



Australian Government

MEM14088 Apply maintenance engineering techniques to equipment and component repairs and modifications

Release: 1

MEM14088 Apply maintenance engineering techniques to equipment and component repairs and modifications

Modification History

Release 1. Supersedes and is equivalent to MEM14088A Apply maintenance engineering techniques to equipment and component repairs and modifications.

Application

This unit of competency defines the skills and knowledge required to apply maintenance engineering and design techniques to determine the repair, modification or replacement requirements of mechanical, fluid and electrical plant, and facilities. It is suitable for people working at a technician level in maintenance-related design drafting or in maintenance-related supervision or management and applies across all engineering disciplines. It should be selected in conjunction with appropriate technical units for the equipment or components being considered for maintenance and includes reviewing condition analysis and non-destructive test (NDT) reports.

The conduct of condition analysis and NDT tests is covered by the relevant specialist technical units.

Where an organisation or whole of plant maintenance management system is being reviewed or considered for change unit MEM23125 Evaluate maintenance systems should be selected.

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

Pre-requisite Unit

MEM14092 Integrate maintenance fundamentals into an engineering task

MEM23004 Apply technical mathematics

Competency Field

Planning

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Determine job requirements	1.1 Follow standard operating procedures (SOPs) 1.2 Comply with work health and safety (WHS) requirements at all times

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	1.3 Use appropriate personal protective equipment (PPE) in accordance with SOPs 1.4 Identify job requirements from specifications
2. Investigate requirements of maintenance tasks	2.1 Determine the context and parameters of the maintenance task in consultation with stakeholders 2.2 Establish equipment or component original design and any subsequent modifications and repairs 2.3 Obtain current performance specifications 2.4 Determine engineering scientific principles and design techniques required for equipment or component maintenance
3. Investigate alternatives of repair, replacement or modification	3.1 Analyse equipment or component condition analysis reports, including the results of any required NDT 3.2 Review maintenance repair techniques and processes, standard parts, labour and skill requirements 3.3 Determine life cycle design and sustainability implications of maintenance design and maintenance activities 3.4 Determine specification, documentation and graphical techniques required to define designs 3.5 Confirm WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements relevant to repair and modification design projects 3.6 Assess the need for technical and professional assistance 3.7 Determine software requirements for repair and modification design 3.8 Decide if repair, replacement or modification is appropriate and seek any necessary approvals
4. Apply repair and modification design techniques	4.1 Plan, schedule and coordinate the repair or modification design task 4.2 Apply the design process and scientific principles to repair and modification design proposals 4.3 Determine materials, components, maintenance processes, equipment and tools required to implement design 4.4 Create adequate and accurate calculations, preliminary graphics and maintain design process records using appropriate software 4.5 Assess repair and modification designs against design criteria 4.6 Apply systems thinking to problem-solving and decision-making

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	techniques in dealing with contingencies and constraints for continuous improvement and development of design options 4.7 Incorporate required professional and technical assistance 4.8 Apply agreed techniques to define repair or modification
5. Report results	5.1 Record results of investigations, application and development of repair and modification design 5.2 Provide supporting documentation that includes accurate and comprehensive details about techniques used

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

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.	
Specifications include one or more of the following:	• drawings • job sheets • work instructions.
Maintenance repair and modification requirements include one or more of the following:	• scheduled maintenance required under the maintenance management system • unscheduled maintenance as a result of system or component failure • repairs to restore systems or components to operation • modifications to improve system or component reliability or maintainability • maintenance schedule change or equipment or component modification required because of a change in equipment performance requirements including changed production or product design

	• competitive market pressure and ‘lean maintenance’ • changes in available maintenance technology • resources supply including materials, labour and skills • introduction or changes to asset technologies including one or more of the following: • mechanical • fluid • electrical • electronic • system control • sustainability relevant to repair and modification design tasks • WHS, risk and applicable standards and code requirements.
Planning processes include one or more of the following:	• establishing maintenance parameters and design criteria • contributing to the negotiation and advice process • preliminary planning, investigations and costing • identifying design, development, prototyping activities and skills requirements • planning and scheduling design activities • improving, adjusting and rescheduling as required by emergency contingencies and constraints.
Design process includes one or more of the following:	• establishing design parameters and criteria • research, measurement, experimentation and investigation • generating ideas • synthesis, problem-solving and decision-making, and addressing constraints • techniques: • scientific principles • calculation and graphics • prototyping • mock-up • selecting components and hardware • evaluating solutions against design criteria • consultation, adjustments and agreement • finalising design and sign-off.
Design criteria includes one or more of the following:	• function and fit for purpose • aesthetics • manufacturability and maintainability • sustainability • cost constraints • ergonomics, anthropometrics and physiology • facilities, plant, services and skills available

	WHS and risk.
Sustainability includes:	- 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.
Life cycle analysis includes one or more of the following:	- improving sustainability of products and services - all aspects of manufacture of a single product - the entire operations of an organisation - a particular aspect of operations including environmental implications.
Appropriate licensed technical and professional assistance includes one or more of the following:	- technical support and advice relating to elements which have intrinsic dangers - professional support for technologies.
WHS, regulatory requirements and enterprise procedures include:	- WHS acts, regulations and 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.
Prototyping includes:	- mock-ups - physical and virtual modelling with post-processing for computer numeric control (CNC) and rapid prototyping.
Results to be reported and supporting information include one or more of the following:	- investigations - application of principles and techniques - calculations - specifications - diagrams - CAD files - mock-ups or prototypes of designs.

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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM14088A Apply maintenance engineering techniques to equipment and component repairs and modifications.

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 MEM14088 Apply maintenance engineering techniques to equipment and component repairs and modifications

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Performance Evidence

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

- following work instructions, standard operating procedures (SOPs) and safe work practices
- communicating, negotiating and reviewing maintenance brief with stakeholders
- determining or confirming scientific principles and design techniques, design specification requirements and work health and safety (WHS) and regulatory requirements
- evaluating multiple solutions
- investigating life cycle design, sustainability, technical and professional assistance required, and maintenance alternatives for repairs and modifications on at least two occasions
- planning, scheduling and coordinating maintenance task on at least two occasions
- solving problems and making decisions with systems thinking for contingencies and constraints, and continuous improvement
- defining designs, specifying, documenting and applying techniques on at least two occasions
- selecting components and hardware
- creating and maintaining adequate and accurate calculations and design process records
- reporting and documenting results on at least two occasions.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

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)
- factors that determine maintenance requirements
- sustainability implications of maintenance processes, materials and products, including consideration of life cycle analysis
- design and planning processes, criteria and techniques

- concurrent engineering techniques, systems thinking, problem-solving and decision-making, and continuous improvement methods
- WHS acts and regulations, codes of practice, standards, registration and risk assessment for design, maintenance and prototyping activities
- procedures for planning, scheduling and coordination of maintenance design
- sources of professional and technical assistance
- typical maintenance criteria including:
 - strength and serviceability of repairs compared to original
 - function and aesthetics
 - maintainability and manufacturability
 - preventative maintenance evaluation criteria including mean time between failure (MTBF) and failure mode effects analysis (FMEA)
 - required quality, cost and sustainability
- design calculation techniques
- typical maintenance design requirements of various industries
- typical repairs, parts, skills and maintenance processes
- hardware specifications and catalogues
- typical maintenance plant, equipment and tools
- plant condition and maintenance assessment techniques
- typical maintenance techniques and technologies for monitoring, preventative maintenance, online and breakdown maintenance, disassembly, repair, reassembly and recommission
- design calculations layout and documentation for design checking and maintenance records
- design process documentation and reports, including specifications and CAD graphics
- software for maintenance planning and repair and modification design, including CAD and stress analysis software
- software and systems including system control and data acquisition (SCADA) and distributed control systems (DCS) for maintenance control and information distribution
- developments in repair and modification design
- options for mock-up, modelling and prototyping.
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying maintenance engineering techniques to equipment and component repairs and modifications 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 or its replacement and comply with the National Vocational Education and Training Regulator Act 2011, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory 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 that 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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