



Australian Government

MEM09157A Perform mechanical engineering design drafting

Release: 1

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Modification History

Release 1 New unit. Replaces MEM09141A but not equivalent.

Unit Descriptor

This unit of competency covers the preparation of design drawings or graphics used in the mechanical engineering, manufacturing engineering and related industry sectors. The unit includes working with a design brief or concept prepared by an engineer or other designer as well as the specification of items, functions, limits, fits, tolerances, and other engineering information required for the eventual production of fully detailed drawings. The unit requires the design drawing to be performed using appropriate computer-aided design (CAD) and other drafting techniques that include sketching, computer graphics and the application of drawing standards.

Application of the Unit

This unit applies to the undertaking of designated design tasks and the specification in design drawings and graphics of mechanical plant, products, projects, system changes or improvements in domestic, commercial, industrial, agricultural, medical, military or entertainment industries. For ease of reference the term 'drawing' is used in this unit.

The design drawing is normally undertaken at the direction of an engineer, scientist or other designer who will pass on a concept brief to the design draftsman. The concept brief may be a sketch, hard copy plan or document, or a CAD generated file. The unit requires design drawings to be produced using appropriate CAD software. Depending on the task or project, production or supervision of hard copy drawings may also be required.

The unit also includes supervision of detailed drawing production and managing of requests for further information from detailed draftspersons.

This may require completion of appropriate engineering design or evaluation units from the MEM05 Metal and Engineering Training Package depending on the design drawing task and previous industrial experience.

This unit does not cover the production of detailed drawings (often known as shop drawings). Where detailed drawing skills are required the relevant MEM detailed drawing units should be selected.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

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

1	Clarify the design drawing task	1.1	Receive design drawing brief and check completeness of information
		1.2	Confirm software and file formats to be used for design drawings with designer and detail draftspersons
		1.3	Determine stakeholders to be consulted in design drawing process
		1.4	Assess work health and safety (WHS), regulatory, sustainability or environmental issues relevant to design task
		1.5	Confirm design drawing brief and provide preliminary advice on feasibility
2	Produce mechanical or maintenance engineering-related drawings	2.1	Determine range of engineering drawings required
		2.2	Produce orthogonal drawings of mechanical components and assemblies to relevant standards using appropriate computer graphical techniques
		2.3	Produce 3-D images of mechanical components and assemblies to relevant standards using computer graphical techniques
		2.4	Determine and apply required dimensioning, tolerancing for limits and fits, surface finish and weld symbols, and

- other required graphical convention information appropriate to mechanical or maintenance engineering applications
- 2.5 Seek technical and professional assistance or clarification of design information, as required.
- 2.6 Confirm final range of design drawings to be produced with designer, detail draftspersons and other stakeholders
- 3 Provide final drawings files and documents
- 3.1 Submit final design drawings for sign-off by designer or specified authority
- 3.2 Prepare CAD files for export to detailer
- 3.3 Provide documentation, drawings, data files and clearances according to job requirements and enterprise drawing management system and procedures

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|---|---|-----|---|
| 4 | Supervise
production of
detail drawings | 4.1 | Supervise production of detail drawings |
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Required Skills and Knowledge

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

Required skills

Required skills include:

- reviewing mechanical or maintenance engineering applications for required features, functions and context of engineering design drawings
- determining the range of design drawings required, including:
 - design drawings specified by designer and other requests (e.g. from clients and regulators)
 - models, views and sections required to indicate assembly, function, dimensions and materials
 - design drawings required to clearly indicate engineering design specifications to detailer
- using CAD systems, comparing and selecting available software, functions and features appropriate to the design drawing task
- developing orthographic, isometric and other 3-D graphical representations
- representing mechanical components and assemblies using sketching and computer graphics
- representing mechanical components and features using a comprehensive range of standard conventions and graphical techniques
- representing a range of mechanical assemblies using standard graphical representations
- selecting and applying design criteria to meet requirements of the design brief
- engaging appropriate licensed technical and professional assistance for advice, as required, and reporting results of review and the application of graphics techniques
- providing documentation, images and files according to job and enterprise procedures

Required knowledge

Required knowledge includes:

- application of the role of engineering design, design drawing and detail drawing in mechanical and maintenance engineering tasks and projects, such as:
 - design specifications
 - mechanical and maintenance procedures
 - technical specifications and descriptions
- availability and features of standards related to mechanical plant and devices, design,

maintenance and alteration

- AS 1100 Technical drawing, and means of locating and referencing other relevant standards
- availability and features of standards related to mechanical plant and devices, design, maintenance and alteration
- application of relevant standard for mechanical designs
- methods of representing mechanical components and assemblies using sketching and computer graphics, including all relevant symbols, conventions, abbreviations, and so on
- current and traditional methods of documentation generation and control:
 - computer library files
 - reference charts and catalogue information
 - manual drawing
 - generation of orthogonal images from models
- worksite procedures for the processing and filing of graphics, specifications and operating and maintenance instructions/manuals
- WHS and regulatory requirements, codes of practice, risk assessment and registration requirements relevant to mechanical and maintenance applications

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 produce a variety of graphical representations of mechanical and maintenance-related assemblies and components that are consistent with design information and relevant standards and conventions.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • select and apply design criteria to meet requirements of the design brief • review features, functions and context of engineering drawings • develop orthographic, isometric and other 3-D graphical representations • represent mechanical components and assemblies using sketching and computer graphics • represent mechanical components and features using a comprehensive range of standard conventions and graphical techniques • represent a range of mechanical assemblies using standard graphical representations • recognise when to engage appropriate licensed technical and professional assistance for advice • provide documentation, images and files.
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.

Designer	A designer is usually a professional engineer but may also be a scientist, engineering technologist, architect or other person with appropriate skills and knowledge for the design task. The term may also refer to situations where a team of designers are used to produce a design
Design drawing brief	The design drawing brief will be communicated to the design draftsman and will include: • major and critical engineering specifications (e.g. dimensions, limits, fits, tolerances and materials) • required features and performance of equipment (e.g. volume, temperature and flow)

	- standards that must be adhered to - client requests - budget and project schedule - procedures to be followed for further clarifications
Design drawings	Design drawings is used in this unit to include all 3-D and 2-D files and hard copies produced as part of the design drawing process
Design criteria for mechanical designs	Criteria for mechanical designs may include: - function - aesthetics - manufacturability and maintainability - marketability - sustainability: - social, economic and environmental - material and energy resources - cost constraints - ergonomics, anthropometrics and physiology - facilities, plant and skills available - safety and risk
Appropriate licensed technical and professional assistance	Appropriate licensed 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 - industry codes of practice - risk assessments - registration requirements

	• safe work practices • state and territory regulatory requirements applying to electrical work
Mechanical assemblies	Mechanical assemblies may include: • machines, drives and transmissions • materials handling equipment (e.g. belt conveyors, augers and pneumatic conveyors) • guards, handrails and platforms • structures, vessels and tanks • fan, ventilation, air conditioning service and ducting • manufacturing plant and process layouts • manufactured products
Mechanical components and features represented by standard conventions and graphical techniques	Mechanical components and features represented by standard conventions and graphical techniques may include: • hole basis, shaft basis and keyway tolerances and fits • dimensions, tolerances for limits and fits • materials and surface finish • weld symbols • webs, cross-sections and cutting planes • chain drives, gear sets, pulley and belt drives • threads, fasteners and springs • shafts, keyways and splines • structural sections
Features, functions and context of engineering design drawing	Features, functions and context of engineering design drawing include: • uses of design drafting for purposes, such as: • design specifications • production specifications • maintenance procedures • technical specifications and descriptions • graphical representation techniques, including orthogonal, 2-D and 3-D modelling, isometric and mechanical perspective, dimensioning, limits and fits, welding and other standard symbols • role of WHS and regulatory requirements, codes of practice, ministerial directives, risk assessment and registration requirements • availability and features of a range of standards related to mechanical plant and devices, design, maintenance and alteration • typical criteria for mechanical designs

	• software developments • current graphical methods compared with traditional methods • emerging developments in graphics and related engineering software
Standards and codes	This refers to all relevant Australian and international standards and codes applicable to a particular design task

Unit Sector(s)

Competency field

Unit sector Drawing, drafting and design

Custom Content Section

Not applicable.