



Australian Government

Department of Education, Employment and Workplace Relations

MEM09210A Create 3-D solid models using computer-aided design (CAD) system

Release: 1

MEM09210A Create 3-D solid models using computer-aided design (CAD) system

Modification History

Release 1 - New unit of competency

Unit Descriptor

This unit covers preparing the 3-D computer-aided drafting (CAD) environment, creating and modifying 3-D solid models, and producing output from the 3-D model.

Application of the Unit

This unit is suitable for those working within a drafting work environment and may be applied across a range of engineering disciplines. This unit applies to the production of 3-D solid models using CAD modelling software. Operations at this level include, but are not limited to, the creation and manipulation of entities, such as arcs, lines and primitives, such as spheres, cones, cylinders and boxes. It includes the use of region and solid modelling techniques, section views, and pre-drawn library files. Work also includes extraction of properties and application of basic rendering techniques.

This unit includes applications in CAD, computer graphics and animation, rapid prototyping, medical testing and visualisation of scientific research.

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

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

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	Determine solid modelling requirements	1.1	Check purpose, scope and information requirements for modelling task
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and apply relevant codes, standards and symbols relevant to work
		1.5	Consult appropriate personnel to ensure the work is coordinated effectively with others involved in the project
		1.6	Obtain and apply workplace occupational health and safety (OHS) and environmental procedures for work
2	Prepare 3-D environment	2.1	Apply workplace procedures to retrieve and manipulate required information and navigate computing technology
		2.2	Set up a 3-D environment on the screen to allow multiple viewing
		2.3	Create 3-D views on the screen by manipulating drawing planes and inserting 3-D geometric shapes
		2.4	Establish coordinate system and orientation according to job requirements
		2.5	Determine and exploit key features of solid modelling software package

- | | | | |
|---|-------------------------------|-----|---|
| 3 | Produce output from 3-D model | 3.1 | Perform drawing for solid modelling |
| | | 3.2 | Exploit features of modelling software to optimise productivity |
| | | 3.3 | Extract physical properties to job requirement, including volume, mass and centre of gravity |
| | | 3.4 | Apply rendering techniques |
| | | 3.5 | Produce 3-D drawings incorporating section views with all necessary annotation |
| | | | |
| 4 | Complete CAD operations | 4.1 | Confirm model accurately reflects specifications, is presented according to work requirements and contains all relevant information |
| | | 4.2 | Save and file drawing elements according to organisational procedure |
| | | 4.3 | Evaluate work and identify areas for improvement |
| | | 4.4 | Close applications, perform CAD housekeeping and maintain organisational filing system |

Required Skills and Knowledge

Required skills

Required skills include:

- using computing technologies and navigating software
- obtaining relevant job instructions and specifications
- creating the appropriate entities in 3-D space
- manipulating the entities in 3-D space
- creating swept, extruded and revolved solids in 3-D space
- modifying, where appropriate, existing 3-D models
- saving drawing files in the appropriate format
- extracting the physical properties of shapes created in 3-D space from the drawing file to meet job requirements
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task-related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- creating intelligent models using parametric modelling
- producing composite models (composite regions and composite solids)
- producing sectioned models (cutting planes and cross hatching)
- using pre-drawn library files and primitives to produce a 3-D model
- extracting mass and area properties from solid model
- applying rendering techniques to a 3D model (rendering types and preferences, render lighting techniques, and views and scenes)
- using various materials and surface finish options
- producing hard copies of 3-D solid models
- saving 3-D models in various file formats for retrieval into other CAD application software
- producing orthogonal detail drawings of components on standard drawing sheets to a recognised drafting scale

Required knowledge

Required knowledge includes:

- purpose for which the 3-D model is to be developed
- appropriate coordinate system for the job
- reasons for selecting the chosen coordinate system
- orientation of the model with respect to the coordinate system
- number of views required to establish the model
- procedures for creating entities in 3-D space

- the entities that can be created/manipulated in 3-D space
- procedures for manipulating entities in 3-D space
- procedures for creating swept, extruded and revolved solids in 3-D space
- applications of swept, extruded and revolved solids
- procedures for modifying existing 3-D models
- rendering types and preferences, render lighting techniques, views and scenes
- procedures for saving drawing files
- the various formats in which drawing files can be saved
- reasons for using different formats when saving drawing files
- procedures for extracting data with respect to the physical properties of shapes created in 3-D space
- the physical properties of shapes created in 3-D space that can be extracted from the drawing file
- hazard and control measures associated with using CAD system, including housekeeping
- safe work practices and procedures
- terminology associated with solid modelling (region modelling, solid modelling, and wire frame, as opposed to solids)
- region modelling techniques (creating a region primitive and editing regions)
- solid modelling techniques (creating solid primitives, editing solid primitives, and conversion from region to solid models)

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 create 3-D models using CAD systems.
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 • select and use 3-D CAD software to create solid models that meet design specifications.
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 creating 3-D models using CAD systems 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

Solid modelling task	Solid modelling task may include: • terminology • region modelling • solid modelling • parametric modelling • composite models • section models • library files and 3-D primitives • other relevant software packages for the production of 3-D models • mass and area properties • rendering techniques • material finishes • production of hard copies • saving and retrieval of files of varying formats • consolidation (e.g. project work)
Rendering techniques	Rendering techniques may include: • rendering types and preferences • render lighting techniques • views and scenes
Appropriate personnel	Appropriate personnel may include: • supervisor • leading hand • foreman • manager • site engineer • trainer • mentor • teacher • team member
OHS requirements	OHS requirements may include: • legislation • personal protective equipment • material safety management systems • hazardous substances and dangerous goods code • awards provisions • safe work practices

Environmental requirements	Environmental requirements may refer to: • liquid waste • solid waste • gas, fume, vapour, and smoke emissions, including fugitive emissions • excessive energy and water use • excessive noise
Resource requirements	Resource requirements may include: • computer software • stationary • software reference documentation • reference texts • consumables • computer • printing equipment

Unit Sector(s)

Drawing, drafting and design

Custom Content Section

Not applicable.