



Australian Government

MEM14087 Apply manufactured product design techniques

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Modification History

Release	Comments
2	Metadata updated.
1	This unit of competency was first released in MEM Manufacturing and Engineering Release 3.0.

Application

This unit of competency defines the skills and knowledge required to apply engineering design techniques to manufactured products or components including documentation of the design process. Documentation may include calculations, specifications, computer-aided design (CAD) files, risk analysis, sustainability and life cycle assessments. It is suitable for people working at a technician level in a manufactured product design work environment and applies to people working individually or as part of a team.

Licensing/Regulatory Information

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

Pre-requisite unit(s)

MEM14089 Integrate mechanical fundamentals into an engineering task

MEM23004 Apply technical mathematics

MEM23063 Select and organise mechanical engineering material tests

MEM23109 Apply engineering mechanics principles

Competency field(s)

Planning

Unit sector(s)

N/A

Elements and Performance Criteria

Elements	Performance criteria
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<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 1.3 Use appropriate personal protective equipment (PPE) in accordance with SOPs 1.4 Identify job requirements from specifications
2. Investigate manufactured product design requirements	2.1 Review product design brief with stakeholders 2.2 Determine engineering and scientific principles and design techniques required for product design process 2.3 Investigate life cycle design and sustainability implications of design requirement 2.4 Determine required specification, documentation and graphical techniques to define design 2.5 Confirm WHS and other regulatory requirements 2.6 Identify codes, standards and risk management requirements 2.7 Investigate software requirements for product design process
3. Apply manufactured product design techniques	3.1 Plan, schedule and coordinate the design task 3.2 Analyse available materials, components, manufacturing processes, tooling and suppliers against design requirements 3.3 Create adequate and accurate calculations and preliminary graphics, and maintain design process records 3.4 Evaluate multiple solutions against design criteria, risk, failure mode, sustainability and cost 3.5 Apply systems thinking, problem-solving and decision-making techniques in dealing with contingencies and constraints in the continuous improvement and development of design options 3.6 Incorporate required professional and technical assistance 3.7 Finalise specification and documentation according to requirements of the design
4. Report results	4.1 Record results of investigations, application and development of design

	4.2 Provide supporting documentation that includes accurate and comprehensive details about techniques used
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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.
Context of manufactured product design includes:	• budget and market considerations • technological advantages and disadvantages of materials, equipment and suppliers • resources supply, including materials, labour and skills • sustainability issues relevant to design task, including WHS, risk management, standards and codes of practice.
Planning processes include one or more of the following:	• establishing design parameters and design criteria • contributing to the negotiation and advice process • preliminary planning, design 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 and developing proposals • synthesis, problem-solving, decision-making and addressing constraints • techniques: ○ scientific principles ○ calculation and graphics ○ prototyping ○ mock-up ○ evaluating solutions against design criteria ○ review and revision of design in consultation with stakeholders ○ finalising design and sign-off.
Design criteria includes one or more of the following:	• function • aesthetics • manufacturability and maintainability • marketability • sustainability, including life cycle analysis • cost constraints on costs of design, development, tooling up, manufacture, marketing and distribution • ergonomics, anthropometrics and physiology • facilities, plant and skills available • safety and risk.
Analysis includes one or more of the following:	• product and component performance requirements • assessment against manufacturing capability of organisation • failure mode effects and risk • static and dynamic analysis of loads • stresses and deformations resulting • graphical and mathematical methods and software options

	• suitability of materials for purpose and manufacturing process.
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 and regulations and relevant standards • industry codes of practice • risk assessments • registration requirements • safe work practices • state and territory regulatory requirements.
Results to be reported and supporting documentation include one or more of the following:	• investigations • application of principles and techniques • calculations • specifications • diagrams • CAD files • mock-ups

	• prototypes.
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Unit Mapping Information

Current Code and Title	Previous Code and Title	Comments	Equivalence
MEM14087 Apply manufactured product design techniques	MEM14087A Apply manufactured product design techniques		Equivalent

Assessment Requirements for MEM14087 Apply manufactured product design techniques

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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 design 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, materials and components, manufacturing processes, tooling and component supply chain for product
- investigating life cycle design and sustainability, technical and professional assistance required on at least two occasions
- planning, scheduling and coordinating the design task
- selecting design components using design process and scientific principles
- 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
- 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)
- context of manufactured product design
- planning and design processes
- sustainability implications of materials, product and processes, including consideration of life cycle analysis
- manufactured product design processes and techniques
- product analysis parameters
- systems thinking, problem solving and decision making, and continuous improvement methods
- WHS and regulatory requirements, standards and risk assessment for design and prototyping activities
- sources of professional and technical assistance procedures for planning, scheduling and coordination of design
- typical product design criteria
- design calculation techniques
- product planning and design software including for CAD, stress analysis and project management
- design process documentation, records and reports, including specifications and CAD graphics
- typical materials and components used in manufacturing
- tooling, plant and processes for particular products and materials
- characteristics of cast, forged, machined and sheet metal components, moulded and extruded plastic components, and components made from other materials or by other processes produced by the organisation
- professional and technical assistance for product development
- prototyping options, including mock-ups, physical and virtual modelling, and rapid prototyping.

Assessment Conditions

- Assessors must:
 - have vocational competency in applying manufactured product design techniques 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.

Link

Companion volumes, including implementation guides, are found on the national training register - <https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=45a7f1d5-61a5-447a-9688-7abbd7e1a5c7>.