



Australian Government

**MEM10023 Design and connect control
switching of circuits for building services
and industrial equipment**

Release: 3

MEM10023 Design and connect control switching of circuits for building services and industrial equipment

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 designing and connecting control switching of circuits.

It covers basic switching and control arrangements and hazards and safety requirements associated with static electricity discharge from components.

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

Essential Performance Capabilities (EPCs):

- EPC 41 – Demonstrate the knowledge and skills to design and connect switching circuits, as per AS/NZS 3000.
- EPC 51 – Describe the functioning of basic electronic circuits used in common electrical power circuit applications including electronic logic controls, related hazards and safety requirements.

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

MEM10016	Terminate and test electrical wiring and accessories
MEM10018	Select cable types and sizes to suit loads and electrical installation environment
MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
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.

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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. Design control switching of circuits | 2.1. Design agreed control switching of circuits to comply with specifications and regulatory requirements |
| | 2.2. Document agreed design of control circuits in accordance with procedures |
| | 2.3. Obtain the necessary tools, equipment, test instruments and materials needed to connect the control circuits |
| 3. Connect control switching of circuits | 3.1. Isolate and tag circuits and equipment in accordance with procedures, where required |
| | 3.2. Terminate and connect control circuit components to comply with the design and regulatory requirements |
| | 3.3. Functional test control circuit operation to ensure compliance with agreed design |
| | 3.4. Rectify any non-compliances and re-test to meet requirements |
| | 3.5. Terminate and connect control circuits |

Elements describe the essential outcomes.

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

3.6. Test control circuits to ensure functionality

3.7. Document control circuits 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.

Control switching of circuits include five (5) or more of the following:

- multiple light switching circuit
- master control circuit
- local start-stop control and with electrical interlocking
- connecting a timer in a controlled circuit
- a multiple motor starting circuit which incorporates start, stop and jog control
- machine safety circuit
- line conditioners
- inverters
- uninterrupted power supplies (UPS)
- energy management systems

Control circuit components include five (5) or more of the following:

- multi-way switches
- switches with more than two positions and Off
- push buttons
- electromechanical relays
- programmable relays
- contactors
- motor reversing contactors
- three-phase starters
- reduced voltage starters

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.

- transducers/sensors, including:
 - limit, proximity, float and pressure switches
 - photoelectric cells
 - light and temperature sensors

Regulatory requirements include: • AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules

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 MEM10023 Design and connect control switching of circuits for building services and industrial equipment

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

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 electrical and non-electrical isolation requirements to prevent the creation of hazards linked from the loss of machine/system/process control according to established procedures
- using lock out tag procedures with appropriate tags/signs
- proving electrical isolation and following established safety rules prior to working on electrical equipment or wiring
- ensuring all electrical equipment and tools are tested and tagged and are up to date
- developing according to specifications at least five (5) or more of the following control circuit designs:
 - multiple light switching circuit
 - master control circuit
 - local start-stop control and with electrical interlocking
 - connecting a timer in a controlled circuit
 - a multiple motor starting circuit which incorporates start, stop and jog control
 - machine safety circuit
 - line conditioners
 - inverters
 - uninterrupted power supplies (UPS)
 - energy management systems
- terminating and connecting to comply with the above selected control circuit scenarios and regulatory requirements at least five (5) or more of the following control circuit devices:

- multi-way switches
- switches with more than two positions and Off
- push buttons
- electromechanical relays
- programmable relays
- contactors
- motor reversing contactors
- three-phase starters
- reduced voltage starters
- transducers/sensors, including:
 - limit, proximity, float and pressure switches
 - photoelectric cells
 - light and temperature sensors
- programming timers and using the monitoring facility of the programmable relay to verify the values of the timer
- testing connected control circuit devices as against agreed design and rectifying any non-compliant functions
- complying with the Australian/New Zealand Wiring Rules and local supply requirements for three-phase motor installations and starters
- testing control circuits to ensure functionality
- using test equipment to locate faults, completing remedial action and retesting to ensure compliance
- documenting connected control circuits 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)
- electrical drawings – conventions in linework, symbols used in electrical circuit diagrams, placement and arrangement of circuit components
- drawing schematic circuit diagrams complying with Australian Drawing Standard AS/NZS 1102.101-1989 Graphical symbols for electrotechnical documentation – General information and general index, and converting to wiring diagrams
- construction and operation of contactors and relays with various types of contacts, including:
 - normally open
 - normally closed
 - timed on closing
 - timed in opening
 - timed in both closing and opening
- drawing contactors in circuits and drawing conventions applied

- control diagrams drawn as ladder diagrams where the ladder stiles are the supply lines and the ladder rungs are the various circuit lines
- control circuit variations, including:
 - two-position control
 - local or remote operation
 - two-wire control
 - two-wire and push button control where extra start push-buttons are all placed in parallel and where extra stop push-buttons are placed in series
 - reversing circuits – use of mechanical and electrical interlocks
 - jogging control
- common control devices used in circuits, including:
 - multi-way switches
 - switches with more than two positions and Off
 - push buttons
 - electromechanical relays
 - programmable relays
 - contactors
 - motor reversing contactors
 - three-phase starters
 - reduced voltage starters
 - transducers/sensors, including:
 - limit, proximity, float and pressure switches
 - photoelectric cells
 - light and temperature sensors:
- programmable timers, including specifications to be met and functions to be controlled including machine operation or process output
- line conditioners and the purpose they provide
- inverters and the purpose they provide
- energy management systems and the purpose they provide
- static electricity discharge or electrostatic discharge and the hazards associated and the precautions to be taken.

Assessment Conditions

- Assessors must:
 - have vocational competency in designing and connecting control switching of circuits for building services and industrial equipment 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.

Links

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