

# SEMPEO2-61 - SQA Unit Code FP49 04

## Producing CAD models (drawings) using a CAD system



### Overview

This standard covers a broad range of basic competences that you need, to set up and operate a computer aided drawing (CAD) system to produce detailed three-dimensional models for engineering activities. It will prepare you 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.

You will be given a specific 'model' brief or a request for a change/modification to a model, and you will be required to access these requirements and to extract all necessary information in order to carry out the modelling operations. You 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. You 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, you 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.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for working with the CAD equipment. You 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. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide an understanding of your work, and will enable you to apply appropriate computer aided drawing procedures and techniques for 3D modelling and conventional mechanical and production engineering drawings. You 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.

You will understand the safety precautions required when working with the computer modelling/drawing system. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to

## SEMPEO2-61 - SQA Unit Code FP49 04

### Producing CAD models (drawings) using a CAD system

---

yourself and others in the workplace.

#### **Specific Standard Requirements**

In order to prove your 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 scope 7, and must include a minimum of **seven** of the features listed in scope 8.

## SEMPEO2-61 - SQA Unit Code FP49 04

### Producing CAD models (drawings) using a CAD system

---

#### Performance criteria

- You must be able to:*
- P1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
  - P2 plan the modelling activities before you start them
  - P3 use appropriate sources to obtain the required information for the model to be created
  - P4 access and use the correct modelling software
  - P5 use appropriate techniques to create models that are sufficiently and clearly detailed
  - P6 use codes and other references that follow the required conventions
  - P7 make sure that models are checked and approved by the appropriate person
  - P8 save the models in the appropriate file type and location
  - P9 produce hard copies of the finished models, with sufficient detail to allow production
  - P10 deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve
  - P11 shut down the CAD system to a safe condition on completion of the modelling activities

# SEMPEO2-61 - SQA Unit Code FP49 04

## Producing CAD models (drawings) using a CAD system

---

### Knowledge and understanding

*You need to know and understand:*

- K1 the specific safety precautions to be taken when working with computer systems (to include 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)
- K2 the importance of good housekeeping arrangements (such as cleaning down work surfaces; putting storage devices, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)
- K3 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)
- K4 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)
- K5 the correct start-up and shutdown procedures to be used for the computer systems
- K6 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
- K7 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)
- K8 the documentation required for particular applications (such as design briefs, specification sheets, request for change orders)
- K9 types of drawings that may be produced by the modelling software
- K10 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)
- K11 the national, international and organisational standards and conventions that are used for the models/drawings
- K12 the application and use of modelling tools (such as for straight lines, curves and circles; how to add dimensions and text to drawings)
- K13 how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment
- K14 the applications of different 3D modelling programmes (such as surface, solid and wire frame)

## **SEMPEO2-61 - SQA Unit Code FP49 04**

### **Producing CAD models (drawings) using a CAD system**

---

- K15 how to produce models with sufficient information to allow them to be successfully exported to the manufacturing system used
- K16 the need for document control (such as ensuring that completed models are approved, labelled and stored on a suitable storage medium)
- K17 why it is necessary to be able to recall previous issues of modified models
- K18 the need to create backup copies, and to file them in a separate and safe location , also filing and storing hard copies for use in production
- K19 how to produce hard copies of the drawings, and the advantages and disadvantages of printers and plotters
- K20 when to act on your own initiative and when to seek help and advice from others
- K21 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)

# SEMPEO2-61 - SQA Unit Code FP49 04

## Producing CAD models (drawings) using a CAD system

---

### Additional Information

#### Scope/range related to performance criteria

*You must be able to:*

1. Prepare the CAD system for operation, by carrying out **all** of the following:
  - 1.1 check that all the equipment is correctly connected and in a safe and usable working condition (such as cables undamaged, correctly connected, safely routed and PAT tested)
  - 1.2 power up the equipment and activate the appropriate modelling software
  - 1.3 set up the modelling environment and select a suitable template/folder
  - 1.4 set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter)
  - 1.5 set the drawing datum at a convenient point (where applicable)
  - 1.6 create a modelling template to the required standards, which includes all necessary detail (such as title, file/drawing number, material, date)
  
2. Use **three** of the following to obtain the necessary data to produce the required model:
  - 2.1 model brief/request
  - 2.2 specifications
  - 2.3 change order/modification request
  - 2.4 regulations
  - 2.5 manuals
  - 2.6 sample component
  - 2.7 calculations
  - 2.8 previous models/designs
  - 2.9 sketches
  - 2.10 notes from meetings/discussions
  - 2.11 standards reference documents (such as limits and fits, tapping drill charts)
  - 2.12 other available data
  
3. Take into account **three** of the following, as appropriate to the model being produced:
  - 3.1 function
  - 3.2 cost

## SEMPEO2-61 - SQA Unit Code FP49 04

### Producing CAD models (drawings) using a CAD system

---

- 3.3 physical space
  - 3.4 quality
  - 3.5 lifetime of the product
  - 3.6 operating environment
  - 3.7 manufacturing method
  - 3.8 tolerances
  - 3.9 interfaces
  - 3.10 ergonomics
  - 3.11 clearance
  - 3.12 safety
  - 3.13 materials
  - 3.14 aesthetics
4. Carry out **all** of the following before producing the engineering model:
- 4.1 ensure that the data and information you have is complete and accurate
  - 4.2 review the data and information to identify the model requirements
  - 4.3 recognise and deal with problems (such as lack of, or incorrect, information and technical issues)
5. Use **one** of the following modelling tools:
- 5.1 surface modelling
  - 5.2 solid modelling
  - 5.3 wire frame modelling
6. Use **all** of the following CAD operations to highlight design areas in the modelling environment:
- 6.1 pan
  - 6.2 isometric
  - 6.3 zoom
7. Produce models which include the use of **eight** the following from the part feature menu:
- 7.1 extrude
  - 7.2 solid model
  - 7.3 mirror
  - 7.4 revolve
  - 7.5 wire frame
  - 7.6 radius
  - 7.7 hide
  - 7.8 rib
  - 7.9 rectangular pattern
  - 7.10 fillet
  - 7.11 cut/remove
  - 7.12 circular pattern

# SEMPEO2-61 - SQA Unit Code FP49 04

## Producing CAD models (drawings) using a CAD system

---

- 7.13 shell
- 7.14 other specific feature
  
- 8. Modify parts in the assembly environment using the following feature:
  - 8.1 constrained parts and assemblies
  - Plus **eight** more from the following:
    - 8.2 straight lines
    - 8.3 insertion of standard components
    - 8.4 hidden detail
    - 8.5 dimensions
    - 8.6 symbols and abbreviations
    - 8.7 hatching and shading
    - 8.8 angular surfaces
    - 8.9 curved surfaces
    - 8.10 parts lists
    - 8.11 text
    - 8.12 circles or ellipses
    - 8.13 material colour
    - 8.14 surface texture
    - 8.15 other specific detail
  
- 9. Produce a model for export to one of the following manufacturing systems:
  - 9.1 CNC machine
  - 9.2 3D printer
  - 9.3 other specific system
  
- 10. Save and store models in appropriate locations, to include carrying out **all** of the following:
  - 10.1 ensure that your model has been checked and that it complies to your company QA procedure
  - 10.2 check that the model is correctly titled, referenced and annotated
  - 10.3 save the model to an appropriate storage medium (such as hard drive, DVD, external storage device)
  - 10.4 create a separate backup copy, and place it in safe storage
  - 10.5 register and store the models in the appropriate company information system (where appropriate)
  - 10.6 record and store any changes to the models in the appropriate company information system (where appropriate)
  
- 11. Produce models which comply with **one** or more of the following:
  - 11.1 organisational guidelines
  - 11.2 statutory regulations and codes of practice
  - 11.3 CAD software standards
  - 11.4 BS and ISO standards



## **SEMPEO2-61 - SQA Unit Code FP49 04**

### **Producing CAD models (drawings) using a CAD system**

---

11.5 other international standard

## SEMPEO2-61 - SQA Unit Code FP49 04

### Producing CAD models (drawings) using a CAD system

---

**Developed by** SEMTA

**Version number** 2

**Date approved** December 2011

**Indicative review date** December 2016

**Validity** Current

**Status** Original

**Originating organisation** SEMTA

**Original URN** 61

**Relevant occupations** Engineering and manufacturing technologies; Engineering;

**Suite** Performing Engineering Operations Suite 2

**Key words** engineering, engineering operations, producing CAD models, CAD system, manufacturing, modelling operations, 3D modelling, software, engineering drawings, drawing procedures