rating and effects of load power factor. 3.2 Describe features and applications of power transformers. Range: must include but is not limited to — transmission transformer, local power distribution transformer, and large consumer transformer. 3.3 Describe general risks and safety control measures when working with transformers. Range: three risks.	Knowledge of: Single phase and three phase transmission and distribution transformers and large transformers consumer installations. VA rating and the effects of load power factor on the output of transformers. Performance characteristics of transformers including but not limited to percentage regulation. Explain the terms 'iron losses' and 'copper losses' and the practical methods of reducing these losses. Explain that the regulation of a transformer can be maintained by incorporating tap changing. Safe working procedures for testing and connecting transformers. Risks and safety control measures for transformers including possible back-feeds from live secondary circuits. Disconnection and reconnection of instrument transformers. Precautions that must be taken before disconnecting the load from a current transformer.	CC 38G, 23E	L4 2 credits Maps to US 32640
3.2.4: Demonstrate knowledge of	4.1 Describe common methods of starting, controlling and protecting electric motors.	Knowledge of: Methods for starting electric motors including: – direct online	CC 33G, 34G, 35G	L4 1 credit Maps to US 32641

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
starting, controlling, and protection of electric motors.	Range: one single-phase motor, one three-phase motor; may include but is not limited to — direct online, reduced voltage, soft start, variable speed drive. 4.2 Identify the requirements for motors from AS/NZS 3000. Range: two requirements. 4.3 Explain an electricity distributor restriction for limiting motor starting currents.	– reduced voltage – soft start – variable speed drive Criteria for selection of motor starters for various single phase and three phase motor applications The advantages and disadvantages and impact on performance of the methods of motor starting and speed control. The effects of soft starters and variable speed drives on the electricity supply. Protection for motor faults and overloads including: – magnetic overloads – thermal overloads – thermistor protection – electronic controllers. Design of starting and control circuits and safety interlock methods including: – typical motor and control circuit connections – protection – isolation – control and braking – automatic starting – emergency stopping – machine safety i.e. AS/NZS 4024 – requirements in AS/NZS 3000 – Electricity Distributor requirements for three phase motor installations and starters and methods for limiting transient starting current as specified by Electricity Distributor requirements.		

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.2.5: Demonstrate knowledge of motor faults, their diagnoses, and appropriate remedies.	5.1 Explain the effects of factors that can damage electric motors. Range: two factors and their effects; factors may include but are not limited to — reduced supply voltage, harmonics, multiple quick succession starts, current and cooling at reduced speeds, overloading. 5.2 Describe the symptoms, likely causes, and remedies of electric motor faults. Range: two motor faults; electric motor faults may include but are not limited to — field, armature, stator, rotor, mechanical.	Knowledge of: The effects on motors of: – reduced supply voltage, – harmonics, – multiple quick succession starts, – current and cooling at reduced speeds, – overloading a motor. The types of faults affecting the performance of: – DC motors – single phase induction motors – three phase induction motors. The symptoms and likely causes of motor faults in the: – supply – field – armature – stator – rotor – mechanical. The use of motor wiring diagrams and testing techniques for determining faults safely.	CC 33G, 34G, 35G	L4 2 credits Maps to US 32641 Related practical 3.5 LO2

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) or any current subsequent amendments and replacements.

Year Three:

Electrician Module 3.3

Commissioning electrical installations, alternative energy, specialised installations and installation verification

To advance an electrical industry student to a sound working knowledge of commissioning and de-commissioning electrical installations, alternative energy production, electrical standards and installation verification in readiness for trade examinations.

Credits: 14

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: Module 2.7

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.3.1: Demonstrate knowledge of de-commissioning electrical installations.	1.1 Describe a de-commissioning plan. Range: includes but not limited to — features of a plan, process to develop a plan, and recognising when other trades or specialists may need to assist. 1.2 Identify requirements for unused cables and alterations to parts of an electrical installation from AS/NZS 3000. Range: one requirement for unused cables, one requirement for alterations. Guidance information: De-commissioning – for the purposes of this assessment, refers to the removal of fittings and equipment (rather than replacement) and the necessary steps to make the resulting exposed energy supply system safe. Electrical installation – refers to all or a significant part of an electrical installation or plant equipment. This	Knowledge of: Systematic approach to de-commissioning electrical equipment as necessary i.e. – using check and test sheets – identification of all circuits involved – investigation of operational and safety impacts on other circuits and equipment – development of Safe Work Method Statements (SWMS), Job Safety Analysis (JSA) or similar for the job at hand – mitigation of risk of injury or damage to equipment from energy release including possible mechanical movement – isolation of all energy sources – tagging – testing – securing – earthing – mitigating the risks of mechanical damage to cables and equipment – safe removal of equipment and termination of unused cables – requirements for dealing with unused conductors and equipment – acceptable methods of disposing of hazardous materials – records and documentation. The types of potential operational situations that carry increased safety risks that may be encountered in various areas of industry and the need for assistance from more experienced industry personnel when working in that type of situation. Knowing an individual's personal limits and when to seek assistance including from other specialist trades such as gas fitters. Who is authorised to safely shutdown plant and equipment.	CC 25E, 2E CC 2E, 39G CC 2E, 39G	L4 2 credits Maps to US 32642 Related practical 3.6 LO1

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	might be to accommodate the removal/installation of all or part of a structure or plant. The intention is that the installation or plant involved is more complicated requiring more complex planning than a single circuit and fittings or an appliance.	The process to obtain assistance from an experience or authorised person.	CC 39G CC 39G	
3.3.2: Demonstrate knowledge of commissioning plans.	2.1 Describe a commissioning plan. Range: includes but not limited to — features of a plan, process to develop a plan, testing required, recognising when other trades or specialists may need to assist. Guidance information: Commissioning – for the purposes of this assessment, refers to the safety testing, livening and functional testing of circuits and equipment ready to handover to the customer for use.	Knowledge of: Systematic approach to commissioning electrical equipment as necessary i.e. – using check and test sheets – development of Safe Work Method Statements (SWMS), Job Safety Analysis (JSA) or similar for the job at hand – mitigation of risk of injury or damage to equipment from machine start up including possible mechanical movement – testing prior to energisation to AS/NZS 3000 – circuit voltage testing – phase rotation checks – systematic loading up – equipment/circuit function checks – instrumentation/control checks – equipment operational checks – records and documentation 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. Knowing an individual's personal limits and when to seek assistance including from other specialist trades such as gas fitters. Who is authorised to safely start up plant and equipment.	CC 25E, 2E CC 39G	L4 2 credits Maps to US 32642 Related practical 3.4 LO3, 3.5 LO1, 3.5 LO3, 3.6 LO2

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
		The process to obtain assistance from an experience or authorised person.		
3.3.3: Demonstrate knowledge of electrical installation verification, fault repair, and maintenance.	3.1 Describe electrical installation verification with reference to AS/NZS 3019. Range: must include but is not limited to — the purpose, Certificate of Verification. 3.2 Outline the process when a fault is discovered while carrying out an electrical installation verification. Range: documenting, reporting, further action to rectify faults. 3.3 Describe the types and process for maintaining electrical installations. Range: types of maintenance must include but is not limited to — repairs, pre-emptive maintenance, maintenance for compliance. Guidance information: Process for maintaining electrical installations – refers to identification, scheduling,	Knowledge of: Verification of electrical installations, which may include but not limited to: – visual inspection – mechanical inspection – thermal imaging AS/NZS 3000 AS/NZS 3019 AS/NZS 3017 Suitable reports such as a Certificate of Verification Actions to rectify discovered faults General maintenance of electrical installations such as: – lamp replacement – battery replenishment and cleaning – checking/tightening of terminations – repairs or replacement of damaged or faulty parts and equipment – cleaning out and removal of rubbish, removal of access obstacles, dusting and cleaning – calibration of equipment, removal of redundant equipment – operational checks – filling out of maintenance and check records – lubrication – bearing checks – current checks – cleaning of cooling fans and paths – oil replacement – desiccant replacement	CC 37E	L4 2 credits Maps to US 32642 Related practical 3.5 LO2, LO4.

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	documentation, reporting on the results and any issues found, communication with customers.	– rodent and insect control measures – water tightness – removal of vegetation. Documentation of maintenance carried out and report on the results and any issues found. Documentation for compliance or regulatory reasons such as building warrant of fitness's or health and safety requirements.		
3.3.4: Demonstrate knowledge of alternative energy generation systems.	4.1 Describe the basic installation and operation of alternative energy generation systems. Range: two different systems. 4.2 Describe the basic configuration, installation, operation, and appropriate use of energy output components. Range: two components; may include but is not limited to — inverters, chargers, energy storage systems, electric vehicle charging systems. 4.3 Identify applicable standards for alternative generation systems. Range: two different standards. Guidance information:	Foundation knowledge of: Alternative energy generation systems i.e. – solar – wind – fuel driven – micro hydro – tidal/wave/current generation – electric vehicle charging systems. Basic knowledge of the installation, operation and appropriate uses for the types of: – battery storage systems – charging systems – inverters – generators. Interconnection of DC to AC systems. Interconnection of different generation systems to a single load. General awareness of emerging technology.	CC 12E	L4 2 credits Maps to US 32643

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Alternative energy generation systems – examples include but are not limited to – photovoltaic/solar, wind, fuel driven, micro hydro, tidal, wave.			
3.3.5: Demonstrate knowledge of safe practices when isolating and testing generation, charging, and storage systems.	5.1 Describe appropriate foundational safe practices when isolating and testing of generation, charging, and storage systems. Range: may include but is not limited to — battery storage systems, charging systems, inverters, and generators.	Foundation knowledge of: Safe isolation and testing of generation, charging and storage systems. Awareness of applicable standards i.e. – AS/NZS 3000 – AS/NZS 3010 – AS/NZS 4509.1 – AS/NZS 4509.2 – AS/NZS 4777.1 – AS/NZS 4777.2 – AS/NZS 5033	CC 12E	L4 1 credit Maps to US 32643
3.3.6: Demonstrate knowledge of electrical industry hazardous areas.	6.1 Define the nature of hazardous areas. 6.2 Describe the training and experience required to work safely in hazardous areas. 6.3 Identify requirements for hazardous areas from AS/NZS 3000. Range: two requirements. Guidance information: Hazardous areas – as defined in the Electricity (Safety) Regulations and AS/NZS 3000.	Knowledge of: Areas classified as hazardous as defined in the Electricity (Safety) Regulations) and AS/NZS 3000. The nature of hazardous areas. Awareness of additional training and experience required for competency with electricity in hazardous areas. Awareness of the AS/NZS 3000 requirements for hazardous areas. Awareness of standards for Hazardous areas i.e. AS/NZS 60079 series EEHA = electrical equipment in hazardous areas	CC 40E CC 39G CC 40E	L4 1 credit Maps to US 32644

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.3.7: Demonstrate knowledge of electrical installations on construction and demolition sites.	7.1 Outline fundamental requirements for electrical circuits on construction and demolition sites from AS/NZS 3012. Range: two requirements each for supply, control and protection. 7.2 Outline the requirements for initial and periodic inspection and testing of construction and demolition sites.	Knowledge of: Construction and demolition sites: – awareness of the requirements of AS/NZS 3012 – supply requirements – types of switchboards required – methods of protection and control of circuits – requirements for construction wiring, lighting and circuits for lifts – the requirements and methods for Initial and periodic inspection and testing.	CC 41G	L4 2 credits Maps to US 32644
3.3.8: Demonstrate knowledge of electrical standards for special electrical installations.	8.1 Identify electrical installations defined as special in AS/NZS 3000. Range: four installations. 8.2 Identify requirements for special electrical installations from AS/NZS 3000 and other relevant standards. Range: four requirements. 8.3 Explain requirements to work competently in hazardous areas. Range: awareness of personal limitations, when to seek assistance, training and experience.	Knowledge of: What are special electrical installations – as defined in AS/NZS 3000 Awareness of standards specifying additional requirements to AS/NZS 3000 and their relationship to AS/NZS 3000, including but not limited to: – AS/NZS 3001 Relocatable installations and their site supply – AS/NZS 3002 Shows and carnivals – Electrical vehicle charging Awareness of the experience and training required to work in specialised areas. Awareness of possible personal limitations of any electrical worker in experience and the need to know when to seek assistance from experienced personnel. Installations that are subject to periodic inspections by electrical inspectors.	CC 40E CC 39E	L4 2 credits Maps to US 32644

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3001:2008, Electrical installations - Transportable structures and vehicles including their site supplies
AS/NZS 3002:2008, Electrical installations - Shows and carnivals
AS/NZS 3003:2018, Electrical installations - Patient areas
AS/NZS 3010:2017, Electrical Installations (generating sets)
AS/NZS 3012:2019, Electrical installations - Construction and demolition sites
AS/NZS 3017:2007, Electrical installations - Verification guidelines
AS/NZS 3019:2007, Electrical installations - Periodic verification
AS/NZS 4509.1:2009, Stand-alone power systems Safety and installation
AS/NZS 4509.2:2010, Stand-alone power systems System design
AS/NZS 4777.1:2016, Grid connection of energy systems via inverters Installation requirements
AS/NZS 4777.2:2020, Grid connection of energy systems via inverters Inverter requirements
AS/NZS 5033:2014, Installation and safety requirements for photovoltaic (PV) arrays
AS/NZS 60079 series, Explosive Atmospheres
Electricity (Safety) Regulations 2010
or any current subsequent amendments and replacements.

Year Three:

Electrician Module 3.4

Cable selection using standards, mains cables and switchboards

To advance an electrical industry student to a sound working knowledge of selecting cables using standards, installing mains cables and switchboards in preparation for qualification as an electrician.

Credits: 13

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: None

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.4.1: Select cables for different applications. Range: three different applications.	1.1 Communicate with stakeholders to establish and meet job requirements. 1.2 Carry out maximum demand calculations to establish cable sizes for jobs. 1.3 Select appropriate cables using manufacturers data, AS/NZS 3000 and AS/NZS 3008.1.2.	Cable selection for: – single phase and multiphase mains – submains – sub circuits. Understand and make cable selections based where appropriate on: – manufacturers data and cable ratings i.e. ○ current carrying capacity ○ short circuit capacity – installation methods, harmonics and external influences on capacity – maximum allowable length – maximum demand calculations – fault loop impedance – voltage drop – cable insulation type – AS/NZS 3000 and AS/NZS 3008.1.2	CC 18E	L4 3 credits Maps to US 32646 On-job Related theory 3.1 LO3
	Guidance information: Applications – refers to the different types of installation requirements. Examples include cables installed in air, completely surrounded by thermal insulation, partially surrounded by thermal insulation, in wiring enclosures, in wiring enclosures completely surrounded by thermal insulation, in wiring enclosures partially surrounded by thermal insulation, buried direct in the ground, underground in wiring enclosures, different environmental conditions such as indirect sunlight, very hot or very cold ambient temperatures, bunching/grouping of cables. Selection of cables – Cable selection is influenced by factors such as volt drop, current carrying capacity, short circuit current, earth fault loop impedance, environmental conditions, maximum circuit length. Stakeholders – refers to clients, installation owners, management, public, other trades people on site, candidate's work team, and any other people affected by work on site and/or the outcome of that work. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken			
3.4.2: Install mains and submain cables.	2.1 Communicate with stakeholders to establish and meet installation requirements.	Apply methods of selecting between aerial conductors and underground conductors. Install cables underground and or overhead.	CC 20E CC 21G	L4 5 credits Maps to US 32647 On-job

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	2.2 Select and install mains and submain cables to comply with AS/NZS 3000. Range: one mains, one submain. 2.3 Install and test a submain earthing system to an outbuilding. Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	Terminate cables where necessary in enclosures such as pillars, pits, mains connection boxes, switchboards. Test cables to AS/NZS 3000. Apply the requirements for earthing system: – cable sizing for protective device co-ordination – 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 – the requirements for the installation of a MEN link in an installation and its application to distribution board configurations including to an outbuilding – Testing of earthing.	CC 37E CC 31E CC 32E CC 32E CC 32E	Related theory 3.1 LO3, LO4, LO5.
3.4.3: Install a main switchboard.	3.1 Communicate with stakeholders to establish and meet installation requirements. 3.2 Plan the placement and configuration of a main switchboard as per AS/NZS 3000. Range: may include but not limited to — access, associated control and protection devices, wiring, metering equipment. 3.3 Install and connect a main switchboard.	Apply the requirements in AS/NZS 3000 for switchboards. Planning and design for switchboards: – suitable switchboard locations and accessibility – restricted locations – Apply the planning process for connection to an electricity distributors/supply equipment – Apply acceptable arrangements and preparation for installation of revenue metering equipment – Design to ensure adequate conductor sizes – Apply construction requirements and fire-protection measures – Apply where necessary the requirements for protection against switchboard: ○ over and under voltage ○ {internal arc faults ○ {fault current ○ {surges.	CC 26E, 27E, 28E	L4 5 credits Maps to US 32648 On-job Related theory 3.1 LO1, LO2, 3.3 LO2.

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	3.4 Test a switchboard installation and document test results. Guidance information: Stakeholders – refers to clients, installation owners, management, public, other trades people on site, candidate's work team, and any other people affected by work on site and/or the outcome of that work. For this assessment, the switchboard must be tested to meet the requirements of AS/NZS 3000 and with reference to AS/NZS 3017. The mains polarity must be tested to ensure it is correct. Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.	– Apply the correct interconnection between switchgear – Apply the correct installation of earthing – Apply the identification of switchboards and neutral conductors – Determine prospective short circuit current, electricity distributor minimum and maximum fault levels – Apply the selection, co-ordination and arrangement of suitable protection devices and cables for: o short circuits o overloads o earth faults o earth leakage o arcing – Install final sub circuits into switchboards. Test work including tests to ensure correct polarity.		

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3008.1.2:2017, Electrical installations - Selection of cables (Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand conditions) AS/NZS 3017:2007, Electrical installations - Verification guidelines AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment or any current subsequent amended or replacement versions.

Year Three:

Electrician Module 3.5

Installation, verification, and maintenance of electrical installation

To advance an electrical industry student to a sound practical working knowledge of installation, and verification of electrical installations in preparation for qualification as an electrician.

Credits: 20

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: None

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.5.1: Install electric motors and a variable frequency drive. Range: One single-phase, one three-phase AC induction motor, one VFD.	1.1 Wire electric motors and a VFD. 1.2 Commission electric motors and a VFD.	Installing and commissioning: – Single phase induction motor – Three phase induction motor – Variable frequency drive		L4 3 credits Maps to US 32649 On-job – but may be assessed in a classroom, workshop, or a simulated work environment. Related theory 3.3 LO2
3.5.2: Diagnose and repair electric motor faults. Range: two motors.	2.1 Use fault finding procedures to diagnose electric motor faults. Range: motor faults may include but are not limited to — supply, field, armature, stator, rotor, mechanical faults. 2.2 Provide a customer report on repair or replacement options. 2.3 Repair or replace motors diagnosed with a fault. Range: must include — relevant installation tests.	The use of motor wiring diagrams and testing techniques for determining faults safely.	CC 35G	L4 2 credits Maps to US 32649 On-job – but may be assessed in a classroom, workshop, or a simulated work environment. Related theory 3.2 LO5

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Guidance information: Candidates are expected to locate and reference the relevant clauses in the Standards that relate to the electrical work being undertaken.			
3.5.3: Prepare for and plan an electrical installation. Range: includes but not limited to — working within time and budget constraints.	3.1 Communicate with stakeholders to establish installation requirements. Range: includes but not limited to — obtaining information on the number, position, type, and style of electrical fittings and equipment, the quality and finish required for the work. 3.2 Plan the size and arrangement of electrical cables and circuit protection. Range: must include but not limited to — mains cable loading and maximum demand calculations, number of sub-circuits, size of sub-circuit cables, rating of circuit protection. 3.3 Use a schedule to organise and procure the fittings and material required to complete the installation.	Take charge (under suitable supervision) of wiring a complete installation to a schedule and within time/budget constraints. Test and commission to the requirements of AS/NZS 3000 and the Electricity (Safety) Regulations. Documentation and/or certification of results.	CC 25E, 37E	L4 3 credits Maps to US 32650 On-job Related theory 3.1 LO1, LO2, LO3, LO4, LO5, 3.3 LO2

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	3.4 Arrange electrical supply. 3.5 Prepare health and safety arrangements appropriate for the job. Range: must include but not limited to — risk assessment and planning for implementation of appropriate risk controls. 3.6 Select and prepare tools and associated equipment. Guidance information: Electrical installation – includes but is not limited to mains cable, switchboard, earthing, circuit control and protection equipment, subcircuits. Stakeholders – refers to clients, installation owners, management, public, other trades people on site, candidate's work team, and any other people affected by work on site and/or the outcome of that work.			

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
	Learning outcomes 3.5 LO3, LO4, and LO5 are to be completed for the same installation.			
3.5.4: Install and test the electrical installation.	4.1 Carry out the electrical installation. Range: includes but not limited to — application of risk controls, safe and sound work practices, compliance with AS/NZS 3000, compliance with the building code where applicable, compliance with stakeholder expectations for the installation including the quality and finish of work. 4.2 Test to the requirements of AS/NZS 3000 and confirm that the installation is safe to connect to the supply. 4.3 Arrange for the completion of a certificate of compliance by a registered tradesperson. Guidance information: Learning outcomes 3.5 LO3, LO4, and LO5 are to be completed for the same installation.	Take charge (under suitable supervision) of wiring a complete installation to a schedule and within time/budget constraints. Test and commission to the requirements of AS/NZS 3000 and the Electricity (Safety) Regulations. Documentation and/or certification of results.	CC 25E, 37E	L4 5 credits Maps to US 32650 On-job Related theory 3.1 LO1, LO2, LO3, LO4, LO5, 3.3 LO2

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.5.5: Liven an electrical installation.	5.1 Coordinate the connection of the electrical installation to the supply. 5.2 Carry out functional tests of the installation and confirm that the installation is safe and ready for use. Guidance information: Learning outcomes 3.5 LO3, LO4, and LO5 are to be completed for the same installation.	Take charge (under suitable supervision) of wiring a complete installation to a schedule and within time/budget constraints. Test and commission to the requirements of AS/NZS 3000 and the Electricity (Safety) Regulations. Documentation and/or certification of results.	CC 25E, 37E	L4 2 credits Maps to US 32650 On-job Related theory 3.1 LO1, LO2, LO3, LO4, LO5, 3.3 LO2
3.5.6: Carry out verification of an electrical installation.	6.1 Communicate with stakeholders to establish and meet verification requirements. 6.2 Carry out a verification inspection and testing on an electrical installation in accordance with AS/NZS 3019. 6.3 Complete a report on the verification findings. Guidance information: Stakeholders – refers to clients, installation owners, management, public, other trades people on site, candidate's work team, and any	Verification of electrical installations, which may include but not limited to: – visual inspection – mechanical inspection – thermal imaging AS/NZS 3000 AS/NZS 3019 AS/NZS 3017 Suitable reports such as a Certificate of Verification. Actions to rectify discovered faults.	CC 37E	L4 5 credits Maps to US 32651 On-job Related theory 3.3 LO3

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	other people affected by work on site and/or the outcome of that work. The verification certificate completed for the purpose of this assessment cannot be used to issue official certification of the installation.			

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3008.1.2:2017, Electrical installations - Selection of cables (Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand conditions) AS/NZS 3017:2007, Electrical installations - Verification guidelines AS/NZS 3019:2007, Electrical installations - Periodic verification AS/NZS 3760:2010, In-service safety inspection and testing of electrical equipment AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment AS/NZS 5761:2011, In-service safety inspection and testing - Second-hand equipment prior to sale AS/NZS 5762:2011, In-service safety inspection and testing - Repaired electrical equipment or any current subsequent amendments and replacements.

Year Three:

Electrician Module 3.6

De-commissioning and commissioning and maintenance of electrical installations

To advance an electrical industry student to a sound practical working knowledge of de-commissioning, commissioning and maintenance of electrical installations in preparation for qualification as an electrician.

Credits: 11

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: None

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
3.6.1: De-commission an electrical installation.	1.1 Communicate with stakeholders to establish and meet de-commissioning requirements. 1.2 Develop a de-commissioning plan for the safe removal of the installation. 1.3 De-commission an electrical installation following the plan. Guidance information: De-commissioning – for the purposes of this assessment, refers to the removal of fittings and equipment (rather than replacement) and the necessary steps to make the resulting exposed energy supply system safe. De-commissioning plan – a plan of the steps for the safe removal of an installation or equipment covering points such as: • Risk assessment and controls including the de-energization of all energy sources.	Apply a systematic approach to de-commissioning electrical equipment as necessary i.e. – using check and test sheets – identification of all circuits involved – investigation of operational and safety impacts on other circuits and equipment – development of Safe Work Method Statements (SWMS), Job Safety Analysis (JSA) or similar for the job at hand – mitigation of risk of injury or damage to equipment from energy release including possible mechanical movement. – isolation of all energy sources – tagging – testing – securing – earthing – mitigating the risks of mechanical damage to cables and equipment – safe removal of equipment and termination of unused cables – requirements for dealing with unused conductors and equipment. – acceptable methods of disposing of hazardous materials – records and documentation. 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. Knowing an individual's personal limits and when to seek assistance including from other specialist trades such as gas fitters. Who is authorised to safely shutdown plant and equipment.	CC 25E, 2E CC 2E, 39G	L4 3 credits Maps to US 32652 On-job Related theory 3.3 LO1

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	• Ensuring the safe and effective disconnection of disused energy sources. • Removal steps for circuits and equipment. • Ensuring the safety and functionality of any remaining installation. • Records and documentation. Electrical installation – refers to all or a significant part of an electrical installation or plant equipment. This might be to accommodate the removal of all or part of a structure or plant. The intention is that the installation or plant involved is more complicated requiring more complex planning than a single circuit and fittings or an appliance. Stakeholders – may include but is not limited to — client, installation owners, management, public, other trades people on site, candidate's work team, other people affected by work on site and/or the outcome of that work.	The process to obtain assistance from an experience or authorised person.		
3.6.2:	2.1 Communicate with stakeholders to establish and meet commissioning requirements.	Apply a systematic approach to commissioning electrical equipment as necessary i.e. – using check and test sheets	CC 25E, 2E	L4 3 credits Maps to US 32652

Learning outcomes	**Performance criteria**	**Teaching content guide** EAS Teaching Guidelines Electrical Workers Core Competencies	**References** EASQ CC	**Notes**
Commission an electrical installation.	2.2 Develop a commissioning plan for the safe livening and start-up of an electrical installation. 2.3 Commission an electrical installation following the plan. Guidance information: Commissioning – for the purposes of this assessment, refers to the safety testing, livening and functional testing of circuits and equipment ready to hand over to the customer for use. Commissioning plan – a plan of the steps for the safe livening and start-up of an installation or equipment covering points such as: • Risk assessment and controls including prevention of injury or damage to equipment from machine start up including possible mechanical movement. • Installation steps for circuits and equipment. • Required testing prior to energization.	– development of Safe Work Method Statements (SWMS), Job Safety Analysis (JSA) or similar for the job at hand – mitigation of risk of injury or damage to equipment from machine start up including possible mechanical movement – testing prior to energisation to AS/NZS 3000 – circuit voltage testing – phase rotation checks – systematic loading up – equipment/circuit function checks – instrumentation/control checks – equipment operational checks – records and documentation 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. Knowing an individual's personal limits and when to seek assistance including from other specialist trades such as gas fitters. Who is authorised to safely start up plant and equipment The process to obtain assistance from an experience or authorised person.	CC 39G	On-job Related theory 3.3 LO2

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	• Function and operational testing. • Records and documentation. Electrical installation – as above Stakeholders – as above			
3.6.3: Maintain electrical installations. Range: three installations.	3.1 Communicate with stakeholders to establish and meet maintenance requirements. 3.2 Carry out maintenance of electrical installations appropriate to stakeholder requirements. 3.3 Complete maintenance documentation. Guidance information: Maintenance of electrical installations is intended to be more than the replacement of a single electrical fitting or other small repair. It is intended to be a more overall installation check, repair, maintain, clean, tighten etc involving a whole installation or significant portion of an installation. General maintenance of electrical installations – can be carried out in	General maintenance of electrical installations such as: – lamp replacement – battery replenishment and cleaning – checking/tightening of terminations – repairs or replacement of damaged or faulty parts and equipment – cleaning out and removal of rubbish, removal of access obstacles, dusting and cleaning – calibration of equipment, removal of redundant equipment – operational checks – filling out of maintenance and check records – lubrication – bearing checks – current checks – cleaning of cooling fans and paths – oil replacement – desiccant replacement – rodent and insect control measures – water tightness – removal of vegetation. Documentation of maintenance carried out and report on the results and any issues found. Documentation for compliance or regulatory reasons such as building warrant of fitness's or health and safety requirements.		L4 5 credits Maps to US 32653 On-job Related theory 3.3 LO3

Learning outcomes	Performance criteria	Teaching content guide EAS Teaching Guidelines Electrical Workers Core Competencies	References EASQ CC	Notes
	accordance with any of the following: a maintenance schedule, design specifications, manufacturer's instructions, industry standards, acceptable industry practice, stakeholder requirements or similar. Maintenance documentation - may include but is not limited to a written report on maintenance carried out, reporting on projected future maintenance needed or likely to be needed, reporting on the condition of equipment, maintenance logs/documentation for compliance purposes such as a building warrant of fitness. Stakeholders – refers to clients, installation owners, management, public, other trades people on site, candidate's work team, and any other people affected by work on site and/or the outcome of that work.			

Specific reference materials:
AS/NZS 3000:2007, Electrical Installations (known as the Australian/New Zealand Wiring Rules) AS/NZS 3017:2007, Electrical installations - Verification guidelines AS/NZS 4836:2011, Safe working on or near low-voltage electrical installations and equipment or any current subsequent amended or replacement versions.

Year Three or Four:

Electrician Module 3.7

External theory and regulation exams

To study for and sit external trade theory and regulations examinations towards registration as an electrician.

Credits: 11

Ministry Classification of Internet Based Learning Indicated: Web enhanced (3)

Mode of Delivery: Blended (face to face and LMS supported or enhanced)

Pre-requisites: None

Learning outcomes	Performance criteria	Teaching content guide	Notes
3.7.1: Demonstrate knowledge of electrical theory for registration of electricians.	1.1 Present answers and explanations to questions relating to electrical theory. Range may include but is not limited to – health and safety, fundamental principles, power systems, conductors, circuits, switches and switchboards, accessories, earthing, electrical motors, testing, transformers, hazardous and specialist areas, design, electrical calculations.	Electrician modules 1.1 to 3.6 are the recommended prior knowledge for this assessment. As part of this learning outcome, it is expected that the student will spend significant time studying and preparing to pass the EWRB theory exam.	L4 6 credits Maps to US 21766
3.7.2: Demonstrate knowledge of electrical legislation, New Zealand Codes of Practice, and Standards.	2.1 Present answers in response to questions regarding the provisions of the Electricity Act 1992 and Electrical (Safety) Regulations 2010 and subsequent amendments. Range: provisions of the Act and regulations may relate to but are not limited to – electrical safety, registration and licensing of workers, testing of prescribed electrical work, certification of prescribed electrical work, connection of prescribed electrical work. 2.2 Present answers in response to questions regarding the New Zealand Electrical Codes of Practice and Standards, as cited in the Electrical (Safety) Regulations 2010 and subsequent amendments. Range: Refer to Guidance Information.	Electrician modules 1.1 to 3.6 of this curriculum are recommended as part of the prior knowledge for this assessment. As part of this learning outcome, it is expected that the student will spend significant time studying and preparing to pass the EWRB regulations exam.	L4 5 credits Maps to US 1702

Guidance Information:
21766: This unit standard is the capstone assessment of electrical theory required for registration as an electrician. To achieve this unit standard, candidates must pass the EWRB Electrician Theory Examination.
1702: This unit standard is the capstone assessment of regulations of electrical trades required for registration as an electrician. To achieve this unit standard, candidates must pass the EWRB Electrician Regulations Examination.

They are usually assessed near the end of the apprenticeship in the New Zealand Certificate in Electrical Theory and Practice (Level 4) [Ref: 2388] and the New Zealand Certificate in Electrical Trade (Level 4) [Ref: 4204]. The examinations are based on the requirements of the EWRB Teaching Guidelines for Electricians, and Essential Capabilities for Electrical Registration. The EWRB examination is the only valid assessment tool for this unit standard, and credit for this unit standard may only be awarded on evidence of passing the examination.
Achievement of this unit standard alone does not entitle trainees to legally perform prescribed electrical work without supervision. Until registered and licensed under the Electricity Act 1992, trainees are assisting, and must work under supervision when carrying out prescribed electrical work. Registration and licensing requirements are available at https://www.ewrb.govt.nz/
Information about examination conditions, including which documents and equipment are allowed to be taken into the examination room are available from the EWRB website at https://ewrb.aspeqexams.com/home

Terminology used in the curriculum document

Appropriate/effective	Is suitable for the task, delivers the required result successfully and efficiently.
Basic	In simple form, not complicated, entry level, rudimentary.
Common/ typical	Found in a lot of workplaces, often used/ordinary, universal (to the type of industry)
Correct/ correctly	The right thing. A task carried out in a manner complying with industry standards and/or following manufacturer's instructions and/or resulting in the appropriate outcome expected and required for the situation.
Day to day	Come across commonly or used regularly, not particularly rare or specialised.
Electrical fittings	Electrical accessories and light fittings
Good/sound (knowledge)	More than an overview but not yet an expert, has working knowledge of a subject.
Industry practice	Those practices that competent practitioners within the industry recognise as current industry best practice.
Many	Lots of articles or situations, a broad range.
Range (of things or situations)	A selection chosen to provide some exposure across the width of a subject.
Safe and sound practice	As it relates to the installation of electrical equipment is defined in AS/NZS 3000
Safely	A task done in a manner that no significant risk, harm, injury or unintended damage is caused to people, animals or property.
Suitable	Appropriate for the job or situation, will give a good result.
Variety	An assortment of different things or situations, (testing knowledge or skill in diverse ways).