Australian Government

Department of Education, Employment and Workplace Relations

MEM09214A Perform advanced engineering detail drafting

Release: 1

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Modification History

Release 1 - New unit of competency

Unit Descriptor

This unit of competency covers producing assembly, sectioned drawings and specialised dimensioning and auxiliary views to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, or equivalent. It includes determining and applying tolerances and dimensions, as required, to complete engineering detail drawing.

Application of the Unit

Skills covered by this unit are applied individually or in a team environment where comprehensive responsibility for the production of the drawing is exercised, and critical dimensions and associated tolerances are determined, where required.
This may include tolerancing and dimensioning for location, form, orientation, profile and runout and includes geometric tolerancing and use of modifiers. Drawings and all tolerances and dimensions are to AS 1100.101–1992 Technical drawing – General principles.
Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

Licensing/Regulatory Information

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

Pre-Requisites

MEM09002B	Interpret technical drawing
MEM09204A	Prepare basic engineering detail drawings
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment

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. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

1	Prepare for drawing work	1.1	Check purpose, scope and presentation requirements for drawing task
		1.2	Determine the information requirements for the finished part or item and its interaction with the next level of assembly or process
		1.3	Undertake requests for further information (RFI) to designer where information cannot be obtained or calculated
		1.4	Identify relevant standards and terminology, symbols and notation required to comply with standard and design
		1.5	Prepare equipment and set up software for drawing work
2	Identify and apply dimensions and tolerances for drawing	2.1	Determine methods of general dimensioning and tolerancing, classes of fit and forms of geometric shapes from engineer, sketches or specifications
		2.2	Select dimensioning and tolerancing scheme and symbols consistent with standards and design requirements
		2.3	Identify and confirm datum points
		2.4	Apply the principles of general dimensioning to engineering drawing
		2.5	Apply the principles of general tolerancing engineering

			drawing
		2.6	Check that each dimension and tolerance symbol can be clearly interpreted for application
		2.7	If required, re-dimension toleranced drawing with new datum positions
		2.8	Extract information from dimensioned drawing
3	Prepare assembly, layout and detail drawings	3.1	Produce sectioned third angle orthogonal assembly drawings
		3.2	Project a primary auxiliary view
		3.3	Produce finished assembly drawings complete with material/part/cutting lists, cross-referencing and any required dimensions (overall and centre-to-centre)
		3.4	Produce all drawings to AS 1100.101–1992 Technical drawing – General principles, or equivalent and enterprise presentation standards
		3.5	Check that all required tolerances and dimensions are on the drawing
		3.6	Apply workplace occupational health and safety (OHS) and environmental procedures
4	Select material, components and/or assemblies	4.1	Interpret specifications to determine material requirements
		4.2	Select components, material and/or assemblies from data sheets or manufacturer catalogues to meet specifications
		4.3	Produce bill of materials
5	Complete drawing work	5.1	Verify drawing compliance with specifications
		5.2	Check drawings to ensure that assembly/fabrication is possible
		5.3	Document and save drawings according to enterprise filing system

Required Skills and Knowledge

Required skills

Required skills include:

- obtaining all relevant work instructions and requirements
- producing all drawings in accordance with AS 1100.101–1992 Technical drawing – General principles, or equivalent
- obtaining all relevant data sheets and catalogues
- calculating required limits, fits, datum references and geometric tolerances where they are not supplied from designer or reference material
- checking drawings for conformance to specification
- checking drawings to ensure that assembly/fabrication is possible
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- reading and selecting correct toleranced dimensions to meet the required class of limit or fit as selected by the engineer or other designer from the specifications
- applying symbols for:
  - dimensions
  - dimension origin
  - reference values
- applying tolerance symbols for:
  - datum identification
  - form
  - location
  - profile
  - runout
  - modifiers
- inserting or calculating geometric tolerances with regard to the roundness, straightness, flatness, concentricity, and so on, of an engineering component
- applying schedules and legends to the drawing
- converting between unilateral, bilateral and limit of size or direct tolerances
- applying tolerances to meet the individual fit classifications between a shaft and hole (clearance, interference and transition)
- determining part quantities and material lengths for inclusion in the parts/material/cutting list

Required knowledge

Required knowledge includes:

- specifications and/or requirements of the component, assembly or layout to be drawn
- functional operation of the component/assembly to be drawn
- surfaces which are to be in contact or separated
- appropriate type of fit for contacting surfaces
- reasons for selecting the chosen type of fit
- calculation methods for determining limits, fits, datum references and geometric tolerances
- effect of surface finish on the performance/operation of surfaces
- all appropriate lineal, diametric and geometric tolerances
- procedures for determining tolerances
- requirements of AS 1100.101–1992 Technical drawing – General principles, or equivalent for drawings to be produced
- specifications of the components, materials and/or assemblies
- appropriate components and materials from supplier/manufacturer catalogues
- reasons for selecting the chosen components and/or materials
- procedures for checking and approving drawings
- reasons for checking the drawings to ensure that manufacturing/assembly is possible, efficient and cost-effective
- drawing specifications
- methods of manufacture/assembly/fabrication from drawings
- unnecessary or inappropriate tolerances
- hazards and control measures associated with performing advanced engineering detail drafting, including housekeeping
- safe work practices and procedures
- engineering features, terminology and abbreviations
- hatching techniques such as large sections, small sections, thin sections and designation of materials
- sectioning systems, such as revolved section, removed section, local or part section, offset section, aligned section and interposed section
- types of bearings
- sectioning conventions, such as screw threads, shafts and rods, webs and thin sections
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- role of datum points in dimensioning and tolerancing a detail engineering drawing
- RFI process for project or enterprise
- symbols used for dimensioning
- symbols used for tolerancing

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 perform advanced engineering detail drafting techniques to produce assembly, sectioned drawings and specialised dimensioning and auxiliary views to AS 1100.101–1992 Technical drawing – General principles, or equivalent.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts. Specifically the candidate must be able to: • work within typical site/teamwork structures and methods • apply worksite communication procedures • comply with organisational policies and procedures, including quality requirements • participate in work meetings • comply with quality requirements • use industry terminology • apply appropriate safety procedures • perform required calculations to determine tolerances and fits required to meet design requirements • produce drawings to AS 1100.101–1992 Technical drawing – General principles, with all components identified.
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, that is the candidate is not in productive work, then an appropriate simulation 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. The assessment environment should not disadvantage the candidate. This unit could be assessed in conjunction with any

	other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced engineering detail drafting or other units requiring the exercise of the skills and knowledge covered by this unit.
Method of assessment	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Range Statement

Equivalent standard	Equivalent standard may include: • AS 1654.1–1995 ISO system of limits and fits – Bases of tolerances, deviations and fits
Dimensioning	Dimensioning may include: • symbols • lines • numerical value • linear • angular • diameter • radius • not to scale (NTS) • auxiliary • reference • common feature • tabular presentation • squares • holes • screw heads • tapers/slope • profiles • notes
Tolerancing	Tolerancing may include: • basic dimension • bilateral • unilateral • zone • datum • tolerance grade • datum feature
Symbols used for tolerancing	Symbols used for tolerancing may include, but are limited to: • datum identification • form • location • profile • runout • modifiers

Symbols used for dimensioning	Symbols used for dimensioning may include, but are not limited to: • diameter • square • counterbore • countersink • depth • dimension origin • reference value • slope • taper • radius • spherical radius
Condition	Condition may include: • fit • limits of size • fundamental deviation • allowance • maximum material condition • least material condition

Geometry tolerancing	Geometry tolerancing may include:
	• virtual condition and size
	• geometric reference frame
	• principle of independency
	• tolerance (form, profile, orientation and position)
	• characteristics, including:
	  • straightness
	  • flatness
	  • circularity
	  • cylindricity
	  • profile
	  • squareness
	  • parallelism
	  • angularity
	  • runout
	• tolerance indication method
	• projected tolerances
	• statistical value tolerances

Assembly drawing types	Assembly drawing types may include:

	• general assembly • detailed assembly • layout drawings • installation drawings • erection diagrams • shop and field assemblies • pictorial exploded drawings

Information from dimensioned drawing	Information from dimensioned drawing may include:
	• limits of size
	• fundamental deviation
	• allowance
	• tolerance, including:
	  • maximum material condition
	  • least material condition
	  • fit

Drawings	Drawings must include: • accurate representation, including any necessary hidden detail of the specific assembly • border, title block and projection symbols • accurate line work • appropriately positioned views • hatching to AS 1100.101–1992 Technical drawing – General principles specifications (sectioned third angle orthogonal assembly drawings) • correct use of terminology and abbreviations
Auxiliary projection	Auxiliary projection (primary views only) may include: • purpose for auxiliary projection • planes of projection • projection involving circular components • border, title block and projection symbols

Unit Sector(s)

Drawing, drafting and design

Custom Content Section

Not applicable.