Overview

This unit identifies the competences you need to set up and operate a computer aided drawing (CAD) system to produce or modify fully detailed drawings for engineering services or fluid power 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 layout, changes or upgrading of system components, changes in connecting devices or piping, additions to systems, etc). The drawings could include fresh and waste water distribution and control, environmental control, refrigeration, heating and ventilation, air conditioning and ventilation, gas distribution, compressed air, hydraulic and pneumatic systems, process control, and instrumentation and control.

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 producing or modifying drawings for engineering services or fluid power systems. 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.
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Performance criteria

You must be able to:

P1 produce drawings that are sufficiently and clearly detailed
P2 produce drawings in the required formats
P3 use codes and other references that follow the required conventions
P4 make sure that drawings are checked and approved within agreed timescales by authorised people
P5 ensure that drawings are properly registered and stored securely
P6 ensure that changes are completed as required by organisational procedures
Knowledge and understanding

You need to know and understand:

K1 the specific safety precautions to be taken when working with CAD systems (to include such things 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)

K2 good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)

K3 the correct start up and shutdown procedures to be used for the computer system

K4 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)

K5 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)

K6 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 - such as pipe bore size and flow rates, component selection catalogues)

K7 types of engineering service or fluid power drawing that may be produced by the software (such as circuit diagrams, block and schematic diagrams, assembly and installation drawings, fault diagnosis diagrams)

K8 the national, international and organisational standards and conventions that are used for the drawings

K9 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)

K10 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

K11 how to access, recognise and use a wide range of standard component and symbol libraries from the CAD equipment

K12 the factors to be taken into account when producing engineering service or fluid power drawings (such as safety requirements, operating
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parameters of components, position of pipes and components to avoid damage, etc)

K13  a basic understanding of the services or fluid power equipment and circuits being drawn, and the function of the equipment and individual components within the system

K14  the selection of the various components, pipes and hoses being used, with regard to such things as pipeline contents, pressure capabilities or heat properties

K15  the importance of following regulations/codes of practice with regard to colour coding/identifying the contents of the pipelines

K16  the use of specific regulations and standard reference tables when selecting cables, pipes, hoses and other service/system components

K17  how pipelines or cables might become damaged or obstruct movement, and the need to consider this in siting and routeing the pipes and cables

K18  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 electromagnetic sources, filing and storing hard copies for use in production

K19  the extent of your own responsibility, and to whom you should report if you have problems that you cannot resolve when producing the drawings
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**Additional Information**

**Scope/range related to performance criteria**

You must be able to:

1. prepare the CAD system for operation by carrying out all of the following:
   1.1 power up the equipment and activate the drawing software
   1.2 set up the drawing system to be able to produce the drawing to the appropriate scale
   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 the drawing datum at a convenient point (where applicable)
   1.5 set up drawing parameters (to include layers, lines type, colour, text styles) to company procedures or to suit the drawing produced (where appropriate)
   1.6 create a drawing template to the required standards, to include all necessary detail (such as title, drawing number, scale, material, date, etc)

2. produce/modify drawings for one of the following activities:
   2.1 fresh water distribution
   2.2 pneumatic circuits
   2.3 heating and ventilation
   2.4 waste water removal
   2.5 gas distribution
   2.6 air conditioning and ventilation
   2.7 environmental control
   2.8 refrigeration
   2.9 instrumentation and control
   2.10 process control
   2.11 compressed air
   2.12 plant and equipment layout
   2.13 hydraulic circuits
   2.14 emergency power generation
   2.15 vacuum system

3. use three of the following to obtain the necessary data to produce the required drawings:
   3.1 drawing brief/request
   3.2 specifications
   3.3 change order/modification request
   3.4 statutory regulations
   3.5 calculations
   3.6 previous drawings/designs
   3.7 sketches
   3.8 standards reference documents (such as pipe and tube tables,
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component catalogues)

3.9 notes from meetings/discussions
3.10 other available data

4. take into account four of the following design features, as appropriate to the drawing being produced:

4.1 function
4.2 cost
4.3 operating environment
4.4 ergonomics
4.5 position of equipment
4.6 lifetime of the product
4.7 connections between equipment/components
4.8 tolerances
4.9 operating conditions (such as pressure, temperature, air flow)
4.10 aesthetics
4.11 type of pipework to be used (such as ferrous, non-ferrous, plastic, clay)
4.12 physical space
4.13 types of component to be used (such as pumps, valves, gauges, meters)
4.14 safety

5. carry out all of the following before producing the engineering drawing:

5.1 obtain all the required data and information you need to produce the required drawing
5.2 review the data and information to identify the drawing requirements
5.3 recognise and deal with problems (information-based and technical)

6. produce/modify one of the following types of engineering service or fluid power drawing:

6.1 circuit diagram
6.2 schematic
6.3 installation/commissioning drawing
6.4 piping and tubing layout
6.5 system drawing
6.6 block diagram
6.7 service drawing

7. produce/modify engineering system/service drawings which include eight of the following:

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

8. save 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, referenced and annotated
   8.3 save the drawing to an appropriate storage medium (such as hard drive, disc, CD, external storage device)
   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
   8.6 register and store the drawings in the designated company information system (where appropriate)
   8.7 record and store any changes to the drawings in the designated company information system (where appropriate)

9. produce/modify drawings which comply with one or more 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 standard
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Developed by
SEMTA

Version number
1

Date approved
November 2007

Indicative review date
December 2013

Validity
Current

Status
Original

Originating organisation
SEMTA

Original URN
06

Relevant occupations
Managers and Senior Officials; Engineering and manufacturing technologies; Engineering; Functional Managers

Suite
Engineering Technical Support Suite 2 2007

Key words
Engineering, technical support, producing engineering drawings, modifying engineering drawings, cad, engineering services, fluid power, water distribution, environmental control, refrigeration.