



Australian Government

MEM234003 Design machines and ancillary equipment

Release: 1

MEM234003 Design machines and ancillary equipment

Modification History

Release 1. Supersedes and is equivalent to MEM234003A Design machines and ancillary equipment.

Application

This unit of competency defines the skills and knowledge required to design significant machinery and ancillary equipment for domestic, commercial, industrial, medical, military or entertainment purposes. It includes consideration of sustainability implications, work health and safety (WHS) requirements, product analysis and product life cycle design as part of the process of investigating and generating ideas. It also includes use of software, modelling and calculations, prototype completion, manufacture and evaluation.

Design activities can also consist of reverse engineering, design rectification or modifications of an existing design. Activities can be the design of specific machine elements such as shafts, bearings, brakes, clutches, springs, pressure vessels, flywheels, and can also be a selection of ancillary equipment such as motors, pumps and valves.

This unit applies to individuals working as a Principal Technical Officer or in an equivalent engineering-related position who are required to design machines and ancillary equipment.

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

Pre-requisite Unit

Nil

Competency Field

Engineering science

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. Clarify the design task and elaborate the specification	1.1 Establish required features of machine and ancillary equipment in consultation with client 1.2 Determine parameters of the brief or contract 1.3 Determine stakeholders to be consulted in design process 1.4 Assess WHS, regulatory, sustainability or environmental issues

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	relevant to design task 1.5 Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility
2. Perform design analysis and prepare concept proposals	2.1 Carry out initial investigations and measurements 2.2 Use current industrial design techniques and carry out required modelling and calculations using appropriate software 2.3 Generate solutions that respond to the design brief 2.4 Check feasibility and evaluate solutions against design criteria, ensuring conformity to standards and codes, technical, economic and WHS requirements 2.5 Determine social and sustainability implications of solutions 2.6 Review concept proposals with client and identify preferred solution
3. Design machines and equipment	3.1 Finalise selected machine or equipment design and ensure preparation of all required documentation, drawings, specifications and instructions 3.2 Consult with client and stakeholders to obtain sign-off on design 3.3 Monitor installation and commissioning with stakeholders and make any necessary adjustments to design

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.

Parameters of the design brief include:	- determination of the degree of innovation and creativity expected by the client - design process limits and budgets
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	• product cost limits and budgets • performance specifications • equipment availability, capacities and restrictions • specified administrative, communication and approval procedures • other special features and limits in the design brief.
WHS, regulatory, sustainability and environmental issues include:	• WHS acts, regulations and relevant standards • industry codes of practice • risk assessments • registration requirements • safe work practices • 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 • state and territory regulatory requirements.
Solutions include those which:	• satisfy the technical requirements of the design brief • are within budget • are able to be manufactured • meet any regulatory requirements • minimise environmental and sustainability impacts.
Current industrial design techniques include:	• sustainability and energy conservation • life cycle design and recyclable components • maintainability, manufacturability and reliability • use of current codes and standards and risk minimisation • developments in design techniques and design software along with software validation techniques.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM234003A Design machines and ancillary equipment.

Links

Companion Volume Implementation Guides are available on VETNet -

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

Assessment Requirements for MEM234003 Design machines and ancillary equipment

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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:

- determining features of machines and equipment
- determining work health and safety (WHS), regulatory and risk management requirements
- interpreting parameters of the brief or contract
- researching current design trends and sustainability implications
- investigating options for machine and equipment design on at least two occasions
- innovating and creating solutions
- generating design solutions on at least two occasions
- measuring, modelling, calculating and analysing using software and validation techniques
- evaluating solutions for feasibility against design criteria
- communicating, negotiating and reviewing with stakeholders and client throughout the process to obtain agreement of proposal and sign-off on design.

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:

- contemporary engineering design methods
- design brief parameters
- research and investigation methods
- techniques for:
 - continuous improvement
 - problem-solving and decision-making
 - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- engineering design software options
- software validation processes
- documentation, drawings, specifications and instructions

- WHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- machine element assembly arrangements and methods
- fastening and sealing methods
- gear design standards and techniques
- strength and stress analysis
- shaft design including:
 - forces, stresses and deflections of coil springs
 - stresses in thick-walled pressurised vessels and cylinders subject to shrink and press fitting
 - disk, hydraulic and cone clutches
 - velocity and acceleration analysis of mechanisms
 - ergonomics principles
 - materials selection
 - failure modes.
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Assessment Conditions

- Assessors must:
 - have vocational competency in designing machines and ancillary 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 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.
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