
Overview

This standard identifies the competences you need to set up and operate a computer aided drawing (CAD) system to produce three-dimensional (3D) drawings, in accordance with approved procedures. You will be given a detailed drawing brief or a request for change/modification order, and you will be required to access these requirements and to extract all necessary information, in order to carry out the drawing operations. You will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. You will be expected to set up co-ordinate systems in 3D space, set up the screen into split views to show true 3D views (isometric) and plan views. You will then be expected to produce both surface and solid models, and to understand their differences and applications. You will use boundary modelling techniques, as well as graphic primitives, to produce your models, and you will apply Boolean operations to construct the solid models. Your responsibilities will require you to comply with organisational policy and procedures for working in the drawing office or CAD suite. You will be required to report any problems with the computer hardware, software or drawing procedures that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work to verbal or written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. Your underpinning knowledge will provide a good understanding of your work and will provide an informed approach to applying computer aided drawing procedures. You will understand the 3D CAD system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate 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 CAD system. You will be required to demonstrate safe working practices throughout and will understand the responsibility you owe to yourself and others in the workplace.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation and other relevant regulations, directives and guidelines
2. prepare the system for operation, and obtain data from relevant sources
3. produce drawings that are sufficient and clearly detailed
4. produce drawings in the required formats
5. use codes and other references that follow the required conventions
6. make sure that drawings are checked and approved within agreed timescales by authorised people
7. ensure drawings are properly saved, registered and stored securely
8. ensure that changes are completed as required by organisational procedures

Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken when working with computer systems (to include such items as safety guidance relating to the use of visual display unit (VDU) equipment and workstation environment, repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)
2. how to return the work area to a safe and useable condition (such as cleaning down work surfaces; putting mobile/social digital devices, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)
3. the basic set-up and operation of the 3D drawing system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner, mobile devices)
4. the correct start-up and shutdown procedures to be used for the computer system
5. how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system
6. 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)
7. the importance of protecting the computer system from viruses, and the implications if the correct procedure is not followed
8. the documentation required for specified applications (such as design briefs, specification sheets, request for change orders)
9. types of drawings that may be produced by the software
10. 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. the national, international and organisational standards and conventions that are used for the drawings
12. how to set up the drawing template parameters (such as layer properties, scale, paper size, colour set-up, line types, dimensioning system, dimensional styles, text styles, table styles, multileader styles)
13. the application and use of drawing tools (such as for straight lines, arcs and

circles, rectangles, polygons, ellipse; how to create hatching and shading on drawings; using the layer properties function)

14. how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment

15. the applications of different 3D modelling programmes (such as surface, solid and wire frame)

16. the different projections used to create 3D drawings (such as isometric, oblique, orthographic, perspective planometric, assembly)

17. the application of different co-ordinate measurements used to create 3D drawings (such as Cartesian, spherical and cylindrical)

18. the display views that can be used on 3D drawings (such as view co-ordinate geometry and object co-ordinate geometry)

19. the application and use of drawing tools for surface or solid modelling; how to modify drawings using surface/solid modelling tools or Boolean operations; how to add dimensions and text to drawings

20. the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location, filing and storing hard copies for use in production)

21. the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings

22. the sources and methods for obtaining the required technical information relevant to the drawing being produced (such as limits and fits, contraction allowances, bearing selection, surface finish)

23. the basic principles of engineering manufacturing operations, assembly and installation methods and limitations of the equipment/processes that are used to produce the drawn item (such as machining methods, joining processes, fabrication, casting and forging), and how these can influence the way you present the drawing

24.

the functionality of the component and how it operates with other components and assemblies

25.

the extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve when producing the drawings

Scope/range

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 is in a safe, tested and usable condition (cables undamaged, correctly connected, safely routed)
- 1.2 power up the equipment and activate the drawing software
- 1.3 set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter)
- 1.4 set up the viewing screen to show multiple views of the components (this will involve isometric, front and side elevations)
- 1.5 set the drawing datum at a convenient point (where applicable)
- 1.6 set up drawing parameters to include layers, line types, colour, text styles to company procedures or to suit the drawing produced
- 1.7 create a drawing template to required standards, which includes all necessary detail

2.

Use three of the following to obtain the necessary data to produce the required drawings:

- 2.1 drawing 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 drawings/designs
- 2.9 sketches
- 2.10 notes from meetings/discussions
- 2.11 other available data

3.

Take into account eight of the following as appropriate to the drawing being produced:

- 3.1 function
- 3.2 cost
- 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 standard parts/components
- 3.13 materials
- 3.14 aesthetics
- 3.15 safety
- 3.16 other design features

4.

Carry out all of the following before producing the engineering drawing:

- 4.1 ensure that specifications and information are complete and accurate
- 4.2 review the specifications and information to identify the drawing requirements
- 4.3 recognise and deal with problems (information based and technical)

5.

Use two of the following modelling tools:

- 5.1 surface modelling
- 5.2 solid modelling
- 5.3 wire frame modelling

6.

Use two of the following co-ordinate measurements to produce 3D models:

- 6.1 cartesian
- 6.2 cylindrical
- 6.3 spherical

7.

Produce and modify 3D drawings, using two of the following tools and techniques:

- 7.1 graphic primitives (dumb solid(s))
- 7.2 surface/solid modifying tools
- 7.3 boundary techniques
- 7.4 Boolean operations

8.

Produce drawings using two of the following methods of projection:

- 8.1 isometric
- 8.2 perspective
- 8.3 oblique
- 8.4 planometric
- 8.5 orthographic

9.

Produce drawings which include ten of the following:

- 9.1 straight lines
- 9.2 insertion of standard components
- 9.3 hatching and shading
- 9.4 dimensions
- 9.5 curved surfaces
- 9.6 sectional detail

- 9.7 angular surfaces
- 9.8 circles or ellipses
- 9.9 parts lists
- 9.10 text
- 9.11 hidden detail
- 9.12 symbols and abbreviations
- 9.13 other specific detail

10.

Save, register and store drawings in appropriate locations, to include carrying out all of the following:

- 10.1 ensure that your drawing has been checked and approved by the appropriate person/s
- 10.2 check that the drawing is correctly titled and referenced
- 10.3 save the drawing to an appropriate storage medium
- 10.4 create a separate backup copy and place it in safe storage
- 10.5 produce a hard copy printout of the drawing for file purposes (where required)
- 10.6 register and store the drawings in the appropriate company information system
- 10.7 record and store any changes to the drawings, and reasons for the changes in the appropriate organisation information system

11.

Produce drawings which comply with one 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
- 11.5
other international standards

SEMETS305

Producing engineering drawings/models using 3D computer aided techniques



Developed by	Enginuity
Version Number	3
Date Approved	30 Mar 2021
Indicative Review Date	01 Mar 2024
Validity	Current
Status	Original
Originating Organisation	Enginuity
Original URN	SEMETS305
Relevant Occupations	Engineering, Engineering and Manufacturing Technologies, Engineering Technicians
Suite	Engineering Technical Support Suite 3
Keywords	Engineering; technical; support; producing; drawings; models; 3D; computer aided; CAD; isometric
