



Australian Government

MEM09158A Perform mechatronics engineering design drafting

Release 1

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Modification History

Release 1 - New unit. Replaces MEM09142A, but not equivalent.

Unit Descriptor

This unit of competency covers the preparation of design drafting for mechatronic 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 drafting. The unit requires the design drafting to be performed using appropriate computer-aided design (CAD) and other drafting techniques that include sketching, computer drafting and the application of drawing standards.

Application of the Unit

This unit applies to the undertaking of designated design tasks and the specification in mechatronic or automated plant, products, projects, and related system changes or improvements.

The design drafting 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 drafting 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 draftsmen.

This unit may require completion of appropriate engineering design or evaluation units from the MEM05 Metal and Engineering Training Package depending on the design drafting 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 drafting brief and check completeness of information
		1.2	Confirm software and file formats to be used for design drafting with designer and detail draftspersons
		1.3	Determine stakeholders to be consulted in design drafting 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 mechatronic related drawings	2.1	Determine range of engineering drawings required
		2.2	Produce orthogonal drafting of mechatronic components and assemblies to relevant standards using appropriate computer graphical techniques
		2.3	Produce 3-D images of mechatronic 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 mechatronic engineering applications
		2.5	Produce graphical representations and circuit diagrams for fluid, electrical and electronic control systems in

- accordance with the design brief
- 2.6 Seek technical and professional assistance or clarification of design information, as required.
- 2.7 Confirm final graphical representations with professional engineering staff and other stakeholders
- 3 Provide final drafting, 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

4	Supervise production of detail drafting	4.1	Supervise production of detail drafting
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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 mechatronic engineering applications for required features, functions and context of mechatronic engineering design drawings
- determining the range of design drafting required, including:
 - design drafting 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 drafting required to clearly indicate engineering design specifications to detailer
- using CAD systems, comparing and selecting available software, functions and features appropriate to the design task
- developing orthographic, isometric and other 3-D graphical representations
- representing mechatronic components and assemblies using sketching and computer graphics
- representing mechatronic components and features using a comprehensive range of standard conventions and graphical techniques
- representing a range of mechatronic 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
- providing documentation, images and files according to job and enterprise procedures

Required knowledge

Required knowledge includes:

- application of the role of engineering design, design drafting and detail drafting in mechatronic tasks and projects, such as:
 - design specifications
 - mechatronic manufacture and maintenance procedures
 - technical specifications and descriptions
 - physical arrangement of mechanical, fluid, electrical and control elements
 - diagrammatic layouts of control circuits

- actuator sequence and logical signal diagrams
- graphical representation techniques
- WHS and regulatory requirements, codes of practice, risk assessment and registration requirements relevant to mechatronic applications
- application of relevant standards for mechatronic design
- worksite procedures for the processing and filing of drafting, specifications and operating and maintenance instructions/manuals
- methods of representing mechatronic 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
 - generation of orthogonal images from models
- manual drawing

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 mechatronic-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 mechatronic engineering drafting • develop orthographic, isometric and other 3-D graphical representations • represent mechatronic components and assemblies using sketching and computer graphics • represent mechatronic components and features using a comprehensive range of standard conventions and graphical techniques • represent a range of mechatronic 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 drafts person 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)

	• control requirements and control methods • electrical and fluid power specifications • 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 mechatronic designs	Criteria for mechatronic 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 • automation 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
Features, functions and context of engineering design drafting	Features, functions and context of engineering design drafting includes: • 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 mechatronic designs • software developments • emerging developments in graphics and related engineering software
Mechatronic components and features represented by standard conventions and graphical techniques	Mechatronic components and features represented by standard conventions and graphical techniques may include: • hole basis, shaft basis and keyway tolerances and fits • dimensioning, tolerancing 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 • surface finishes and welds • electric motors and fluid power actuators • electrical, electronic, electro fluid controls • electrical and electronic circuit components
Mechatronic assemblies	Mechatronic assemblies may include: • robots • automated mechanisms and machines • materials handling equipment (e.g. belt conveyors, augers and pneumatic conveyors) • fan, ventilation, air conditioning service and ducting • manufacturing plant and process layouts • manufactured product with embedded controller • automated machines, drives and transmissions

	• automated materials handling equipment (e.g. belt conveyors, augers and pneumatic conveyors) • guards, handrails and platforms for automated systems • automated fan, ventilation and air conditioning systems • automated manufacturing plant and process layouts • mechatronic devices and products
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
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.