



Australian Government

MEM10019 Select circuit protection devices by type and rating, fit to switchboards and install earthing

Release: 3

MEM10019 Select circuit protection devices by type and rating, fit to switchboards and install earthing

Modification History

Release 3. Prerequisite units updated

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 and installing circuit protection devices to protect against electric shock, over current and over voltage for operating voltages up to 1000 V alternating current (AC) or 1500 V direct current (DC) and install earthing as per multiple earthed neutral (MEN) system.

It covers a comprehensive understanding of earthing arrangements, the MEN system (including sub-installations), the calculation and selection of protective devices, alternative arrangement against electric shock and the requirements for use of residual current devices (RCDs).

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

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

- EPC 16 – Demonstrate and apply in practice the requirements of AS/NZS 3000 in relation to earthing arrangements and fault-loop impedance calculations. Knowledge of alternate earthing systems when required by local Regulatory Authorities.
- EPC 17 – Demonstrate a comprehensive knowledge and understanding of the MEN system and its application, including on sub-installations. Demonstrate how to test an MEN system.
- EPC 27 – Describe and apply in practice the requirements for circuit protection using AS/NZS 3000:2000 and other relevant Australian Standards, e.g. AS/NZS 3018.1.
- EPC 20 – Demonstrate knowledge of the SELV and PELV systems, their application and testing in accordance with AS/NZS 3000.
- EPC 23 – Describe and apply the control and protection requirements for installations and equipment. Demonstrate the ability to select suitable equipment and switchgear for a particular installation or part of an installation using AS/NZS 3000.
- EPC 24 – Demonstrate an understanding of the AS/NZS 3000 and regulatory requirements for the location of switchboards and the arrangement of switchboard equipment in installations. Methods for determining prospective fault current. Switchboard form types.

- EPC 26 – Demonstrate the appropriate 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. Need for calibration of instruments.

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: 2

Pre-requisite Unit

MEM10016	Terminate and test electrical wiring and accessories
MEM10018	Select cable types and sizes to suit loads and electrical installation environment
MEM18001	Use hand tools

Competency Field

Installation and commissioning

Elements and Performance Criteria

Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.								
1. Determine job requirements	<table><tr><td>1.1</td><td>Follow standard operating procedures (SOPs)</td></tr><tr><td>1.2</td><td>Comply with work health and safety (WHS) requirements at all times, including appropriate risk control measures</td></tr><tr><td>1.3</td><td>Use appropriate personal protective equipment (PPE) in accordance with SOPs</td></tr><tr><td>1.4</td><td>Identify job and load requirements from specifications, drawings, job sheets or work instructions</td></tr></table>	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 and load requirements from specifications, drawings, job sheets or work instructions
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1.4	Identify job and load requirements from specifications, drawings, job sheets or work instructions								
2. Prepare and select circuit protection controls and devices	<table><tr><td>2.1</td><td>Organise circuits and switchboard equipment to comply with layout drawings, specifications and regulatory requirements</td></tr></table>	2.1	Organise circuits and switchboard equipment to comply with layout drawings, specifications and regulatory requirements						
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| for electrical installations | 2.2 | Select suitable circuit protective devices to meet specifications |
| | 2.3 | Select RCDs to meet required circuit requirements and specifications |
| | 2.4 | Select switchgear/control gear by type, rating and purpose for a particular installation or part of an installation |
| 3. Install circuit protection controls and devices for electrical installations | 3.1 | Isolate and tag circuits and equipment in accordance with procedures, where required |
| | 3.2 | Install circuit protection devices in compliance with job specifications and requirements |
| | 3.3 | Install RCDs, where required, to protect all lighting and socket outlets in final subcircuits in domestic electrical installations |
| | 3.4 | Install switchgear (including main switch/s) and control gear according to manufacturer and regulatory requirements |
| | 3.5 | Check installed components are straight and square in the required locations and within acceptable tolerances |
| | 3.6 | Terminate earthing to meet with the MEN system requirements |
| | 3.7 | Inspect installed components and earthing system visually to ensure compliance |
| | 3.8 | Test the earthing system for continuity and insulation resistance to ensure compliance |
| | 3.9 | Mark all switches, circuit-breakers, RCDs and other electrical equipment on or adjacent to the switchboard |
| | 3.10 | Document selection of circuit protection devices and electrical installation arrangement 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.

Installations include:

- at least one (1) general electrical installation 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 • AS/NZS 3000:2007 Electrical installations (known as the

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include: Australian/New Zealand Wiring Rules)

- AS/NZS 3012:2010 Electrical installations – Construction and demolition sites

Safe working practices include:

- 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 MEM10019 Select circuit protection devices by type and rating, fit to switchboards and install earthing

Modification History

Release 3. Prerequisite units updated

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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 individual load requirements of the installation
- selecting the appropriate switchboard and layout arrangements
- complying with Australian/New Zealand Wiring Rules, other Australian Standards, e.g. 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, Service Rules and other relevant standards when selecting circuit protection controls and devices in regard to the following aspects:
 - protection against indirect contact, overcurrent or excess earth leakage current conditions and over and under voltage by selecting and installing using safe working practices:
 - a fuse/s for fault current limiting protection
 - an appropriate circuit breaker/s with a current rating not less than the maximum demand of the portion of the electrical installation they control
 - a residual current device (RCD) with a maximum rated residual current of 30 mA
 - control of the electrical installation (or parts thereof) by suitable switching arrangements by selecting and installing using safe working practices:
 - a main switch/es to control the whole of the electrical installation
 - switches for isolation, emergency, mechanical maintenance and functional (control) with appropriate Ingress Protection (IP) rating
 - installing and terminating the compliant earthing system components for the multiple earthed neutral (MEN) system and other earthing arrangements
 - terminating all circuit protection controls and devices

- inspect visually all components and earthing system to ensure compliance
- test earthing system for continuity and insulation resistance
- identify with marking all switches, circuit breakers and RCDs and other electrical equipment on or adjacent to the switchboard
- using test equipment to locate faults, completing remedial action and retesting to ensure compliance
- documenting reasons for selection and installation arrangement 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 and other related standards in regards to the following:
 - requirements for the selection and installation of switchgear and controlgear, including:
 - protection against indirect contact
 - protection against over current or excess earth leakage current conditions
 - protection against over voltage and under voltage
 - control of the electrical installation (or parts thereof) by suitable switching arrangements
 - design, selection (including form type) and installation of switchboards
- design of an electrical installation
- design, selection (including form type) and installation of switchboards
- application and segregation requirements 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
- protection against indirect contact, including:
 - methods of protection
 - protection by automatic disconnection of supply
 - touch-voltage limits
 - earthing system impedance
 - disconnection times
 - supplementary equipotential bonding
 - protection by the use of Class II equipment or by equivalent insulation
 - protection by electrical separation
- protection by the use of RCDs
- protection against thermal effects in normal service

- protection against unwanted voltages
- protection against over current and fault currents
- protection against over voltage
- protection against injury from mechanical movement
- devices for isolation
- fire integrity
- protection from damp situations
- earthing system terms, parts and arrangement
- devices and operating principles for automatic disconnection of supply, including circuit breakers, fuse and RCDs
- devices for isolation and switching, including for the following functions:
 - isolation
 - emergency
 - mechanical maintenance
 - functional (control)
- switchboards and distribution boards purpose, types, application, layout and compliance requirements
- bonding of metallic meter enclosures
- minimum fault levels specified by electricity network operator
- methods for determining prospective fault current
- MEN arrangement, resultant fault current path and magnitude, operation of protective devices and implication of MEN link absence during fault conditions
- knowledge of alternate earthing systems when required by local Regulatory Authorities, e.g. TT low voltage supply earthing system in dairy sheds in New Zealand
- construction and demolition requirements as per AS/NZS 3012:2010 Electrical Installations – Construction and demolition sites.

Assessment Conditions

- Assessors must:
 - have vocational competency in selecting circuit protection devices by type and rating, fitting to switchboards and installing earthing 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 condition. 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.

Links

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