Course outline: 442 Capstone G105A
UEENEEG105A - Verify compliance and functionality of low voltage general electrical installations

Qualification:	Certificate III in Electrotechnology Electrician - UEE30811
Applicable to:	Learners, industry/employers, governments, community and Global Energy Training Solutions as the provider
Unit of competency:	Accessible from: http://training.gov.au/Training/Details/UEENEEG105A
Related policies:	Policy & Procedure 1 – Enrolment Policy Policy & Procedure 2 – Credit Transfer & Recognition of Prior Learning Policy & Procedure 3 – Learner Support Policy & Procedure 4 – Assessment Policy & Procedure 5 – Academic Misconduct Policy & Procedure 6 – Alcohol & Other Drugs Policy & Procedure 7 – Access, Equity & Diversity Policy & Procedure 8 – Vulnerable People Policy & Procedure 9 – Work, Health & Safety Policy & Procedure 10 – Incident, Injury & Rehabilitation Policy & Procedure 11 – Competency, & Qualification Assessment Decisions Policy & Procedure 12 – Complaints & Appeals Policy & Procedure 13 – Privacy Policy & Procedure 14 – Fees Policy & Procedure 15 – Industry & Employer Engagement Policy & Procedure 16 – Trainers & Assessors Policy & Procedure 17 – Administration & Other Staff Policy & Procedure 18 – Quality Assurance Policy & Procedure 19 – Business & Financial Risk Management Policy & Procedure 20 – Changes to Qualifications or Business Policy & Procedure 21 – Conflict of Interest Policy & Procedure 22 – Records Management Policy & Procedure 23 – Marketing & Advertising
Monitor and review:	Policy & Procedure 18 – Quality Assurance
Responsibility:	Ben Murphy – as Proprietor
Questions/queries:	Feedback and suggestions welcomed: office@gets.com.au (+61) 02 6262 0077

Table of Contents

1. Material requirements

- AS/NZS 3000:2007 incorporating amendment 1 and 2
- Scientific calculator, ruler, pens and pencils
- Note book
- Hand tools
- Covered footwear
- Internet access (provided)

2. Session summaries

Day 1	
Required Skills and Knowledge	Electrical installations and equipment — principles and requirements T1 Effects of electric current encompassing: • Physiological effects of current. • Basic principles by which an electric current can produce heat, light, motion and a chemical reaction. T2 Single path practical circuit encompassing: • Arrangement of energy source, protection device, switch and load in a circuit. • The purpose of each component in the circuit. • Consequences of an open-circuits, closed-circuits and short-circuits. T3 Single-source multiple-path d.c. circuits encompassing: • Circuit configurations and connection. • Relationship between the parameters of voltage, current, resistance and power dissipation in the whole or any part of the circuit. • Safely measuring the parameters for the whole or any part of the circuit. • Methods of determining circuit behaviour for variation in any of the parameters from measured and calculated values. T4 Alternating voltage and current generation, phase relationships, energy in an a.c. circuit encompassing: • Sinusoidal voltage generation and resulting current.

	• The terms period; maximum value; peak-to-peak value; instantaneous value; average value; root-mean-square (r.m.s.) value; and frequency. • Three-phases generation. • Relationship between the phase voltages generated in a three-phase alternator and the conventions for identifying each. • Method of determining the phase sequence or phase rotation of a three-phase supply. • Methods of determining power and energy supplied by three phase circuits. T5 Fundamental safety principles of the AS/NZS 3000 Part 1 (Section 1) and deemed to comply solution given in Part 2 encompassing: • Definition of terms • Fundamental safety principles of protection against direct and indirect contact with live parts; thermal effects; overcurrent; earth faults; abnormal voltages; spread of fire; mechanical injury and external influences. • Fundamental principles of installation design; selection and installation of equipment; means of compliance (including alterations, additions and repairs) and verification of compliance. T6 Electric motor selection, starting method and overload protection encompassing: • Types of motor enclosures suitable for given environmental conditions • Criteria for selecting motor starters and overload protection. • Types and connection arrangements for direct-on-line and reduced voltage starters. • Thermal, magnetic and thermistor overload protection methods. T7 Ability to apply AS/NZ 3000 requirements for protective and functional earthing encompassing: • Purpose of protective and functional earthing. • Parts of the protective earthing systems. • Earthing arrangements, earthing of equipment and equipotential bonding. • Methods of determining the maximum fault loop impedance for a circuit. • Selection of protective conductor and active conductor sizes for each circuit to ensure earth-fault loop impedance is sufficiently low to operate the circuit protective device.

Day 2	
Required Skills and Knowledge	T8 MEN system and its application encompassing: • The roles of the protective earthing (PE) and neutral (N) conductors in an a consumer's installation and their relationship to the protective earth neutral (PEN) conductor in the electricity distributor's system or sub-main to an outbuilding. • The importance of the MEN link when a fault occurs. • The likely consequences of the absence of the MEN link or high impendence in the PEN conductor when a fault occurs. • The requirements for installation of an MEN link in an installation and an outbuilding. T9 Knowledge of the application of transformers encompassing: • Transformers used in distribution and transmission systems and large consumer installations. • Transformers used in welding machines. • Applications in appliances • Risks and safety control measures associated with connection and disconnection of instrument transformers • Safe working procedures when connecting and testing transformers. • AS/NZS 3000 requirements and restriction on the installation and use of transformers. T10 Ability to apply AS/NZ 3000 requirements for protection of circuit against overcurrent and abnormal voltages encompassing: • Minimum fault levels specified by electricity distributors

	• Methods and arrangement for protection against short-circuit currents and overload currents. • Coordination of overload and short-circuit protection devices. • Coordination between conductors and overload protection devices. • Causes of over and undervoltage. • Device and requirements for protection against over and undervoltage. T11 Additional protection by use of RCDs and use of extra-low voltage for basic and fault protection encompassing: • Limitation of an RCD to protect against contact with live parts • AS/NZS 3000 requirements for use of RCDs. • Conditions for use of extra-low voltage to provide for basic and fault protection • AS/NZS 3000 requirements for installation of SELV and PELV systems T12 Ability to select cables for single and three phase mains and sub-mains for single and multiple installations that comply with requirements of AS/NZS 3000 and AS/NZS 3008.1 encompassing: • Methods of determining maximum demand. • Types of cables available. • Installation methods and external influences effecting cable current-carrying capacity • Voltage drop limitation • Short-circuit performance consideration. T13 Ability to select cables for final sub-circuits that comply with requirements of AS/NZS 3000 and AS/NZS 3008.1 encompassing: • Maximum demand of final sub-circuits. • Types of cables available. • Installation methods and external influences effecting cable current-carrying capacity • Effect of earth-fault loop impedance and voltage drop limitations on circuit route length. • Short-circuit performance considerations. T14 Ability to apply AS/NZS 3000 requirements for control and protection of installations encompassing: • Devices for functions of isolation; emergency; Mechanical maintenance and functional control. • Method for assessing prospective short circuit current. • Devices and arrangement for protection against overload and short-circuit current. • Additional protection by RCD • Protection against switchboard internal arc faults.

Day 3	
Required Skills and Knowledge	T15 Ability to apply AS/NZS 3000 requirements for the installation of electrical equipment in given damp situations encompassing: • Limitation of installation of equipment in classified zones. • Selection and location of equipment suitable for installation in given classified zones. • Additional protection by RCD. • Equipotential bonding in showers and bathrooms and swimming and spa pools. T16 Ability to install, modify and test electrical equipment for construction and demolition sites, complying with AS/NZS 3012 and applicable workplace safety legislation encompassing: • Supply and installation requirements. • Protection of circuits. • Initial and periodic inspection and testing • Portable tool safety testing and tagging system in accordance with AS/NZS 3760. T17 Knowledge of AS/NZS 3000 requirements for the installation of aerial conductors and

	underground wiring encompassing: • Types and application of aerial conductors • Aerial span limitations and required clearances • Selection of aerial supporting poles/post and struts for a given application. • Use and requirements of catenary support systems • Acceptable cable types and protection for underground wiring categories. • Underground wiring depth layer and protection • Underground wiring clearances from other services T18 Knowledge of AS/NZS 3000 requirements for electrical installations in hazardous areas encompassing: • Types of areas classified as a hazardous area • Standards to which the selection, installation and maintenance of electrical equipment shall comply. • Additional training required to work competently with electrical equipment for hazardous areas T19 Ability to verify compliance of an electrical installation in accordance with AS/NZS 3000 encompassing: • Visual inspection to determine whether the installation complies with requirements set out in Section 2 to 7 of AS/NZS 3000 and relevant specific installation standards. • Mandatory tests following guidance given in AS/NZS 3017 T20 Ability to perform effective safe isolation of any equipment encompassing: • Preparation of a 'safe work method statement' (SWMS) or Job Safety Analysis (JSA) for effective safe isolation. • Safe methods for identifying source of supply to be isolated. • Switching-off, lock-out and tagging procedures. • Safe methods for confirming effective and safe isolation T21 Ability to apply AS/NZS 3000 requirements to install and terminate thermoplastic insulated cables; elastomer sheathed cables; XLPE sheathed cables; and high temperature cables; armoured cables; and neutral screened cables in a wide range of applications.

Day 4	
Required Skills and Knowledge	T22 Ability to perform the circuit tests required for electrical cables in a range of installations and final sub-circuit encompassing: • Following safe testing procedures. • Tests to show if the earth continuity and earth-fault loop impedance are sufficiently low. • Testing to show if insulation resistance is sufficiently high. • Testing to show if the polarity and circuit connections are correct. T23 Ability to install final sub-circuit wiring into switchboards and connect to switchboard equipment in accordance with AS/NZS 3000 and electricity distributor's requirements. T24 Ability to apply AS/NZS 3000 and electricity distributor's requirements for the installation and connect consumers mains encompassing: • Installing of underground and overhead consumers mains • Terminating consumers mains at pillars, pits mains connection boxes and consumers switchboard. • Install unprotected consumers mains to reduce the risk of short-circuit current to a minimum. • Installing bonding conductors where required. T25 Ability to read, sketch and interpret electrical diagrams encompassing: • Purpose and characteristics of schematic, block and wiring diagrams, plans and schedules. • Conventions used in documenting electrical information

	• Read and interpret schematic, block and wiring diagrams, plans and schedules • Sketch electrical diagrams using conventional symbols T26 Knowledge and understanding occupational safety and health encompassing: • Basics of Occupational Safety and Health regulations • Legal responsibilities for employers and employees • Employers' and employees' own "duty of care". • Safety committees and their role T27 Knowledge and understanding of the requirements for personal safety in the workplace encompassing: • Purpose and use of Safe Work Method Statements (SWMS) or Job Safety Analysis (JSA). • Purpose and process of reporting OHS incidents. • Safety procedures for working with electrical circuits and equipment. • Procedures for safe and effective isolation of electrical supply. • Regulations for the supervision of apprentices and trainees.

Day 5	
Required Skills and Knowledge	T28 Process in rescuing a person in contact with live electrical conductors or equipment and the primary importance of the safety of the rescuer. T29 Application of emergency first aid requirements for an electric shock victim encompassing: • Calling for help. • Applying cardiopulmonary resuscitation (CPR). • Selection and use of fire extinguishers to control electrical fire at accident site. T30 Dangers of high voltage equipment and distribution systems encompassing: • Step and touch and induced voltages. • Sources of induced voltage and stored energy • Creepage and clearance requirements. • Application of safe working procedures in the vicinity of HV equipment. T31 Systematic method of commissioning and decommissioning electrical equipment and installations encompassing: • Commissioning safety procedures • Circuit voltage testing • Phase rotation checks • Functional testing • Instrument and control parameter settings • Decommissioning safety procedures. • Identification of circuits with their control and protection devices. • Impact of isolation on other parts of an installation. • Tagging, testing and earthing. • Safe removal of equipment. T32 Diagnosing and rectifying faults in electrical apparatus and associated circuits encompassing: • Faults such as open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure; • Apparatus such as control devices; fixed appliances/accessories; lighting; electrical machines motors and controls; socket outlets, transformers; protection and metering devices. • Circuits such as those supplying fixed appliances; lighting; socket outlets; motors and controls circuits; transformers; electronic or computer based equipment.

Day 6	
Required Skills and Knowledge	Electrical installations — verification and testing T1 Electrical safety encompassing: • Safety procedures for working on electrical systems, circuits and apparatus. • Safe working practices as a normal part of carrying out electrical installation work • Isolation and lockout procedures • Tools and equipment needed to conduct electrical installation compliance inspection and testing. T2 Legislated regulations encompassing: • legislation and regulations that require installations and equipment to be inspected and tested to ensure they are safe. • the person/bodies responsible for the various aspects of ensuring electrical installations are safe. • results of tests that show an electrical installation is safe for connection to the supply. • results of periodic inspection and tests that show construction site wiring and equipment is safe to use. • results of periodic inspection and tests that show electrical equipment are safe to use. T3 Visual inspection of installations for compliance with the Wiring Rules encompassing: • Protection requirements • General condition • Consumers mains/submains • Switchboards • Wiring systems • Equipment and accessories • Earthing T4 Testing installations encompassing: • tests to ensure: insulation resistance is adequate; earth continuity is such that it will ensure the operation of protection devices under earth fault conditions; polarity of active/s and neutral for mains, submains and final subcircuits is correct; there is no transposition of earthing and neutral conductors; fault-loop impedance is sufficiently low; RCD for correct operation and sensitivity. • functional tests to ensure active/s and neutral for the same circuit are clearly identified with their circuit protection device. • tests that show all circuits and devices operate as intended. • tests to determine the fault level at a particular point in an installation. T5 Documentation encompassing: • results of tests conducted on an installation to comply with requirements and ensure the installation is safe. • documents of the results of testing an installation as required by the local supply authority. • documents of periodic inspection and testing of construction site wiring and equipment in accordance with requirement. • documents of periodic testing and inspection of electrical equipment including tagging requirements.

Day 7	
Required Skills and Knowledge	Practical assessments only

3. Elements and Performance Criteria

Elements and Performance Criteria require practice and demonstration in the work place.

Element		Performance Criteria	Work Performance
1:Prepare to inspect and test an electrical installation.	1.1	OHS measures for the site are identified, obtained and understood.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	1.2	Established OHS risk control measures and procedures in preparation for the work are followed.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	1.3	Safety hazards, which have not previously been identified, are noted and established risk control measures are implemented.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	1.4	Documentation or deemed to comply standard on which installation is based is reviewed and understood.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	1.5	Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	1.6	Tools, equipment and testing devices needed to verify compliance are obtained in accordance with established procedures and checked for correct operation and safety.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	1.7	Preparatory work is checked to ensure no damage has occurred and complies with requirements.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
2:Visually inspect and conduct safety testing on the installation.	2.1	OHS risk control measures and procedures for carrying out the work are followed.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.4	Wiring is checked for suitability for the environments in which they are installed and suitably protected from damage or overheating.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.5	Cable conductor sizes are confirmed as meeting current-carrying capacity requirements and voltage-drop and fault-loop impedance limitations.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.6	Protection methods and devices are validated as meeting coordination requirements for overload and short-circuit protection.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.7	Switchgear and control gear is validated as being appropriately rated and meeting functional requirements.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.8	Evidence that electrical equipment complies with safety requirements is cited.	☐ Satisfactory ☐ Needs improvement ☐ Not performed

	2.9	Earthing system components are checked that they are correctly located and conductors correctly sized.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.10	Marking on switchboards are checked for accuracy and clarity and comply with requirements.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.11	Mandatory tests are conducted to verify that: earthing conductor resistance is sufficiently low; insulation resistance is sufficiently high; all polarities are correct; and circuit connections are correct as per AS/NZS3000.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	2.12	Testing is conducted to verify that: fault-loop impedance is sufficiently low and residual current devices operates as intended as per AS/NZS3000.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
3:Report inspection and test findings.	3.1	OHS risk control work completion measures and procedures are followed.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	3.2	Work site is cleaned and made safe in accordance with established procedures.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	3.3	Non-compliance defects are identified and reported in accordance with established procedures.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	3.4	Recommendations for rectifying defects are made in accordance with established procedures.	☐ Satisfactory ☐ Needs improvement ☐ Not performed
	3.5	Mandatory documentation is completed in accordance with established procedures.	☐ Satisfactory ☐ Needs improvement ☐ Not performed

4. Assessments

Assessment	When	Satisfactory mark/outcome
Theory assessment 1	Day 5	100%
Theory assessment 2	Day 5	100%
Theory assessment 3	Day 5	100%
Theory assessment 4	Day 6	100%
Theory assessment 5	Day 6	100%
Theory assessment 6	Day 6	100%
Practical assessment 1	Day 7	100%
Practical assessment 2	Day 7	100%
Practical assessment 3	Day 7	100%
Workplace Observation	Before or after theory and practical assessments	Must be valid, sufficient, authentic and current
Employer Competency report		
Structured workplace experience interview		
Note: Once all theory, practical and on-site assessments are complete, competency assessment decisions can be made in conjunction with the learner, employer and registered training organisation.		

5. Version control

Version	Date of release	Author	Authorised by	Position	Rational for change
V1	5/10/2015	Ben Murphy	Ben Murphy	Proprietor	Initial release
V2	7/2/2017	Ben Murphy	Ben Murphy	Proprietor	Added Elements and Performance Criteria