



Australian Government

UEEEL0014 Isolate, test and troubleshoot low voltage electrical circuits

Release: 2

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Modification History

Release 2. This is the second release of this unit of competency in the UEE Electrotechnology Training Package.

Typographic errors fixed in Performance Evidence

Workplace evidence requirements updated in Performance Evidence and Assessment Conditions.

Assessor requirements updated in Assessment Conditions.

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Application

This unit involves the skills and knowledge required to isolate, test and troubleshoot electrical circuits operating at voltages up to 1,000 volts (V) alternating current (a.c.) or 1,500 V direct current (d.c.).

It includes working safely, isolating electrical circuits, evaluating low voltage (LV) electrical circuits, applying systematic fault-finding procedures, conducting repairs and completing the necessary documentation.

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

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, may be required.

Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

Pre-requisite Unit

UEECD0007 Apply work health and safety regulations, codes and practices in the workplace

UEECD0019 Fabricate, assemble and dismantle utilities industry components

UEECD0020 Fix and secure electrotechnology equipment

UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications

UEEEL0003 Arrange circuits, control and protection for electrical installations

UEEEL0020 Solve problems in low voltage a.c. circuits

UEEEL0023 Terminate cables, cords and accessories for low voltage circuits

UEEEL0019 Solve problems in direct current (d.c.) machines

UEEEL0021 Solve problems in magnetic and electromagnetic devices

UEEEL0024 Test and connect alternating current (a.c.) rotating machines

UEEEL0025 Test and connect transformers

UEEEL0047 Identify, shut down and restart systems with alternate supplies

and

UEECD0043 Solve problems in direct current circuits

or

UEECD0044 Solve problems in multiple path circuits

UEECD0046 Solve problems in single path circuits

Competency Field

Electrical

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to isolate, test and troubleshoot electrical circuits

PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

- 1.1** Scope of work to be undertaken is determined from relevant documentation, electrical drawings or relevant person/s
- 1.2** WHS/OHS requirements and workplace procedures for a given work area are identified and applied
- 1.3** Electrical hazards are identified, risks are assessed, and control measures are implemented
- 1.4** Relevant industry standards, regulation, legislation and workplace procedures are identified and applied

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| | 1.5 | Advice is sought from the work supervisor to ensure the work is coordinated effectively with others |
| 2 | Apply safe isolation, lock-out and tag-out procedures | |
| | 2.1 | Electrical circuits and conductors, all of their energy sources, and isolation points are identified |
| | 2.2 | Electrical circuits are isolated from all energy sources and secured in accordance with industry and regulatory standards |
| | 2.3 | Safe isolation from all sources of energy is confirmed |
| | 2.4 | Isolation is secured using appropriate devices, tags, lock-out or permit system |
| | 2.5 | Any stored energy is discharged and deenergisation proved |
| | 2.6 | Unused conductors and equipment are dealt with in accordance with regulatory requirements |
| 3 | Conduct compliance inspection and testing on electrical circuits | |
| | 3.1 | Electrical circuits are visually inspected for compliance with regulatory requirements |
| | 3.2 | Mandatory tests are identified, including sequence of tests and equipment required |
| | 3.3 | Continuity of the earthing system is tested for compliance with regulatory requirements |
| | 3.4 | Insulation resistance of the circuit is tested for compliance with regulatory requirements |
| | 3.5 | Polarity of the circuit is tested for compliance with regulatory requirements |
| | 3.6 | Correct circuit connections is tested for compliance with regulatory requirements |
| | 3.7 | Alternative supply systems are inspected and tested for compliance with industry and regulatory standards |
| | 3.8 | Earth fault loop impedance is verified for compliance with regulatory requirements |
| | 3.9 | Operation of residual current devices (RCDs) is tested for compliance with regulatory requirements |

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| | 3.10 | Compliance test results are documented and reported in accordance with industry and workplace requirements |
| | 3.11 | Non-compliances are identified and reported to relevant personnel |
| | 3.12 | Requirements for the verification of circuits are completed in accordance with regulatory requirements |
| 4 | Locate, identify and repair faults in electrical circuits | |
| | 4.1 | Circuits/machines/plant are checked as being isolated, where necessary, in strict accordance WHS/OHS requirements and procedures |
| | 4.2 | Safety hazards resulting from the fault or breakdown are documented and risk control measures identified and implemented in consultation with appropriate person/s |
| | 4.3 | Troubleshooting of electrical circuits is undertaken methodically using measured and calculated values of circuit parameters |
| | 4.4 | Circuit components are dismantled and parts stored to protect against loss or damage |
| | 4.5 | Faulty circuits/components are rechecked and their fault status identified |
| | 4.6 | Materials/replacement parts required to rectify faults are sourced and obtained in accordance with workplace procedures |
| | 4.7 | Effectiveness of the repair is tested in accordance with workplace procedures |
| | 4.8 | Circuit is reassembled, tested and prepared for return to service |
| | 4.9 | Unexpected situations are dealt with safely and with the approval of authorised person/s |
| | 4.10 | Troubleshooting and repair activities are carried out without damage to equipment, circuits, the surrounding environment or services using sustainable energy practices |
| 5 | Complete work and document activities | |
| | 5.1 | WHS/OHS work completion risk control measures and workplace procedures are followed |

- 5.2 Work area is cleaned and made safe in accordance with workplace procedures
- 5.3 Work completion is documented and appropriate person/s notified in accordance with workplace procedures

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Unit must be demonstrated with circuits and equipment operating at voltages up to 1,000 volts (V) alternating current (a.c.) or 1,500 V direct current (d.c.) and must include:

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| Isolating, testing and troubleshooting LV electrical circuits and equipment must include safe isolation, visual inspection and mandatory testing of the following in accordance with industry standards, including one equipment type that has a dual supply, one circuit breaker and one high rupturing capacity (HRC) fuse: | <ul style="list-style-type: none">• at least one of the following:<ul style="list-style-type: none">• main switchboard• distribution boardand• at least three of the following:<ul style="list-style-type: none">• motor• space heater• water heater• lights• socket outlets |
| Locating and diagnosing LV electrical circuit and equipment faults must include at least four of the following common faults in electrical circuits: | <ul style="list-style-type: none">• open circuit• short circuit• incorrect connections• insulation failure• unsafe condition• equipment/component failure• related mechanical failure |

Unit Mapping Information

No equivalent unit

Links

Companion Volume Implementation Guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEEEL0014 Isolate, test and troubleshoot low voltage electrical circuits

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:

- # applying work health and safety (WHS)/occupational health and safety (OHS) workplace procedures, including:
 - # identifying and assessing hazards and risks, and implementing control measures
- # selecting and using correct tools and equipment to isolate, test and troubleshoot electrical circuits
- # performing safe isolation of equipment, including:
 - # preparing a safe work method statement (SWMS) or job safety analysis (JSA) for effective and safe isolation
 - # applying safe methods to identify sources of supply to be isolated
 - # identifying appropriate points of isolation
 - # isolating equipment from all sources of supply by safely switching off switches or circuit breakers, removing fuses or links, or removing circuit connections
 - # securely isolating devices by applying an isolation securing device which requires a deliberate action to engage or disengage
 - # applying a personal danger tag, lock-out or permit system
 - # applying safe methods to confirm effective and safe isolation from all sources of supply
 - identifying the limits of the safe work area
 - discharging any stored energy
 - # proving de-energisation of all relevant electrical equipment and conductors, including:
 - # testing the voltage tester on a known live source
 - # testing between all conductors and a known earth
 - # testing between conductors

- # retesting the voltage tester on a known live source for correct operation
- # correctly using personal protective equipment (PPE) whilst performing effective isolation and operation of low voltage (LV) equipment
- # completing visual inspection of the electrical installation for compliance with regulatory requirements including:
 - # protection requirements
 - # general condition
 - # mains/sub-mains
 - # switchboards
 - # wiring systems
 - # equipment and accessories
 - # earthing
- # conducting mandatory testing to ensure:
 - # compliance with AS/NZS 3000 mandatory test requirements and the application of mandatory tests following guidance of AS/NZS 3017
 - # insulation resistance of mains, sub-mains and final sub-circuits meets the regulatory requirements
 - # earth continuity of the main earthing conductor, protective earthing conductors, combined protective earthing and neutral (PEN) conductors and bonding conductors meet the regulatory requirements
 - # polarity of active, neutral and earth conductors including phase sequence and rotation meet the regulatory requirements
 - # correct connections of active, neutral and protective earthing conductors are tested to ensure no short circuits between conductors, no transposition of conductors that could result in the earthing system or exposed conductive parts becoming energised, and no interconnection of conductors between different circuits, in accordance with regulatory requirements
 - # verification that earth fault-loop impedance limitations are not exceeded in accordance with regulatory requirements
 - # residual current devices (RCDs) have been correctly installed, their function verified, and the isolation of all switched poles verified, in accordance with regulatory requirements
- testing and verifying alternate supplies, including:
 - completing continuity and voltage testing, including output voltage of device/s
 - earth resistance testing, including:
 - continuity of main earthing conductor
 - checking earth bonding integrity and equipotential bonded parts
 - insulation resistance test
 - polarity and checking operation of control device/s
- verifying records for the date of initial certification are completed in accordance with regulatory requirements
- # locating and diagnosing common faults in electrical circuits

- testing and diagnosing high impedance or open circuit neutral fault
- # repairing and/or replacing parts to rectify faults in accordance with AS/NZS 3000
- # applying steps required to ensure the fault does not re-occur
- # completing final testing and re-commissioning
- completing work and documenting activities.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- safety procedures for working on electrical systems, circuits and equipment
- safe working practices as a normal part of carrying out electrical installation work
- tools and equipment needed to conduct electrical installation compliance inspection and testing
- legislation and regulations that require circuits 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 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
- visual inspection of the electrical installation for compliance with regulatory requirements, including:
 - protection requirements
 - general condition
 - mains/submains
 - switchboards
 - wiring systems
 - equipment and accessories
 - earthing
- regulatory requirements related to compliance testing, including:
 - insulation resistance of mains, sub-mains and final sub-circuits
 - earth continuity of the main earthing conductor, protective earthing conductors, combined protective earthing and neutral (PEN) conductors, and bonding conductors
 - polarity of active, neutral and earth conductors including phase sequence and rotation
 - correct connections of active, neutral and protective earthing conductors are tested to ensure no short circuits between conductors, no transposition of conductors that could result in the earthing system or exposed conductive parts becoming energised, and no interconnection of conductors between different circuits
 - earth fault-loop impedance in both 'supply available' and 'no supply available' scenarios
 - correct installation of RCDs, verification of their function, and verification of isolation of

all switched poles

- testing requirements where multiple/alternate supplies are present, including anti-islanding
- AS/NZS 3000 requirements for dealing with unused conductors and equipment
- importance of the MEN link when a fault occurs.
- likely consequences of the absence of the MEN link or high impedance in the PEN conductor when a fault occurs
- requirements for installation of an MEN link in an installation and an outbuilding
- safety implications of high impedance or open circuit neutral faults
- ensure active/s and neutral for the same circuit are clearly identified with their circuit protection device
- tests that show all circuits and equipment operate as intended
- results of tests conducted on an installation to comply with requirements and ensure the installation is safe
- documentation of periodic testing and inspection of electrical equipment, including tagging requirements in accordance with AS/NZS 3760
- techniques and procedures for the effective safe isolation of any equipment, including:
 - preparation of a SWMS or JSA for effective safe isolation
 - safe methods for identifying source of supply to be isolated, including alternate supplies
 - switching-off, lock-out and tagging procedures
 - safe methods for confirming effective and safe isolation of all energy sources
 - industry standards related to isolation
- techniques and procedures for testing and verification of alternate supplies, including:
 - purpose of tests, testing methods and equipment
 - use of continuity and voltage testing meters
 - direct current (d.c.) polarity, including switching and protection equipment
 - earthing arrangements
- troubleshooting concepts, including:
 - need to understand the correct operation of a circuit or equipment, switching and control circuit arrangements
 - common faults with circuits and equipment, including:
 - operator faults
 - incorrect connections
 - open circuits
 - short circuits
 - device faults (mechanical)
 - equipment/component failure
 - supply faults
 - insulation failure
 - unsafe conditions
 - earth leakage

- typical fault symptoms and their causes, including:
 - operation of circuit protective device
 - appliance does not operate
- factors to consider in clarifying the nature of a fault, including:
 - initial fault report
 - confirmation of symptoms of the fault
 - comparison of symptoms with normal operation
- methods for testing, including:
 - visual inspection
 - component isolation
 - test equipment
 - sectional testing
- dealing with intermittent faults (vibration, shock, changes in temperature and electromagnetic interference)
- final testing and recommissioning
- hazards and safety requirements related to equipment incorporating electronic components used in electrical systems.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessors must also hold the occupational licence for the jurisdiction the assessment is occurring where the activity being assessed requires a licence to practice.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in suitable workplace operational situations where it is appropriate to do so, where this is not appropriate, assessment must occur in suitable simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, facilities, equipment and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, relevant industry standards, codes of practice and operation manuals.

In addition, evidence of Performance Evidence items of this unit marked with a hash (#) must be gathered in authentic workplace operational conditions (not simulated) before final determination of competence in this unit can be made.

Links

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<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>