



Australian Government

UEEEL0080 Plan and analyse wiring systems, circuits, control and protection for electrical installations

Release: 1

UEEEL0080 Plan and analyse wiring systems, circuits, control and protection for electrical installations

Modification History

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

Application

This unit involves the skills and knowledge required to plan and analyse wiring systems, circuits, control and protection for electrical installations.

It covers knowledge and application of schemes for protection of persons and property, correct functioning, ensuring compatibility with the supply, arranging installations into circuits and planning switchgear/controlgear and protective devices, selecting wiring systems compatible with the installation conditions, selecting cables that comply with required current carrying capacity, voltage drop and earth fault loop impedance limitations, coordination between protective devices and conductors and documenting arrangement decisions.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

No prerequisites

Competency Field

Electrical

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to plan and analyse wiring systems,

PERFORMANCE CRITERIA

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

1.1 The scope and nature of the electrical installation is determined from job specifications

circuits, control and protection

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| | 1.2 | Load requirements for individual current using equipment are determined from job specifications and/or consultation with appropriate people |
| | 1.3 | Cable routes, the route lengths of cable, and the conditions in which the wiring system is to operate is determined from job specifications or from consultation with appropriate people |
| 2 Evaluate and plan electrical circuits, control and protection | 2.1 | Circuits, control and protective devices are planned to ensure safe and functional operation of the installation and to comply with relevant requirements |
| | 2.2 | Earthing is planned to comply with the multiple earthed neutral (MEN) system requirements |
| | 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 |
| | 2.4 | Residual current devices (RCDs) are planned to meet the required circuit switching and tripping currents, in accordance with relevant industry technical standards |
| | 2.5 | Switchgear/control gear is planned to meet current and voltage requirements and confirmed suitable for environmental conditions (ingress protection (IP) ratings) and functional requirements |
| | 2.6 | Switchboards are planned to accommodate control and protective devices, links, safety services and other distributor equipment in accordance with relevant industry technical standards |
| 3 Plan wiring systems and cables for general electrical installations | 3.1 | Wiring system is planned and suitable for the environments in which it will operate |
| | 3.2 | Cable conductor sizes are planned to meet current carrying capacity requirements and voltage drop and earth fault loop impedance limitations in accordance with relevant industry standards |
| | 3.3 | Circuit protective devices are planned to meet requirements for co-ordination with conductor current carrying capacity in accordance with relevant industry |

		standards
	3.4	Earthing system components are planned to meet multiple earthed neutral (MEN) system in accordance with relevant industry standards
4 Document electrical installation wiring systems, circuits, control and protection	4.1	Rationale for device and wiring system planning and calculations are documented
	4.2	Manufacturer data is referenced in planning of equipment to ensure materials comply with safety requirements and relevant industry standards
	4.3	Electrical installation arrangement and specifications for all items are documented

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 Electrotechnology Training Package Companion Volume Implementation Guide.

Planning circuits for control and protection and selecting wiring systems and cables for at least two different general electrical installations, including:

- 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 is a new 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 UEEEL0080 Plan and analyse wiring systems, circuits, control and protection for electrical installations

Modification History

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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 and performance criteria on at least two separate occasions and include:

- calculating:
 - prospective fault current in accordance with fault levels specified by the local supply authority
 - earth fault loop impedance in a given circuit
 - expected voltage drop in a given circuit
 - maximum demand on consumer mains, submains and final subcircuits
- determining:
 - requirements for discrimination and back-up protection for coordination of protection devices
 - individual load requirements
 - cable routes, the route lengths of cables and the conditions in which the wiring system is to operate
 - the number and types of circuits required for a particular installation
 - current requirements for given final subcircuits
 - layout/schedule of circuits for given installations
 - maximum demand for consumer mains, submains and final subcircuits for an installation in accordance with industry and regulatory standards
 - suitability of the cable insulation
 - the control and protection for electrical installations
 - multiple earthed neutral (MEN) earthing system
 - control and protective devices to comply with requirements
- selecting:
 - circuit protection devices and residual current devices (RCDs) that comply with all requirements
 - circuit protection devices to satisfy maximum demand and coordination
 - circuit protection devices to satisfy requirements for coordination, discrimination, fault

- protection and overcurrent
- minimum size earthing conductors in accordance with relevant industry standards
- circuit breakers to operate when the installation is in island mode
- RCDs/residual-current circuit breaker with overcurrent protection (RCBO) to operate when installation is in island mode
- equipment for damp situations
- overcurrent protection devices, fuses, circuit breakers, RCDs/RCBOs, emergency controls, isolation devices, functional controls and shutdown devices
- a device for fault current limiting protection
- cables for consumer mains, submains and final subcircuits to meet maximum demand and installation conditions, including any derating factors
- cables to satisfy fault loop impedance requirements in addition to current carrying capacity requirements and voltage drop requirements
- conductor size based on the maximum current requirement for a given installation condition
- cables to satisfy voltage drop requirements in addition to current carrying capacity requirements
- isolation and control devices as required by the designed installation and in accordance with industry and regulatory requirements
- dividing the installation into circuits
- obtaining evidence of compliance for the equipment selected
- drawing arrangements of circuit control and protection devices
- documenting the installation arrangement, specification for items selected, reasons for the selections made and electrical installation design.

Knowledge Evidence

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

- Standards philosophy and format, including:
 - performance versus prescriptive requirements
 - purpose of technical standards
 - arrangement and use of technical standards in relation to electrical and electronic work
 - how to read and apply a standard
 - standards and codes that apply to all types of electrical installations
 - standards mandated under regulation (e.g. Wiring Rules) or by an authority, deemed-to-comply standards and local service requirements (e.g. service rules)
 - codes applicable to electrical safe working practices and some aspects of the Building Code of Australia (BCA)
- AS/NZS 3000 requirements and safety principles related to wiring systems, circuits, control and protection for electrical installations
- safety principles for electrical systems in buildings and premises

- WHS/OHS legislated requirements and hazards/risks in an electrical installation
- circuit and control arrangements, including:
 - requirements for the provision of the isolation of every circuit in an electrical installation
 - factors to be considered in determining the number and type of circuits required for an installation
 - number and types of circuits required for a particular installation
- methods of protection against direct and indirect contact
- earthing, including:
 - parts of an earthing system and the purpose of each
 - typical arrangement for a MEN system and for a range of installation arrangements of PE conductors
- requirements for equipotential bonding in a range of installation situations
- the effects of overload and short circuit current
- methods of protection against overload and short circuit current
- devices for automatic disconnection of supply, including:
 - operating principles of thermal/magnetic 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
- methods of protection against over voltage and under voltage
- control of an electrical installation and circuits, including:
 - switch types
 - switching requirements
- switchboards including:
 - purpose, types and applications
 - equipment arrangement
 - whole current metering
 - current transformer metering
 - compliance requirements
 - tariff structures for the supply of electricity
 - single-phase metering
 - multi-phase metering
- design and safety performance requirements, including:
 - supply characteristic considerations when designing an electrical installation
 - external factors that may damage an electrical installation
 - methods to protect against risk of ignition of flammable materials and injury by burns from the thermal effects of current in normal service
 - likely sources of unwanted voltages and the methods for dealing with this potential hazard

- requirements for protection against the harmful effects of faults between live parts of circuits supplied at different voltages
- need for protection against injury from mechanical movement and how this may be achieved
- features of ‘fire rated construction’ and how the integrity of the fire rating can be maintained in relation to the electrical installation
- maximum demand on consumer mains and submains, including:
 - methods for determining the maximum demand on an installation’s consumer mains and submains
 - maximum demand for the consumer mains for given installations up to 400 amperes (A) per phase
- cable selection based on the following requirements:
 - current carrying capacity
 - voltage drop
 - fault loop impedance
- cable types including:
 - application of various cord and cable types, as defined by the properties of their insulation, sheathing, armouring and/or screening
 - Australian and international standard colour codes for cords and cables
 - identification of cords and cables by conductor size, type and rating
 - identification of hardware used in terminating cords and cables
 - requirements to protect and support cables adequately (protection against mechanical damage, protection from adverse temperatures and corrosion and protection from magnetic fields that may affect the performance of the cable)
 - structural components of cables and their purpose (conductor material, stranding, insulation type, voltage rating, screening, sheathing, armour and serving)
- wiring system features, applications, relevant industry standards and testing requirements for safe operation relating to:
 - cords, cables and plugs
 - circular and flat TPS wiring systems
 - TPI cables in non-metallic enclosures
 - TPI cables in metallic enclosures
 - fire protection cabling, including:
 - requirements when passing a wiring system through a fire rated wall or floor
 - techniques for recognising different fire protection cable types
 - SWA cables
 - trailing cables and catenary systems.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training

Organisations current at the time of assessment.

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 workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in 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, equipment and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

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