



Australian Government

UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories

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.

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 includes the installation of wiring enclosures, cable support systems, cables, protection devices, switchgear, control gear, switchboards, and accessories designed to operate at voltages up to 1,000 volt (V) alternating current (a.c.) or 1,500 V direct current (d.c.).

It covers working safely and to installation standards, routing cables to specified locations, terminating cables and connecting wiring at accessories, matching appliances and accessories with that specified, making required circuit connections and completing the necessary installation 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 installations 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

UEECD0016 Document and apply measures to control WHS risks associated with electrotechnology work

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

UEEEL0018 Select wiring systems and select cables for low voltage electrical installations

UEEEL0005 Develop and connect electrical control circuits

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

UEEEL0021 Solve problems in magnetic and electromagnetic devices

UEEEL0014 Isolate, test and troubleshoot low voltage electrical circuits

UEEEL0008 Evaluate and modify low voltage heating equipment and controls

UEEEL0009 Evaluate and modify low voltage lighting circuits, equipment and controls

UEEEL0010 Evaluate and modify low voltage socket outlets circuits

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

UEEEL0025 Test and connect transformers

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 install low voltage (LV) wiring, appliances, switchgear and associated accessories

PERFORMANCE CRITERIA

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

1.1 Nature and location of work is determined from workplace documentation, drawings or relevant person/s to determine the scope of work

- 1.2** WHS/OHS requirements and workplace procedures are applied
 - 1.3** Risks are identified and control measures implemented in accordance with workplace procedures
 - 1.4** Need to test or measure live work is determined in accordance with WHS/OHS requirements and conducted in accordance with workplace safety procedures
 - 1.5** Circuits/machines/plant are checked as being isolated, where necessary, in strict accordance with WHS/OHS requirements and procedures.
 - 1.6** Installation of wiring, appliances, switchgear, control gear and associated accessories is planned and appropriately sequenced in consultation with relevant person/s
 - 1.7** Locations of appliances, switchgear, accessories and cable routes are planned within the constraints of building structure, other services, specifications and regulatory requirements
 - 1.8** Material required for installation work is obtained in accordance with workplace procedures and checked against job specifications
 - 1.9** Tools, equipment and measuring devices required for the installation and work environment are obtained in accordance with workplace procedures and checked for correct operation and safety
 - 1.10** Preparatory work is inspected and checked to ensure no damage has occurred and compliance with job specifications
- 2 Install LV wiring and associated accessories**
 - 2.1** Wiring and accessories are installed and terminated to comply with technical standards and job specifications and requirements
 - 2.2** Accessories are installed straight and square in the required locations and within acceptable tolerances
 - 2.3** Cables and conductors are terminated at accessories in accordance with manufacturer specifications and regulatory requirements

- 2.4 Ongoing compliance and safety inspection of installed wiring systems and testing of installed circuits is undertaken
 - 2.5 Defects revealed through on-going compliance and safety inspection and tests are rectified
 - 2.6 Cable installation and termination is carried out efficiently without unnecessary waste of materials or damage to apparatus, circuits, the surrounding environment using sustainable energy practices
 - 2.7 Unexpected situations are dealt with safely and with the approval of an authorised person
- 3 **Install and connect LV appliances, switchgear and associated accessories**
 - 3.1 Appliances, switchgear and accessories are installed to comply with technical standards and job specifications and requirements with sufficient access to affect terminations, adjustment and maintenance
 - 3.2 Accessories are installed straight and square in the required locations and within acceptable tolerances
 - 3.3 Wiring is terminated at appliances, switchgear and accessories in accordance with manufacturer specifications and functional and regulatory requirements
 - 3.4 Ongoing compliance and safety inspections of the installed appliances, switchgear and accessories are undertaken
 - 3.5 Defects revealed through on-going compliance and safety inspection are rectified
 - 3.6 Installation is carried out efficiently without unnecessary waste of materials or damage to apparatus, circuits, the surrounding environment or services using sustainable energy principles
 - 3.7 Unexpected situations are dealt with safely and with the approval of an authorised person
- 4 **Complete work and document activities**
 - 4.1 WHS/OHS work completion risk control measures and procedures are followed
 - 4.2 Worksite is cleaned and made safe in accordance with workplace procedures

- 4.3** 'As-installed' cables/wiring, appliances, switchgear and accessories are documented and an 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.

Installing LV wiring, appliances, switchgear and associate accessories must include:

- installing and connecting main switches, protective devices and links on a main switchboard and preparing the switchboard for the installation of metering
- installing, modifying and testing electrical installations and equipment for construction and demolition sites
- installing and connecting a switchboard
- socket outlets
- lighting equipment and accessories
- luminaires

Installing LV wiring, appliances, switchgear and associate accessories must also include least four of the following:

- cooking appliances
- smoke and fire detectors
- water heaters and controls
- three phase motor starter and control switches
- fixed electric heating system (room heaters)
- transformers
- appliances producing hot water or steam
- electric heating cables for floors and ceilings
- trace heating
- duct heaters
- electricity converters
- capacitors
- batteries
- gas appliances and equipment
- air conditioning and heat pump systems
- lifts

Wiring systems, enclosures

- metallic conduit

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| and supports must include at least three of the following: | <ul style="list-style-type: none">• non-metallic conduit• trunking• duct• cable tray/ladder• catenary• posts/poles/struts |
| Cable types used for wiring systems must include at least four of the following: | <ul style="list-style-type: none">• thermoplastic insulated (TPI) cable• flat thermoplastic sheathed (TPS)• circular TPS• steel wire armoured• fire rated cable• flexible cables |
| Purpose of wiring system circuits must include: | <ul style="list-style-type: none">• consumer mains• sub-mains• single phase final sub-circuit• three phase final sub-circuit |

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 UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories

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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:

- # reading and interpreting drawings and schedules related to cable layouts, apparatus locations and circuit connections
- # planning cable routes and installation of appliances, switchgear and accessories and obtaining installation materials
- # identifying underground services
- selecting underground consumers mains in accordance with AS/NZS 3000 and local supply authority requirements
- sequencing the installation effectively with other relevant people
- installing and terminating consumer mains for connection via overhead terminals and underground
- # installing of conduit, cable ladder/tray
- # installing wiring systems for low voltage (LV) circuits
- routing, placing and securing cables in accordance with industry standards
- # installing LV electrical apparatus and associated equipment
- selecting equipment suitable for installation in given damp situations
- # placing and securing appliances, switchgear and accessories accurately in their planned location
- terminating cables and conductors, including aerial types in accordance with industry standards
- # terminating subcircuit cabling at switchboards and connecting components including:
 - correct interconnection between switchgear, protection devices and links'
 - use of adequately sized cables
 - correct marking of equipment
 - clear identification of circuit neutral conductors

- # terminating and connecting appliances, switchgear and accessories in accordance with industry standards
- # conducting safety inspection, testing and documentation of installed circuits, including verification of earth continuity, insulation resistance, polarity, circuit connections and protection arrangements
- # maintaining fire integrity.

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:

- standards, codes and requirements applicable to the installation of wiring systems and electrical equipment, including:
 - cables and methods of mechanical protection and support
 - techniques for protection against and from other services
 - identifying prohibited cable locations
 - identifying systems with alternate supplies
 - building codes affecting the installation of cables and current-carrying equipment and accessories in buildings, structures and premises, including limitation on penetration of structural elements, maintenance of fire protection integrity, requirements for emergency/safety services and wiring above suspected ceilings
 - issues affecting electrical installations in heritage buildings and premises (limitation on penetration of structural and finished elements, accessing cable routes, types and colour of exposed accessories)
 - techniques for protection against thermal effects
 - required and permitted locations of current-carrying equipment and accessories
 - control, switching, overcurrent and residual current device (RCD) protection
 - equipotential bonding in accordance with AS/NZS 3000 and local supply authority requirements
 - sizing of wiring enclosures based on space factor recommendations of AS/NZS 3000 Wiring Rules
- techniques for installing cables and wiring systems, including:
 - typical cable routes through buildings, structures and premises
 - application of wiring accessories
 - drawing-in, placing and fixing of cables
 - cable and conductor terminations
 - methods of maintaining fire rating integrity
 - techniques for inspecting and testing installed and terminated cables to ensure they comply with continuity and insulation resistance and are safe to connect to the supply
 - connection of electrical equipment and terminal configuration for connection of phase, neutral and protective earthing conductors for the following types of equipment:

- heating
- lighting and smoke detectors
- motors
- transformers
- switchgear and accessories pendant socket outlets
- appliances.
- termination of subcircuit cabling at switchboards and connection to components including:
 - correct interconnection between switchgear, protection devices and links'
 - correct preparation for fitting and connection of local supply authority equipment
 - use of adequately sized cables
 - correct marking of equipment
 - clear identification of circuit neutral conductors
 - correct polarity
 - safe removal of equipment and termination of unused cable
- varied and additional standards and requirements for special situations, including:
 - patient treatment areas
 - marinas and boats at LV
 - transportable structures and vehicles and their site supplies
 - shows and carnivals
 - systems with alternate supplies
- methods for the installation, modification and testing of electrical installations and equipment for construction and demolition sites, complying with AS/NZS 3012 and applicable workplace safety legislation including:
 - supply requirements
 - switchboards for the purpose of construction and demolition
 - protection of circuits
 - construction wiring
 - lighting
 - socket outlets
 - circuits for lifts
 - calibration of instruments
 - inspection and testing methods
 - initial and periodic inspection and testing
- identifying hazardous areas, including:
 - additional training required to work competently with electrical equipment for hazardous areas
 - nature of areas classified as a hazardous area
 - responsibility for classifying a hazardous area
 - awareness of standards called up by the Wiring Rules for selection, installation, inspection and maintenance of electrical equipment and installations in hazardous areas

AS/NZS 3000 requirements for hazardous areas

- requirements for the installation of cables and accessories in damp situations and extra-low voltage (ELV) installations, including:
 - restricted zones around baths, showers, fixed water containers, pools, sauna heaters and fountains/water features for given installations
 - techniques for selecting equipment suitable for installation in given damp situations
 - voltage range that defines ELV
 - use of RCDs for damp situations
 - separated extra-low voltage (SELV) system and a protected extra-low voltage (PELV) system
 - AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules) requirements for selecting ELV systems and devices for a range of installations and conditions
 - equipotential bonding in showers, bathrooms, swimming and spa pools
- installation of aerial conductors and underground wiring including:
 - AS/NZS 3000 requirements
 - 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 and protection
 - underground wiring clearances from other services
 - techniques for termination of aerial cables
 - techniques for testing of installed cables in compliance with Australian Standards
 - install unprotected consumer's mains to reduce the risk of short-circuit to a minimum
- 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 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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