



Australian Government

MEM10018 Select cable types and sizes to suit loads and electrical installation environment

Release: 2

MEM10018 Select cable types and sizes to suit loads and electrical installation environment

Modification History

Release 2. Minor adjustments to reflect ERAC requirements for electrician licensing and revision of Essential Performance Capabilities

Release 1. New unit

Application

This unit of competency has been developed for Engineering Tradesperson – industrial electrician apprenticeship training, and the recognition of trade-level skills in selecting cables for electrical installation work and equipment in areas including consumer mains, submains and final subcircuits for operating voltages up to 1000 V alternating current (AC) or 1500 V direct current (DC).

It covers a comprehensive understanding of the cable selection process of AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules) and cable selection standards in determining maximum demand, voltage drop limitations, current carrying capacity and short circuit capability.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capabilities (EPCs) classified as ‘critical’:

- EPC 21 – Demonstrate the ability to select cables for mains and submains using AS/NZS 3000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capability, maximum demand and voltage drop, for single phase and three phase installations including multiple installations.
- EPC 22 – Demonstrate the ability to select cables for final subcircuits using AS/NZS 3000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capability, maximum demand, earth loop impedance and voltage drop.
- EPC 27 – Demonstrate knowledge of AS/NZS 3000 and local regulatory requirements for the installation of aerial conductors and underground wiring. Including specialist cables.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: A

Unit Weight: 4

Pre-requisite Unit

Nil

Competency Field

Installation and commissioning

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes.

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

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|--|------|---|
| 1. Determine job requirements | 1.1. | Follow standard operating procedures (SOPs) |
| | 1.2. | Comply with work health and safety (WHS) requirements at all times, including appropriate risk control measures |
| | 1.3. | Use appropriate personal protective equipment (PPE) in accordance with SOPs |
| | 1.4. | Identify job requirements from specifications, drawings, job sheets or work instructions |
| 2. Select wiring systems and cables for electrical installation work and equipment | 2.1. | Select wiring systems to suit loads and electrical installation work environment |
| | 2.2. | Select cable conductor sizes based on current-carrying capacity, short circuit capacity, maximum demand, voltage drop and earth fault-loop impedance in accordance with regulatory requirements |
| | 2.3. | Select circuit protective devices based on current-carrying capacity requirements of the selected cables |
| | 2.4. | Select earthing system parts to meet the multiple earth neutral (MEN) system |
| | 2.5. | Document selection of cable types and sizes and installation requirements in accordance with SOPs |

Foundation Skills

This section describes those required skills (reading, writing, oral communication and numeracy) that are essential to workplace performance in this unit of competency.

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

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Electrical installations include:

- at least one (1) general electrical installations comprising a main switchboard, supplying more than one circuit each for lighting, socket outlets and fixed appliances
- at least one (1) industrial electrical installation comprising a distribution board separate from the main switchboard and at least one (1) circuit supplying a three-phase load and safety system in one of the following industrial environments:
 - factory
 - building
 - off shore platform
 - mine site processing
 - oil and gas installation
 - processing plant
 - workshop
 - underground installation
- three-phase loads include at least one (1) or more of the following:
 - motors – for pumps, conveyors, mills, agitators, crushers and screening plants
 - heaters
 - compressor packages
 - heating, ventilation and air conditioning (HVAC) units
 - facility accommodation units, sea container workshops and storage units, and laboratories
 - workshop equipment, including lathes, milling machines and welders
 - underground dewatering systems and ‘gate end’ boxes for drilling equipment

Regulatory requirements include:

- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- AS/NZS 3008.1.1:2009 Electrical Installations – Selection of

- Safe working practices include:**
- cables – Cables for alternating voltages up to and including 0.6/1 kV – typical Australian installation conditions
 - demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

Release 2. Equivalent. Minor adjustments to reflect ERAC requirements for electrician licensing and revision of Essential Performance Capabilities.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM10018 Select cable types and sizes to suit loads and electrical installation environment

Modification History

Release 2. Minor adjustments to reflect ERAC requirements for electrician licensing and revision of Essential Performance Capabilities

Release 1. New unit

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria on at least two (2) occasions and include:

- following work instructions, standard operating procedures (SOPs) and safe work practices
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- determining the cable routes, length and conditions in which the wiring system is to operate
- complying with relevant Australian/New Zealand Wiring Rules, Cable Selection and Service Rules when selecting cables ensuring coordination between protective devices and conductors in regard to the following aspects:
 - design of the circuit taking into account the safety considerations
 - determining the final subcircuit arrangements
 - determining the factors affecting suitability of wiring systems
 - calculating the maximum demand on consumer mains/submains
 - calculating the current-carrying capacity requirements
 - calculating the voltage drop requirements
 - calculating the expected fault loop impedance
 - selecting cables to satisfy voltage drop, current-carrying capacity and fault loop impedance requirements
 - selecting the appropriate protection devices
 - selecting the appropriate isolation devices and switching arrangements
- selecting earthing system parts to meet the multiple earthed neutral (MEN) system
- documenting reasons for selection and installation requirements in accordance with SOPs.

Knowledge Evidence

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

- safe work practices and procedures and use of personal protective equipment (PPE)

- Australian/New Zealand Wiring Rules, AS/NZS 3008.1.1:2009 Electrical Installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV – typical Australian installation conditions and other related standards in regards to the following:
 - design and safety performance requirements, including:
 - protection of persons, livestock and property from harmful effects
 - correct functioning of the electrical installation for intended use
 - compatibility with the electricity distribution system, or other source of supply, to which the electrical installation is to be connected
 - type of insulation required:
 - thermoplastic
 - elastomer
 - cross-linked polyethylene (XLPE)
 - mineral-insulated metal sheath (MIMS)
 - high temperature
 - supply characteristics
 - reasons for dividing installations into circuits and factors that determine their number and type
 - external influences that may damage installation and be considered in the design, including applying derating factors caused by the effect of:
 - grouping of cables
 - ambient temperature
 - depth of laying
 - thermal resistivity of soil
 - varying of loads
 - thermal insulation
 - direct sunlight
 - acceptable methods of protection against risks of ignition of flammable materials
 - likely sources of unwanted voltages and methods of dealing with this potential hazard
 - requirements for protection against fault current
 - protection against harmful effects of faults between live parts of circuits supplied at different voltages
 - mechanical movement protection
 - fire rated construction and how integrity of fire rating can be maintained
- final subcircuit arrangements, including:
 - factors to consider when determining the number and type of circuits required
 - daily and seasonal demand for lighting, power, heating and other loads in a given installation
 - factors affecting current-carrying capacity of cables
 - layout/schedule of circuits
- factors affecting suitability of wiring systems

- acceptable methods of determining maximum demand on an installation's consumer's mains and submains up to 400 A per phase
- external factors that require the use of a derating factor when determining current-carrying capacity
- requirements for maximum voltage drop in an installation and relevant tables for unit values of voltage drop
- requirements for maximum fault loop impedance in an installation and the relevant tables to determine cable impedances
- accepted methods used against indirect contact when selecting protection devices to protect against overload and short circuit current situations
- provision of isolation of every circuit for a range of installations and conditions
- earthing system parts including the selection of earth electrode, main earthing conductor, main earthing terminal/connection or bar, MEN link, protective earthing conductors and equipotential bonding
- effects of harmonic current on current-carrying capacity
- conditions where short circuit performance may need to be considered.

Assessment Conditions

- Assessors must:
 - have vocational competency in selecting cable types and sizes to suit loads and electrical installation environment at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State as the case requires.
- Where possible assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions. This must cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required, including relevant workplace procedures, product and manufacturing specifications.
- 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.

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