



Australian Government

UEENEEG105A Verify compliance and functionality of low voltage general electrical installations

Release: 4

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Modification History

Release	Action	Core/Elective	Details	Points
3	Edit	N/A	Corrected text in Range Statement	

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers inspection and testing to verify whether an electrical installation is safe and complies with all requirements. It encompasses working safely, visual inspections and mandatory, optional and functional testing following verification procedures, identifying non-compliance defects and mandatory reporting requirements.

Application of the Unit

Not Applicable

Licensing/Regulatory Information

1.2) License to practice

During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships.

In the workplace: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c.

Other conditions may apply under State and Territory legislative and regulatory requirements.

Pre-Requisites

Prerequisite Unit(s) 2)

2.1) Competencies

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEE101 A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102 A	Fabricate, dismantle, assemble of electrotechnology components
UEENEEE104 A	Solve problems in d.c circuits
UEENEEE105 A	Fix and secure electrotechnology equipment
UEENEEE107 A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEE137 A	Document and apply measures to control OHS risks associated with electrotechnology work
UEENEEG006 A	Solve problems in single and three phase low voltage machines

Prerequisite Unit(s) 2)

UEENEEG033 A	Solve problems in single and three phase electrical apparatus and circuits
UEENEEG063 A	Arrange circuits, control and protection for general electrical installations
UEENEEG101 A	Solve problems in electromagnetic devices and related circuits
UEENEEG102 A	Solve problems in low voltage a.c. circuit
UEENEEG103 A	Install low voltage wiring and accessories
UEENEEG104 A	Install appliances, switchgear and associated accessories for low voltage electrical installations
UEENEEG106 A	Terminate cables, cords and accessories for low voltage circuits
UEENEEG107 A	Select wiring systems and cables for low voltage general electrical installations
UEENEEG108 A	Trouble-shoot and repair faults in low voltage electrical apparatus and circuits
UEENEEG109 A	Develop and connect electrical control circuits

2.2) Conditions

- Those holding an 'Unrestricted Electrician's Licence' or equivalent issued in an Australian State or Territory meet the requirements of this unit and its pre-requisite requirements.
- A 'licensed electrician' applying for an 'electrical contractors licence' may be required to undertake this unit to demonstrate their currency with verification of compliance requirements. In this case they are deemed to have met the pre-requisites for this unit provided that:
 - they hold a current 'electricians licence' or its equivalent issued in an Australian State or Territory and
 - have recently been in permanent employment as a

licensed electrician sufficient to evidence current knowledge of applicable standards and regulations.

Employability Skills Information

Employability Skills 3)

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Application of the Unit 4)

4.1) General Application

This unit applies to all qualifications, competencies and/or Skill Sets which require an electrical licence.

Work which requires an electrical licence includes work on and/or supervision of electrical installations at or above low voltage.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the Element. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to inspect and test an electrical installation.	1.1 OHS measures for the site are identified, obtained and understood.
	1.2 Established OHS risk control measures and procedures in preparation for the work are followed.

ELEMENT	PERFORMANCE CRITERIA
	1.3 Safety hazards, which have not previously been identified, are noted and established risk control measures are implemented. 1.4 Documentation or deemed to comply standard on which installation is based is reviewed and understood. 1.5 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site. 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. 1.7 Preparatory work is checked to ensure no damage has occurred and complies with requirements.
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. 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. 2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures. 2.4 Wiring is checked for suitability for the environments in which they are installed and suitably protected from damage or overheating. 2.5 Cable conductor sizes are confirmed as meeting current-carrying capacity requirements and voltage-drop and fault-loop impedance limitations. 2.6 Protection methods and devices are validated as meeting co-ordination requirements for overload and short-circuit protection. 2.7 Switchgear and control gear is validated as being appropriately rated and meeting functional requirements.

ELEMENT	PERFORMANCE CRITERIA
3 Report inspection and test findings.	2.8 Evidence that electrical equipment complies with safety requirements is cited.
	2.9 Earthing system components are checked that they are correctly located and conductors correctly sized.
	2.10 Marking on switchboards are checked for accuracy and clarity and comply with requirements.
	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.
	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.
	3.1 OHS risk control work completion measures and procedures are followed.
	3.2 Work site is cleaned and made safe in accordance with established procedures.
	3.3 Non-compliance defects are identified and reported in accordance with established procedures.
	3.4 Recommendations for rectifying defects are made in accordance with established procedures.
	3.5 Mandatory documentation is completed in accordance with established procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and verifying compliance and functionality of general electrical installations.

All knowledge and skills detailed in this unit should be contextualised to current industry standards, technologies and practices.

KS01-EG105A Electrical installations — verification and testing

Evidence shall show an understanding of electrical installations testing and verification to an extent indicated by the following aspects:

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:

REQUIRED SKILLS AND KNOWLEDGE

- 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.

KS02-EG105A Electrical installations and equipment — principles and requirements

Evidence shall show an understanding of electrical installations and equipment principles and requirements to an extent indicated by the following aspects:

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:

REQUIRED SKILLS AND KNOWLEDGE

- 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.

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 impedance in the PEN conductor when a fault occurs.
- The requirements for installation of an MEN link in an installation and an outbuilding.

REQUIRED SKILLS AND KNOWLEDGE

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

REQUIRED SKILLS AND KNOWLEDGE

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.

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

REQUIRED SKILLS AND KNOWLEDGE

- 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.

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:

REQUIRED SKILLS AND KNOWLEDGE

- 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.

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:

REQUIRED SKILLS AND KNOWLEDGE

- 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.

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment

9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to

EVIDENCE GUIDE

be 'rich' in nature to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

EVIDENCE GUIDE

- Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range statement
- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Verify compliance and functionality of general electrical installations as described as described in 8) and including:
 - A Selecting correct tools and testing equipment.
 - B Identifying visual non-compliance defects.
 - C Using effective methods for conducting mandatory and optional tests.
 - D Identifying non-compliance from test results.
 - E Identifying causes of non-compliance.
 - F Completing mandatory reporting.
 - G Dealing with unplanned events

EVIDENCE GUIDE

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to verifying compliance and functionality of general electrical installations.

Method of assessment

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:

Competent performance with inherent safe working practices is expected in the industry to which this unit applies. This requires assessment in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units

9.5)

There are no concurrent assessment recommendations for this unit.

Range Statement

RANGE STATEMENT

8) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to verifying compliance and functionality of at least two general electrical installations comprising a main switchboard, supplying more than one circuit each for, lighting, socket outlets, and fixed appliances. One of the installations shall include a distribution board separate from the main switchboard and at least one circuit supplying a three-phase load and a safety system.

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not Applicable

Competency Field

2.3) Literacy and numeracy skills

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	4	Writing	4	Numeracy	4
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2.3) Literacy and numeracy skills

Competency Field 5)

Electrical

