



Australian Government

MEM2311A Select electrical equipment and components for engineering applications

Release: 1

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Modification History

Release 1 - New unit. Replaces MEM23051A, but not equivalent.

Unit Descriptor

This unit of competency covers the identification and matching of electrical supply and electrical system equipment and components to mechanical, manufacturing and mechatronic engineering applications. It includes electrical principles and laws, inductive and capacitive effects on AC supplies, control system power supply fundamentals, electrical safety and earthing systems, electrical motors and motor controls.

Application of the Unit

This unit applies to people working as technicians in engineering or related fields where electrical power supply, equipment and systems must be considered. The unit applies to mechanical, manufacturing and mechatronic engineering applications which include electrical equipment, including domestic, commercial or industrial situations. Electrical equipment and component identification covered by this unit is from manufacturer catalogues or other standard specifications. The unit does not cover one-off design or modification to electrical equipment.

The unit does not cover the undertaking of licensed electrical work but will often apply to individuals working as part of a team that includes licensed electricians.

This unit includes knowledge of electrical dangers and safety procedures and the need to comply with work health and safety (WHS) and electrical regulatory requirements.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MEM23004A Apply technical mathematics

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

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

Elements and Performance Criteria

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| 1 | Investigate context of electrical equipment and supply | 1.1 | Review functions and features of devices |
| | | 1.2 | Identify safe machine |
| | | 1.3 | Identify WHS and regulatory requirements |
| | | 1.4 | Determine available sources for any required licensed electrical |
| | | 1.5 | Review sustainability implications of energy source options |
| 2 | Determine electrical supply, equipment and components required for engineering-related tasks | 2.1 | Assess electrical supply specifications for engineering application |
| | | 2.2 | Analyse electrical motors and their control options for suitability |
| | | 2.3 | Estimate power factor requirements for engineering applications |
| | | 2.4 | Examine engineering application control and communication requirements |
| | | 2.5 | Appraise isolation, shutdown and emergency equipment options |
| | | 2.6 | Analyse maintenance, life cycle and sustainability requirements of electrical systems and equipment options |
| | | 2.7 | Apply specification, documentation and graphical techniques, modelling, mock-up or prototyping |

- techniques, where required, to achieve or test options
- 2.8 Identify preferred electrical supply system, equipment and components
- 3 Report results
 - 3.1 Record results of investigation, evaluation and application
 - 3.2 Provide documentation, such as calculations, diagrams, programs and files

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- evaluating relevance of WHS, regulatory requirements, standards and codes of practice
- evaluating multiple solutions against design criteria, risk, sustainability and cost factors
- applying life cycle design and sustainability parameters to identification of task
- solving problems and making decisions with systems thinking approach for contingencies and constraints and continuous improvement
- reviewing sustainability implications, functions and features of devices, machines and systems employing electricity and electrical principles
- integrating electrical evaluation techniques with overall engineering application requirements, including mechanical; fluid power; electronic; heating, ventilation, air conditioning and refrigeration (HVAC/R); and controller and networking
- assessing and applying basic electrical principles and techniques, software basic analysis and graphics skills and techniques to engineering tasks
- ensuring safe electrical working practice
- ensuring compatibility of units in calculations
- reporting and documenting results of investigation, evaluation and application, calculations, diagrams, programs and files

Required knowledge

Required knowledge includes:

- energy source options, sustainability implications of electricity generation, distribution and use
- sustainable sources of energy
- features and function of electrical systems in a range of engineering applications, such as:
 - sources and reliability of supply (e.g. mains, generators and batteries)
 - fault and other protection requirements
 - electrical system control and interfacing with other systems
 - maintainability
 - efficiency
 - fitness for purpose
- WHS and regulatory requirements with particular emphasis on automation safety, codes of practice, standards, risk management and registration requirements
- the effects of electricity on humans, including dangerous high currents and voltages

related to extra low, low and high voltage applications and relating these to engineering applications

- licensed technical and professional assistance
- electrical laws and theorems
- electrical circuit components
- AC and DC electrical supply systems:
 - single and 3-phase power
 - power factor
 - distribution systems, including transformers, cables and switchboards
 - local area distribution considerations and supply authority requirements
 - typical and possible faults and dangerous situations
 - earthing systems, such as multiple earth neutral (MEN) system
- circuit protection devices, such as fuses, thermal relays, circuit breakers and residual current devices
- basic electrical circuits and applications for lighting, motors, controllers, heaters and coolers
- graphical symbols and diagrammatic representation of basic circuits and power supply fundamentals
- electrical power consumption
- electrical measurements and techniques

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to apply electrical principles to ensure safe practice, assist with systems development, component selection and maintenance and broadly evaluate electrical features, functions and performance of machines or systems. This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • identify effects and dangers of electricity • review sustainability implications, functions and features of electrical devices, machines and systems • assess and apply basic electrical principles and techniques • evaluate of suitability of electric power supply for applications • apply appropriate calculations and methods for electric motor control • ensure safe electrical working practice and compatibility of units in calculations • report and document results.
Context of and specific resources for assessment	• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application. • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. • Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Electrically powered equipment and systems	Electrically powered equipment and systems in mechanical, manufacturing and mechatronic engineering applications may include: • motors • electrical supply equipment, including transformers, switchboards, and power circuit components • sensors, programmable logic controllers (PLCs) and control circuits • isolation, shutdown and emergency cut-offs • lighting
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	• heating, cooling and ventilation • average and maximum load, power factor, switch board layout, earthing and protection systems and power consumption and cost
• Electrical-related engineering tasks	Electrical-related engineering tasks covered by this unit include, but are not limited to: • determining WHS, regulatory and risk management requirements • evaluating electrical supply options • technical evaluation of options for electrical equipment and components against performance, cost and reliability requirements • determining methods for start, stop, speed control and reversing of a range of electric motors • matching of electrical equipment to other systems
Automation safety	Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity. Standards apply to general plant design and use as well as the 'functional safety of safety-related electrical, electronic and programmable electronic control systems'
Appropriate licensed technical and professional assistance	Appropriate technical and professional assistance may include: • technical support and advice relating to elements which have intrinsic dangers, such as: • high pressure • energised fluid vessels • high temperatures and heat energy capacity • wiring with high current control voltages above extra low voltage • professional support for technologies, such as: • specialist electric motor drives and controllers • specialist materials, plastics, metal alloys and nano materials • special processes, foundry, alloy welding, heat treatment, sealing and fastening
WHS, regulatory requirements and enterprise procedures	WHS, regulatory requirements and enterprise procedures may include: • WHS Acts and regulations • relevant standards • codes of practice from Australian and overseas engineering and technical associations and societies • risk assessments • registration requirements

	• safe work practices • state and territory regulatory requirements applying to electrical work
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular mechatronic analysis task
Systems thinking	Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
Life cycle assessment	Life cycle analysis can be used to improve sustainability of products and services. It may be applied to: • all aspects of manufacture of a single product • the entire operations of an organisation • a particular aspect of operations, such as environmental implications
Sustainability implications	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: • meeting all regulatory requirements • conforming to all industry covenants, protocols and best practice guides • minimising ecological and environmental footprint of process, plant and product • maximising economic benefit of process plant and product to the organisation and the community • minimising the negative WHS impact on employees, community and customer

Unit Sector(s)

Competency field

Unit sector Engineering science

Custom Content Section

Not applicable.