



Australian Government

UEEEL0003 Arrange circuits, control and protection for electrical installations

Release: 2

UEEEL0003 Arrange circuits, control and protection for electrical installations

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 involves the skills and knowledge required to select, arrange and terminate circuits, control and protection devices and systems for electrical installations operating at low voltage (LV).

It includes protection of persons and property, correct functioning, ensuring compatibility with the supply, arranging installation into circuits, selecting and arranging switchgear/control gear and protective devices to meet compliance requirements, and documenting arrangement decisions.

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 volt (V) alternating current (a.c.) or 120 V direct current (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

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

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 electrical circuits, control and protection installation

2 Arrange electrical circuits, control and protection

PERFORMANCE CRITERIA

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

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|------------|---|
| 1.1 | The extent and nature of the electrical installation is determined from job specifications |
| 1.2 | Hazards are identified, risks are assessed and control measures are implemented |
| 1.3 | Load requirements for individual current-using equipment is determined from job specifications and/or consultation with appropriate persons |
| 2.1 | Circuits, control and protective devices are arranged to ensure safe and functional operation of the installation and to comply with relevant industry technical standards and job specification requirements |
| 2.2 | Earthing is arranged and terminated to comply with the multiple earthed neutral (MEN) system requirements |

- | | |
|---|---|
| 3 Document electrical installation circuits, control and protection arrangements | <p>2.3 Protective devices are selected to meet the required switching and tripping currents coordination and discrimination for overload and short circuit protection in accordance with relevant industry technical standards</p> <p>2.4 Residual current devices (RCDs) are selected to meet the required circuit switching and tripping currents, in accordance with relevant industry technical standards</p> <p>2.5 Switchgear/control gear is selected to meet current and voltage requirements and confirmed suitable for environmental conditions (ingress protection (IP) ratings) and functional requirements</p> <p>2.6 Switchboards are arranged to accommodate control and protective devices, links, safety services and other distributor equipment in accordance with relevant industry technical standards</p> |
| | <p>3.1 Evidence is obtained from manufacturer/suppliers that electrical equipment selected complies with safety requirements in accordance with workplace procedures</p> <p>3.2 Device selection/s rationale and calculations are documented in accordance with workplace procedures</p> <p>3.3 Electrical installation and specifications for selected items are documented in accordance with workplace procedures and forwarded to appropriate person/s</p> |

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.

Arranging circuits for control and protection must include at least two electrical installations comprising:

- a main switchboard, supplying more than one circuit each for:
- lighting

- socket outlets
- fixed appliances
- one installation must include a circuit supplying a three-phase load
- one installation must include a distribution board separate from the main switchboard.

Unit Mapping Information

This unit replaces and is equivalent to UEENEEG063A Arrange circuits, control and protection for electrical installations.

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 UEEEL0003 Arrange circuits, control and protection for electrical installations

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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:

- # determining the extent and nature of the installation from job specifications
- # arranging the control and protection for electrical installations with and without safety services
- arranging, testing and terminating a multiple earthed neutral (MEN) earthing system
- # applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures and practices
- # applying safety principles for electrical systems in buildings and premises
- # applying sustainable energy principles and practices
- calculating prospective fault current in accordance with minimum fault levels specified by local supply authority
- calculating earth fault-loop impedance
- dealing with unplanned events/situations in accordance with workplace procedures in a manner that minimises risk to personnel and equipment
- determining requirements for discrimination and back-up protection for coordination of protection devices
- # determining individual load requirements
- # arranging and terminating circuits, control and protective devices to comply with requirements
- # selecting circuit protective devices and residual current devices (RCDs) that comply with all requirements
- # selecting minimum size-earthing conductors in accordance with relevant industry standards
- selecting circuit breakers to operate when installation is in island mode
- selecting RCDs/residual-current circuit breaker with overcurrent protection (RCBO) to operate when installation is in island mode

- drawing arrangements of 2-pole RCDs, 4-pole RCDs and combination RCDs
- obtaining evidence of compliance for the equipment selected
- # dividing installation into circuits
- selecting equipment for damp situations
- # coordination of protection devices and circuit wiring
- # selecting overcurrent protection devices, circuit breakers and RCDs/RCBOs
- selecting fuses, emergency controls, isolation devices, functional controls and shutdown devices
- selecting a device for fault current limiting protection
- documenting installation arrangement, specification for items selected and reasons for the selections made.

Knowledge Evidence

- AS/NZS 3000 safety principles and deemed to comply requirements including:
 - definition of terms
 - direct contact with live parts
 - indirect contact with live parts
 - thermal effects of current
 - overcurrent
 - earth faults
 - abnormal voltages
 - spread of fire
 - mechanical injury
 - external influences
 - fundamental principles of; installation design; selection and installation of equipment; means of compliance (including alterations, additions and repairs), and verification of compliance
 - methods and devices that comply with industry standards for providing protection against indirect contact
 - requirements for installation design and selection of equipment, including:
 - compliant protection arrangements
 - correct functioning
 - compatibility with supply
 - arrangement of circuits
- circuit and control arrangements, including:
 - reason for dividing electrical installations into circuits
 - factors to be considered in determining the number and type of circuits required for an installation
 - daily and seasonal demand for lighting, power, heating and other loads in a given installation
 - number and types of circuits required for a particular installation

- diagrams/schedules of circuits for given installations
- application and arrangements of separated extra-low voltage (SELV) and protected extra-low voltage (PELV) circuits, including earthing requirements and testing
- application and arrangement of an isolated supply
- hazards and risks in an electrical installation, including:
 - effects on the human body of various levels of alternating current (a.c.) and direct current (d.c.) current and duration of current flow for various current paths
 - risk of ignition of flammable materials due to the thermal effects of current or electric arcs in normal service of an electrical installation
 - risk of injury from mechanical movement of electrically actuated equipment
 - protection against direct contact (basic protection)
 - acceptable methods
 - use of ELV
- protection against indirect contact, including:
 - indirect contact with live parts of an electrical installation may occur
 - components of the ‘automatic disconnection of supply’ method of protection against indirect contact
 - the terms ‘touch voltage’ and ‘touch current’
 - the current path when a short circuit fault to exposed conductive parts of an appliance occurs
 - protection against indirect contact is by the use of Class II equipment and by electrical separation
 - additional protection by use of RCDs
 - protection against indirect contact by use of ELV and electrical separation
 - protection requirements for damp situations
- earthing, including:
 - parts of an earthing system and the purpose of each, including the terms:
 - earthed
 - earthed situation
 - earth electrode
 - equipotential bonding
 - MEN system
 - protective earth-neutral (PEN) conductor
 - main earthing conductor
 - protective earthing (PE) conductor
 - functional earthing
 - MEN link
 - typical arrangement for a MEN system and for a range of installation arrangements of PE conductors
 - typical earthing arrangements for outbuildings
 - alternate earthing systems only when required by local Regulatory Authorities (e.g. TT

- low voltage supply earthing system in dairy sheds in New Zealand)
- requirements for equipotential bonding in a range of installation situations
- protection against overload and short circuit current, including:
 - overload current or fault currents in an electrical installation
 - limitations of the use of overcurrent protection on current limited sources
 - equivalent circuit of an earth fault-loop
 - level of fault current possible at a given point in an installation from the fault-loop impedance and data from the local supply authority
 - requirements for coordination of protection devices for discrimination and back-up protection, and between protective devices and conductors of an installation
 - methods and devices that comply with industry standards for providing protection against the damaging effects of overload and fault current
- devices for automatic disconnection of supply, including:
 - operating principles of thermal/magnet circuit breakers, common types of fuses and RCDs
 - tripping characteristics of various types of circuit breakers
 - time/current curves and fusing characteristics of various types of fuses
 - tripping characteristics of various types of RCDs
 - factors in a fault-loop that will affect the impedance of the circuit
 - maximum impedance of an earth fault-loop to ensure operation of a protection device
- protection against over voltage and under voltage, including:
 - causes of over and under voltage and how this may affect the electrical system
 - methods for protection against over and under voltage
- control of an electrical installation and circuits, including:
 - switch types, current and voltage ratings and ingress protection (IP) rating and where these apply
 - switching requirements for isolation, emergency, mechanical maintenance and functional control
 - control arrangement for complete installations with and without safety services and an alternative supply, including:
 - d.c. polarity requirements
 - correct rating of d.c. switches
- switchboards/distribution boards including:
 - purpose, types and applications
 - physical and circuit arrangements for whole current and current transformer metering
 - physical and circuit arrangements of main switches, circuit protection devices, fault current limiters and metering equipment, and other distributor equipment
 - switchgear types, ratings, characteristics and applications related to alternate supplies
 - compliance requirements, including:
 - location and access
 - arc-fault protection

- identification
- construction suitability
- equipment marking
- wiring
- fire protection
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace policies and procedures.

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 (PPE) equipment 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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