
Overview

This standard identifies the competences you need to set up and operate a computer aided drawing (CAD) system to produce or modify fully detailed drawings for electrical or electronic engineering activities, in accordance with approved procedures.

The drawings produced will be relatively straightforward and uncomplicated, and are likely to be based on existing drawings but will require some changes (such as changes to circuit layout, changes or upgrading of components, change in connecting devices or wiring, dimensional differences), and will include circuit and wiring diagrams, block diagrams, schematics, printed circuit board layouts, electrical cabling/routeing, installation, assembly of panels and sub-assemblies.

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 be expected to use current British, European and company standards to produce the drawing template and to carry out the drawing activities.

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 that are outside your permitted authority, to the relevant people. You will be expected to work to instructions, either alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying the appropriate computer aided drawing procedures for the production or modification of electrical or electronic engineering drawings. You will understand the 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. produce/modify drawings that are sufficiently and clearly detailed
2. produce/modify drawings in the required formats
3. use codes and other references that follow the required conventions
4. make sure that drawings are checked and approved within agreed timescales by authorised people
5. ensure that drawings are properly registered and stored securely
6. 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 CAD systems (to include items such 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. good housekeeping arrangements (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 correct start up and shutdown procedures to be used for the computer systems
4. how to identify and select the correct drawing software package from the on-screen menu or graphical equivalent; 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. 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)
6. the importance of protecting the computer system from viruses, and the implications if the correct procedure is not followed
7. the sources and methods for obtaining any required technical information relevant to the drawing being produced (such as drawing briefs, request for changes or modifications to drawings; sketches of circuits, technical information, current carrying capacity of wires/cables, component selection catalogues)
8. types of electrical/electronic drawing that may be produced by the software (such as circuit and wiring diagrams, block and schematic diagrams, circuit board layouts and circuit board assembly, assembly and installation drawings)
9. the national, international and organisational standards and conventions that are used for the drawings
10. how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour setup, line types, dimension system and text styles)
11. the application and use of drawing tools (such as for straight lines, curves and circles); how to add dimensions and text to drawings, producing layers of drawings
12. how to access, recognise and use a wide range of standard electrical/electronic component and symbol libraries from the CAD equipment

13. the factors to be taken into account when producing electrical/electronic drawings (such as safety requirements, operating parameters of components, position of components in relation to other sources or circuits, possibility of external interference)
14. a basic understanding of the electrical/electronic equipment and circuits being drawn and the function of the individual components within the circuits
15. the selection of the various components and cables being used with regard to their operating ranges and current carrying capacity
16. the use of specific regulations and standard reference tables when selecting components and cables (such as BS7671/IET wiring regulations)
17. the basic calculations that may be required to be carried out to verify the acceptability of components and circuits (such as Ohm's Law)
18. 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
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the extent of your own responsibility, and to whom you should report to if you have problems that you cannot resolve when producing the drawings

Scope/range related to performance criteria

1. Prepare the CAD system for operation, by carrying out **all** of the following:
 1. power up the equipment and activate the drawing software
 2. set up the drawing system to be able to produce the drawing to the appropriate scale
 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)
 4. set the drawing datum at a convenient point (where applicable)
 5. set up drawing parameters (to include layers, lines type, colour, text styles) to company procedures or to suit the drawing produced (where appropriate)
 6. create a drawing template to the required standards, to include all necessary detail (such as title, drawing number, scale, material, date)
2. Produce/modify drawings for **one** of the following activities:
 1. electrical engineering
 2. electronic engineering
3. Use **three** of the following to obtain the necessary data to produce the required drawings:
 1. drawing brief/request
 2. sketches
 3. previous drawings/designs
 4. change order/modification request
 5. electrical regulations
 6. notes from meetings/discussions
 7. standard reference documents (such as for current carrying capacity of cables, component catalogues)
 8. calculations (such as Ohm's Law)
4. Take into account **four** of the following design features, as appropriate to the drawing being produced:
 1. function
 2. power supplies
 3. types of electrical or electronic components available
 4. operating voltages
 5. position/orientation of circuit elements/components

6. aesthetics
 7. connections between components
 8. physical dimensions of the circuit
 9. method of installation (such as conduit, trunking, traywork)
 10. connectors/test point access
 11. types of cable (such as PVC, wire armoured, mineral insulated)
 12. safety
 13. use of appropriate technology for circuit design (such as single sided, double sided, multilayer, flexi-rigid)
 14. signal integrity parameters (such as capacitance, inductance, resistance, insulation voltages)
 15. specified operating environment conditions (such as temperature, humidity, shock and vibration)
5. Carry out **all** of the following before producing the drawing:
1. obtain all the required data and information you need to produce the required drawing
 2. review the data and information to identify the drawing requirements
 3. recognise and deal with problems (information-based and technical)
6. Produce/modify **one** of the following types of drawing:
1. circuit diagram
 2. circuit board assembly
 3. wiring diagram
 4. general assembly drawing
 5. block diagram
 6. panel assembly
 7. schematic
 8. installation
 9. system/distribution drawing
 10. cable and routeing
 11. circuit board layout
 12. manufacture of cable looms
7. Produce/modify electrical/electronics drawings which include **ten** of the following:
1. straight and angled lines
 2. type and size of wires/cables
 3. curved/contour lines
 4. connection/termination details
 5. circles or ellipses
 6. test points
 7. dimensions

8. electrical/electronic symbols and abbreviations
9. text/parts lists
10. colour/component coding
11. insertion of standard electrical/electronic components
12. fault diagnostics (such as flow diagrams)
13. other specific electrical/electronic detail

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

1. ensure that your drawing has been checked and approved by the appropriate person/s
2. check that the drawing is correctly titled, referenced and annotated
3. save the drawing to an appropriate storage medium (such as hard drive, disc, external storage device)
4. create a separate backup copy and place it in safe storage
5. produce a hard copy printout of the drawing for file purposes (where required)
6. register and store the drawings in the designated company information system (where appropriate)
7. record and store any changes to the drawings, and reasons for the changes in the designated company information system (where appropriate)

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9. Produce/modify drawings which comply with **one** of the following:

1. organisational guidelines
2. CAD software standards
3. BS and ISO standards
- 4.

other international standard

SEMTS205

Producing/modifying electrical or electronic engineering drawings using a CAD system



Developed by	Enginuity
Version Number	2
Date Approved	28 Feb 2015
Indicative Review Date	30 Mar 2018
Validity	Current
Status	Original
Originating Organisation	Semta
Original URN	SEMTS2-05
Relevant Occupations	Engineering, Engineering and Manufacturing Technologies
Suite	Engineering Technical Support Suite 2
Keywords	Engineering; technical support; producing engineering drawings; modifying engineering drawings; CAD; electrical; electronic; circuit layout; circuit diagrams; wiring diagrams
