
Overview

This standard identifies the competences you need to set up and operate a computer aided drawing (CAD) system to produce fully detailed drawings for engineering systems/services activities, such as water distribution, waste water, environmental control, refrigeration, heating and ventilation, air conditioning and ventilation, gas distribution, plant and equipment, compressed air, process control, and instrumentation and control, in accordance with approved procedures. The types of drawing produced will include circuit diagrams, block diagrams, schematics, assembly and installation, and system design/modification. 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 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 use current British, European, International and company standards to produce a drawing template, for a range of paper sizes that must include the drawing title, scale used, date of drawing, and other relevant information. You will then be expected to produce fully detailed drawings to enable the systems/services to be installed, commissioned, maintained or modified.

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/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 for engineering systems/service drawings. You will understand the computer 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 computer

drawing 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 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 (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. how to return the work area to a safe and useable condition (such as cleaning down work surfaces; putting media, 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 computer systems, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)
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 drawing briefs, specification sheets, request for change orders)
9. types of engineering system/service drawings that may be produced by the software (such as circuit diagrams, block and schematic diagrams, assembly and installation drawings, fault diagnosis diagrams)
10. the national, international and organisational standards and conventions that are used for the drawings
11. how to set up the drawing template parameters (such as layer properties, scale, paper size, colour set up, line types, dimension system, dimensional styles, text styles, table styles, multileader styles)

12. the application and use of drawing tools (such as for straight lines, arcs and circles, rectangles, polygons, ellipse; how to add dimensions and text to drawings, using the layer properties function)
13. how to access, recognise and use a wide range of standard component symbol libraries from the CAD equipment
14. the factors to be taken into account when producing engineering system/service drawings (such as safety requirements, operating parameters of components, position of components in relation to other sources or circuits, possibility of external interference)
15. an understanding of the system/service equipment and circuits being drawn, and the function of the equipment and individual components within the system/service (such as mechanical, electrical, fluid power, instrumentation and control components)
16. the selection of the various components, pipes and hoses being used, with regard to such items as pipeline contents, pressure capabilities or heat properties
17. the need to follow regulations/codes of practice with regard to colour coding/identifying the contents of the pipelines
18. the use of specific regulations and standard reference tables when selecting cables, pipes, hoses and other service/system components
19. how pipelines or cables might become damaged or obstruct movement, and the need to consider this in siting and routeing the pipes and cables
20. the selection of the various electrical components and cables being used, with regard to their operating ranges and current carrying capacity
21. the use of specific regulations and standard reference tables when selecting electrical components and cables (such as IET wiring regulations)
22. the constraints laid down by existing national and international legislation, statutory and non-statutory regulations, industry and national standards, industry guidelines and professional codes that regulate engineering system/service drawing/design activities
23. 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)
24. the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings
- 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 the drawing system to be able to produce the drawing to the appropriate scale
- 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 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 the 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 statutory regulations
- 2.5 manuals
- 2.6 previous drawings/designs
- 2.7 calculations
- 2.8 sketches
- 2.9 standards reference documents (such as pipe and tube tables, fluid power component catalogues)
- 2.10 notes from meetings/discussions
- 2.11 other available data

3.

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

- 3.1 function
- 3.2 cost
- 3.3 operating environment
- 3.4 ergonomics
- 3.5 position of equipment
- 3.6 lifetime of the product
- 3.7 connections between equipment/components
- 3.8 tolerances

- 3.9 operating conditions (such as pressure, temperature, air flow)
- 3.10 aesthetics
- 3.11 type of fluid power components (such as pipework, valves)
- 3.12 physical space
- 3.13 types of electrical components (such as cables, relays, switches)
- 3.14 interfaces
- 3.15 types of mechanical plant or components (such as pumps, valves, machines)
- 3.16 safety
- 3.17 types of instrumentation/control equipment (gauges, meters, monitoring)
- 3.18 other specified design features

4.

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

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

5.

Produce drawings for one of the following engineering systems/services:

- 5.1 fresh water distribution
- 5.2 gas distribution
- 5.3 heating and ventilation
- 5.4 waste water
- 5.5 refrigeration
- 5.6 air conditioning and ventilation
- 5.7 environmental control
- 5.8 compressed air
- 5.9 instrumentation and control
- 5.10 process control
- 5.11 emergency power generation
- 5.12 plant and equipment

6.

Produce three of the following types of engineering system/service drawings:

- 6.1 circuit diagrams
- 6.2 schematics
- 6.3 service drawings
- 6.4 piping and tubing layouts
- 6.5 system drawings
- 6.6 installation/commissioning
- 6.7 block diagrams

7.

Produce engineering system/service drawings which include twelve of the following:

- 7.1 straight lines
- 7.2 connection/termination details
- 7.3 dimensions

- 7.4 service supplies
- 7.5 angled lines
- 7.6 type and size of pipes and hoses
- 7.7 text
- 7.8 symbols and abbreviations
- 7.9 insertion of standard mechanical components, plant or equipment
- 7.10 characteristics of the system/service
- 7.11 insertion of standard electrical components
- 7.12 curved/contour lines
- 7.13 insertion of standard fluid power components
- 7.14 circles or ellipses
- 7.15 insertion of standard instrumentation/process control equipment
- 7.16 hidden detail
- 7.17 fault diagnostics (such as fault trees, flow diagrams)
- 7.18 parts lists
- 7.19 installation/commissioning details
- 7.20 other specific service/system detail

8.

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

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

9.

Produce drawings which comply with one of the following:

- 9.1 organisational guidelines
- 9.2 statutory regulations and codes of practice
- 9.3 CAD software standards
- 9.4 BS and ISO standards
- 9.5 other international standards

SEMETS310

Producing engineering systems/services drawings using computer aided techniques



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