SEMAE3185

Producing aeronautical mechanical engineering drawings using computer aided techniques

Overview

This standard identifies the competences you need to set up and operate a computer aided drawing (CAD) system to produce detailed drawings for aeronautical mechanical engineering activities, in accordance with approved procedures. The drawings produced will include detail component drawings for manufacturing, aircraft assembly and sub-assembly drawings, equipment installation drawings, fault location aids such as flow diagrams, and modification drawings. You will be given a detailed drawing brief or a request for change/modification order and you will be expected 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 use current British, European and company standards to produce a drawing template for a range of paper sizes, and 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.

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 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 the creation of aeronautical 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, 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 and other relevant regulations, directives and guidelines
2.
produce drawings that are sufficiently and clearly detailed

1.
prepare CAD system for operation using approved procedures
2.
produce 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 computer systems (to include such items as safety guidance relating to the use of display screen equipment (DSE) 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 set-up and operation of the computer systems, and the peripheral devices that are used (such as mouse, light pens, digitisers and tablets, printers or plotters, and scanners)
4. the correct startup and shutdown procedures to be used for the computer systems
5. the methods and procedures used to minimise the chances of infecting a computer with a virus
6. the implications if the computer you are using does become infected with a virus and who to contact if it does occur
7. 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; the use of access codes for personal files
8. 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)
9. the documentation required for particular applications (such as drawing briefs, specification sheets, request for change orders)
10. types of drawing that may be produced by the software (such as first and third angle drawings, sectional elevations, isometric or oblique drawings)
11. how to set up the viewing screen to show multiple views to help with drawing creation (to include isometric front and side elevations)

12. the national, international and organisational standards and conventions that are used for the drawings
13. how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set-up, line types, dimension system and text styles)
14. the application and use of drawing tools (such as for straight lines, curves and circles; hatching and shading on drawings; how to add dimensions and text to drawings, and layers to drawings)
15. how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment
16. the difficulties that can emerge in manufacturing processes because of poor drawings/design
17. the aeronautical mechanical equipment and structures being drawn, and the function of the individual components within the equipment/structure
18. the manufacturing processes used for producing the components being drawn
19. the use of specific regulations and standard reference tables when selecting mechanical components (such as rivets, mechanical fasteners, securing and locking devices)
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 away from possible corruption, 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 relevant sources and methods for obtaining any required technical information relevant to the drawing being produced (such as limits and fits, contraction allowances, bearing selection, surface finish)
23. 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 mechanical design activities
24. the 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
25. the functionality of the component and its interrelationship with other components and assemblies
26. the extent of your own responsibility and to whom you should report 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:

- 1.1 check that all the equipment is correctly connected and in a safe, tested and usable working 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, lines type, 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 (such as title, drawing number, scale, material, date)

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 standards reference documents (such as limits and fits, tapping drill charts, rivet dimensions)
- 2.12 other specific data

3.

Take into account six of the following design features, in relation to the drawing being produced:

- 3.1 function
- 3.2 materials
- 3.3 clearance
- 3.4 operating environment
- 3.5 quality
- 3.6 cost

3.7 aesthetics
3.8 interfaces
3.9 manufacturing method
3.10 lifetime of the product
3.11 physical space
3.12 safety
3.13 ergonomics
3.14 tolerances
3.15 other specific feature

4.

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

4.1 ensure that data and information are 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 mechanical engineering drawings for three of the following:

5.1 flaps
5.2 windows
5.3 mission consoles
5.4 stairs
5.5 under-floor structures
5.6 galleys
5.7 hatches
5.8 trunking/ducting
5.9 side structures
5.10 bulkheads
5.11 doors
5.12 engine nacelle
5.13 front fuselage section
5.14 avionics cabinets
5.15 cabin roof
5.16 box sections
5.17 centre fuselage section
5.18 floor
5.19 fin
5.20 tail plane
5.21 rear fuselage section
5.22 cockpit/cabin
5.23 nose
5.24 ailerons
5.25 mechanical components
5.26 wing
5.27 side structures
5.28 structural repairs
5.29 aircraft detail assemblies (such as stringers, frames, ribs, trays, skins, panels, tanks, brackets)

5.30 fluid power circuits/pipe layouts
5.31 other specific mechanical equipment

6.

Interpret and produce drawings using two of the following methods of projection:

6.1 first angle orthographic projections
6.2 isometric/oblique projections
6.3 third angle orthographic projections

7.

Produce two of the following:

7.1 detail drawings
7.2 general arrangement drawings
7.3 sub-assembly drawings

8.

Produce mechanical engineering drawings which include ten of the following:

8.1 straight lines
8.2 symbols and abbreviations
8.3 hidden detail
8.4 dimensions
8.5 curved/contour lines
8.6 sectional detail
8.7 angled lines
8.8 circles or ellipses
8.9 parts lists
8.10 text
8.11 geometrical tolerancing
8.12 insertion of standard components
8.13 other specific detail

9.

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

9.1 ensure that your drawing has been checked and approved by the appropriate person/s
9.2 check that the drawing is correctly titled and referenced
9.3 save the drawing to an appropriate storage medium
9.4
create a separate backup copy and place it in safe storage
9.5
produce a hard copy printout of the drawing for file purposes
9.6 register and store the drawings in the appropriate company information system
9.7 where appropriate, record and store any changes to the drawings in the appropriate company information system

10.

Produce drawings in compliance with one of the following:

10.1 CAD software standards
10.2 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
10.3 Ministry of Defence (MoD)
10.4 Military Aviation Authority (MAA)
10.5 Aerospace Quality Management Standards (AS)
10.6 Federal Aviation Authority (FAA)
10.7 BS, ISO or BSEN standards and procedures
10.8 customer standards and requirements
10.9 company standards and procedures
10.10 aircraft manufacturer's requirements

Behaviours

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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