SEMPEO204 - SQA Unit Code J4HT 04

Producing mechanical engineering drawings using a CAD system

Overview

This standard covers a broad range of basic competences you need to set up and operate a computer aided drawing (CAD) system to produce detailed drawings for mechanical engineering activities. It will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or it will act as a basis for the development of additional skills and occupational competences in the working environment. The type of drawings produced will include detail component drawings for manufacturing, assembly and sub-assembly drawings, installation drawings, fault location aids such as flow diagrams, and modification drawings.

You will be given a specific drawing brief or a request for a change/modification to a drawing, 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, material to be used and other relevant information. You will then be expected to produce fully detailed drawings to enable the manufacture, assembly, installation or modification of the product to take place. On completion of the drawing 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 generating mechanical engineering 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, 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 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.

Specific Standard Requirements

In order to prove your ability to combine different drawing features, at least one of the drawings produced must be of a significant nature, and must have a minimum of **seven** of the features listed in scope 7.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines
2. plan the drawing activities before you start them
3. use appropriate sources to obtain the required information for the drawing to be created
4. access and use the correct drawing software
5. use appropriate techniques to create drawings, in the required formats, that are sufficiently and clearly detailed
6. use codes and other references that follow the required conventions
7. make sure that drawings are checked and approved by the appropriate person
8. save the drawings in the appropriate medium and location
9. produce hard copies of the finished drawings
10. 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
11. shut down the CAD system to a safe condition on completion of the drawing activities

Knowledge and understanding

You need to know and understand:

1. 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)
2. good housekeeping arrangements (such as cleaning down work surfaces; storage devices, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)
3. the methods and procedures used to minimise the chances of infecting a computer with a virus
4. the implications if the computer you are using does become infected with a virus and who to contact if it does occur
5. the relevant sources and methods for obtaining any required technical information relevant to the drawing being produced (such as drawing briefs, specification sheets, request for changes or modifications to drawings; technical information such as limits and fits, contraction allowances, bearing selection, surface finish)
6. 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
7. the functionality of the component being drawn, and its interrelationship with other components and assemblies
8. the correct start-up and shutdown procedures to be used for the computer systems
9. identification of the correct drawing software package from the menu or operating 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)
10. the use of software manuals and related documents to aid efficient operation of the relevant drawing system

11. 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)
12. types of drawings that may be produced by the software (such as first and third angle drawings, sectional elevations, isometric or oblique drawings)
13. how to set up the viewing screen to show multiple views of the drawing to help with drawing creation (to include isometric front and side elevations)
14. the national, international and organisational standards and conventions that are used for the drawings
15. 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)
16. the application and use of drawing tools (such as for straight lines, curves and circles; how to create hatching and shading on drawings; how to add dimensions and text to drawings; producing layers of drawings)
17. how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment
18. the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium)
19. how to save and store drawings, (such as determining document size; how to check that there is sufficient space to save the file in your chosen destination; saving and naming the file/drawing)
20. the need to create backup copies, and to file them in a separate and safe location
21. how to produce hard copies of the drawings, and the advantages and disadvantages of printers and plotters
22. when to act on your own initiative and when to seek help and advice from others
23. 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)

Scope/range related to performance criteria

1. Prepare the CAD system for operation by carrying out **all** of the following:
    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, PAT tested)
    2. power up the equipment and activate the appropriate drawing software
    3. set up the drawing system to be able to produce the drawing to the appropriate scale
    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)
    5. set the drawing datum at a convenient point (where applicable)
    6. set up drawing parameters (to include layers, line types, colour, text styles) to company procedures or to suit the drawing produced
    7. create a drawing template to the required standards, which includes all necessary detail (such as title, drawing number, scale, material, date)

2. Use **three** of the following to obtain the necessary data to produce the required drawings:
    1. drawing brief
    2. specifications
    3. drawing change or modification request
    4. regulations
    5. manuals
    6. sample component
    7. calculations
    8. existing drawings/designs
    9. sketches
    10. notes from meetings/discussions
    11. standards reference documents (such as limits and fits, tapping drill charts)
    12. other specific data

3. Take into account **three** of the following design features, as appropriate to the drawing being produced:
    1. function

2. materials
3. clearance
4. operating environment
5. quality
6. cost
7. aesthetics
8. interfaces
9. manufacturing method
10. life of the product
11. physical space
12. safety
13. ergonomics
14. tolerances

4. Carry out **all** of the following before producing the engineering drawing:
    1. ensure that the data and information you have is complete and accurate
    2. review the data and information to identify the drawing requirements
    3. recognise and deal with problems (such as information-based and technical)

5. Interpret and produce drawings, using **two** of the following methods of projection:
    1. first angle orthographic projections
    2. isometric/oblique projections
    3. third angle orthographic projections

6. Produce **two** of the following types of drawing:
    1. detail drawings
    2. sub-assembly drawings
    3. general arrangement drawings
    4. installation drawings

7. Produce mechanical drawings which include **ten** of the following:
    1. straight lines
    2. symbols and abbreviations
    3. hidden detail
    4. dimensions

5. curved/contour lines
6. sectional detail
7. angled lines
8. circles or ellipses
9. parts lists
10. text
11. geometrical tolerancing
12. insertion of standard components
13. other specific detail

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 your supervisor
    2. check that the drawing is correctly titled and referenced
    3. save the drawing to an appropriate storage medium (such as hard drive, CD/DVD, 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
    6. register and store the drawings in the appropriate company information system (where appropriate)
    7. record and store any changes to the drawings in the company information system (where appropriate)

9. Produce drawings which comply with the following:
    1. BS and ISO standards
       Plus **one** more from the following:
    2. organisational guidelines
    3. statutory regulations and codes of practice
    4. CAD software standards
    5. other international standard

Behaviours

Additional Information

You will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as:

- strong work ethic
- positive attitude
- team player
- dependability
- responsibility
- honesty
- integrity
- motivation
- commitment

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