

Unit 061

Producing CAD models (drawings) using a CAD system

Level: 2

Credit value: 11

NDAQ number: 500/9514/6

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided modelling system to produce detailed three-dimensional models for engineering activities. It will prepare the learner for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or it will provide a basis for the development of additional skills and occupational competences in the working environment.

The learner will be given a specific 'model' brief or a request for a change/modification to a model, and they will be required to access these requirements and to extract all necessary information in order to carry out the modelling operations. The learner will need to select the appropriate equipment and modelling software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to produce models in a 3D modelling environment, and to print 2D and 3D prints or plots.

On completion of the modelling activities, the learner will be expected to return all documentation, reference manuals or specifications to the designated location, to shut down the CAD system correctly, and to leave the work area in a safe and tidy condition.

The learner's responsibilities will require them to comply with health and safety requirements and organisational policy and procedures for working with the CAD equipment. The learner will need to take account of any potential difficulties or problems that may arise with the computer hardware, software or drawing procedures, and to seek appropriate help and advice in determining and implementing a suitable solution. The learner will work under a high level of supervision, whilst taking responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide an understanding of their work, and will enable them to apply appropriate computer aided drawing procedures and techniques for 3D modelling and conventional mechanical and production engineering drawings. The learner will understand the modelling CAD system and software used, and its application, and will know about the various tools and techniques used to produce the models and drawings, to the required depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the computer modelling/drawing system. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Produce CAD models (drawings) using a CAD system
2. Know how to produce CAD models (drawings) using a CAD system

Guided learning hours

It is recommended that **61** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from national occupational standard Performing Engineering Operations Unit No. 61: Producing CAD models (drawings) using a CAD system (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by Semta.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from Semta's website:

http://www.semta.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's Performing Engineering Operations Level 2 unit assessment strategy which can be downloaded from Semta's website:

http://www.semta.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit specific additional assessment requirements:

In order to prove their ability to combine different 3D modelling features, at least one of the models/drawings produced must be of a significant nature. It must involve a minimum of five of the operations listed in assessment criteria 1.12, and must include a minimum of seven of the features listed in assessment criteria 1.13.

Unit 061 Producing CAD models (drawings) using a CAD system

Outcome 1 Produce CAD models (drawings) using a CAD system

Assessment criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
2. prepare the CAD system for operation, by carrying out all of the following:
 - check that all the equipment is correctly connected and in a safe and usable working condition (such as cables undamaged, correctly connected, safely routed)
 - power up the equipment and activate the appropriate modelling software
 - set up the modelling environment and select a suitable template/folder
 - set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter)
 - set the drawing datum at a convenient point (where applicable)
 - create a modelling template to the required standards, which includes all necessary detail (such as title, file/drawing number, material, date)
3. plan the modelling activities before they start them
4. use appropriate sources to obtain the required information for the model to be created
5. use **three** of the following to obtain the necessary data to produce the required model:
 - model brief/request
 - change order/modification request
 - manuals
 - calculations
 - sketches
 - specifications
 - regulations
 - sample component
 - previous models/designs
 - other available data
 - standards reference documents (such as limits and fits, tapping drill charts)
 - notes from meetings/discussions
6. take into account **three** of the following, as appropriate to the model being produced:
 - function
 - quality
 - manufacturing method
 - ergonomics
 - materials
 - cost
 - lifetime of the product

- tolerances
 - clearance
 - aesthetics
 - physical space
 - operating environment
 - interfaces
 - safety
7. carry out all of the following before producing the engineering model:
- ensure that the data and information they have is complete and accurate
 - review the data and information to identify the model requirements
 - recognise and deal with problems (such as lack of, or incorrect, information and technical issues)
8. access and use the correct modelling software
9. use appropriate techniques to create models that are sufficiently and clearly detailed
10. use **one** of the following modelling tools:
- surface modelling
 - solid modelling
 - wire frame modelling
11. use all of the following CAD operations to highlight design areas in the modelling environment:
- pan
 - isometric
 - zoom
12. produce models which include the use of the following from the part feature menu:
- constrained parts
- Plus **eight** more from the following:
- extrude
 - revolve
 - hide
 - fillet
 - shell
 - solid model
 - wire frame
 - rib
 - cut/remove
 - mirror
 - radius
 - rectangular pattern
 - circular pattern
13. modify parts in the assembly environment using the following feature:
- constrained parts and assemblies
- Plus **eight** more from the following:
- straight lines
 - dimensions
 - angular surfaces
 - text
 - surface texture

- insertion of standard components
 - symbols and abbreviations
 - curved surfaces
 - circles or ellipses
 - material colour
 - hidden detail
 - hatching and shading
 - parts lists
 - other specific detail
14. produce the following to provide sufficient detail for manufacture:
- 3D isometric or model view to provide a pictorial view
- Plus **one** more from the following:
- first angle 2D drawings (2 or 3 views) with dimensions
 - third angle 2D drawings (2 or 3 views) with dimensions
 - the most informative model that could be dimensioned
15. use codes and other references that follow the required conventions
16. produce models which comply with one or more of the following:
- organisational guidelines
 - statutory regulations and codes of practice
 - CAD software standards
 - BS and ISO standards
 - other international standard
17. make sure that models are checked and approved by the appropriate person
18. save the models in the appropriate file type and location
19. save and store models in appropriate locations, to include carrying out all of the following:
- ensure that their model has been checked and that it complies to their company QA procedure
 - check that the model is correctly titled, referenced and annotated
 - save the model to an appropriate storage medium (such as hard drive, disc, CD, external storage device)
 - create a separate backup copy, and place it in safe storage
 - register and store the models in the appropriate company information system (where appropriate)
 - record and store any changes to the models in the appropriate company information system (where appropriate)
20. produce hard copies of the finished models, with sufficient detail to allow production
21. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve
22. shut down the CAD system to a safe condition on completion of the modelling activities

Unit 061 Producing CAD models (drawings) using a CAD system

Outcome 2 Know how to produce CAD models (drawings) using a CAD system

Assessment criteria

Underpinning knowledge

The learner will be able to:

1. describe the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment such as lighting, seating, positioning of equipment; repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)
2. describe the importance of good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)
3. describe the relevant sources and methods for obtaining any required technical information relevant to the model being produced (such as drawing briefs, specification sheets, request for changes or modifications to models; technical information such as limits and fits, contraction allowances, bearing selection, surface finish)
4. describe the identification of the correct 3D drawing software package from the menu or windows environment; the various techniques that are available to access and use the CAD software (such as mouse, menu or tool bar, light pens, digitisers and tablets, printers or plotters, and scanners)
5. describe the correct start-up and shutdown procedures to be used for the computer systems
6. explain how to access the specific computer modelling software to be used, and the use of the help file to aid efficient operation of the relevant drawing system
7. explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)
8. describe the documentation required for particular applications (such as design briefs, specification sheets, request for change orders)
9. describe the types of drawings that may be produced by the modelling software
10. explain how to set up the viewing screen to show multiple views of the component to help with drawing creation (to include isometric front and side elevations)
11. describe the national, international and organisational standards and conventions that are used for the models/drawings
12. describe the application and use of modelling tools (such as for straight lines, curves and circles; how to add dimensions and text to drawings)
13. explain how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment
14. describe the applications of different 3D modelling programmes (such as surface, solid and wire frame)
15. describe the need for document control (such as ensuring that completed models are approved, labelled and stored on a suitable storage medium)
16. explain why it is necessary to be able to recall previous issues of modified models
17. describe the need to create backup copies, and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production

18. explain how to produce hard copies of the drawings, and the advantages and disadvantages of printers and plotters
19. explain when to act on their own initiative and when to seek help and advice from others
20. describe the importance of leaving the work area and equipment in a safe condition on completion of the drawing activities (such as correctly isolated, removing and disposing of waste)