

SQA Advanced Unit Specification

General information for centres

Unit title: Engineering Drawing

Unit code: HT72 47

Unit purpose: This Unit is designed to enable candidates to gain knowledge of current standards relating to the reading and production of engineering drawings and to apply draughting principles and communication techniques to component and assembly drawings to enable the manufacture of an engineering product. The examples used can be based on the candidate's chosen area of engineering discipline.

On completion of the Unit the candidate should be able to:

- 1 Interpret engineering drawings and modifications.
- 2 Create two-dimensional engineering drawings from which manufacture and/or assembly will be possible.
- 3 Prepare a parts list and add instructions for manufacture and/or assembly.

Credit points and level: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

Recommended prior knowledge and skills: It would be an advantage for the candidate to have a basic knowledge and understanding of graphical communications, draughting skills, current ISO/BS standards and their abbreviations, conventions and symbols used in drawings, tolerancing and dimensioning, although this is not absolutely essential as these concepts and skills are covered in this Unit. Possession of basic knowledge and skills may be evidenced by possession of a Higher in Graphical Communications or the following National Qualifications Units:

Engineering Drawing Office Practice; Graphical Engineering Communication
Engineering Draughting Skills; Introduction to CAD/CAM or similar Unit

Core skills: There may be opportunities to gather evidence towards Core Skills in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

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Assessment: The assessment for Outcome 1 is split into two parts. The first part covering the recognition of conventions and symbols in the form of short answer questions; the second part in the form of a graphical exercise covering one of the following: Auxiliary Views, Sectional Views or Partial Views. The candidate should have access to drawing and/or CAD equipment to undertake the graphical exercise. This assessment should be conducted under controlled, supervised conditions.

The assessment for Outcomes 2 and 3 in this Unit should be combined together into one graphical assignment. This should be an on-going assessment in which the candidate produces a minimum of two component drawings and an assembly/sub-assembly drawing and applies current standards to the drawings. They should also include balloon referencing, parts list and manufacturing notes. A checklist should be used to record the candidate's achievement. The candidate should have access to manual drawing equipment and/or CAD facilities as well as extracts from relevant current standards.

SQA Advanced Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Interpret engineering drawings and modifications

Knowledge and/or skills

- ◆ abbreviations
- ◆ convention recognition
- ◆ symbol recognition
- ◆ surface texture
- ◆ partial views
- ◆ auxiliary views
- ◆ section views
- ◆ modification and revision procedures to drawings and specifications

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. Each candidate will need to demonstrate that she/he can answer questions correctly based on a sample of **six from eight** of the knowledge and skills.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample from the knowledge and/or skills items is required each time the Outcome is assessed.

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- 1 Identify, from a given prepared drawing containing abbreviations, conventions and symbols, representations from current standards.
- 2 Given a drawing of a component, apply a simple modification and update the records, and on the same sheet produce one of the following:
 - ◆ a section view of the component
 - ◆ an auxiliary view of the component
 - ◆ a partial view of the component

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Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open-book conditions and candidates should have access to BS/ISO specifications for Engineering Drawing Practice.

Assessment guidelines

A mixture of short answer questions and graphical assignments should be used to obtain candidate evidence. It is recommended that the total assessment time for Outcome 1 should be 1-hour.

The graphical assignment in this Outcome can, if considered appropriate, be combined with the graphical assignment in Outcome 2.

Outcome 2

Create two-dimensional engineering drawings from which manufacture and/or assembly will be possible

Knowledge and/or skills

- ◆ draughting skills
- ◆ current BS/ISO standards relating to drawing
- ◆ interpretation and reading of drawings
- ◆ component drawings with reference to dimensions, tolerances and materials
- ◆ assembly drawings with reference to manufacture and assembly

Evidence requirements

All knowledge and/or skills items must be assessed. Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ prepare drawings in third angle projection
- ◆ present drawings correctly in accordance with current standards
- ◆ apply appropriate information to suit manufacture or processing of the component
- ◆ make use of conventions, abbreviations, dimensions, text, symbols, and layout - all in accordance with current standards
- ◆ produce component drawings and assembly or sub-assembly drawings in accordance with current standards and, by integration with Outcome 3, with enough information to allow for manufacture and assembly

The candidate should be given a rough sketch of an assembly or sub-assembly with basic outline dimensions and constraints, from which detailed component and assembly drawings are produced. Produce a minimum of two component drawings and one assembly/sub-assembly drawing.

Candidates should have access to current BS/ISO specifications for Engineering Drawing Practice.

Assessment guidelines

Candidate responses may be checked using an appropriately devised checklist.

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Outcome 3

Prepare a parts list and add instructions for manufacture and/or assembly

Knowledge and/or skills

- ◆ preparation of a parts list
- ◆ material selection
- ◆ standard part selection
- ◆ parts referencing
- ◆ instructions to aid manufacture and/or assembly

Evidence requirements

All knowledge and/or skills items must be assessed. Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ produce an accurate parts list from their drawing created in Outcome 2
- ◆ select appropriate standard parts and materials
- ◆ apply referencing
- ◆ add instructions to the drawing created in Outcome 2 to aid manufacture and/or assembly

It is expected that this Outcome will be integrated with Outcome 2. When the candidate is able to produce a satisfactory drawing meeting the criteria in Outcome 2 they will be expected to add to the drawing they have created the associated parts list, balloon reference, manufacture and/or assembly instructions.

The candidate will be expected to add to the drawing sufficient information to allow for the manufacture and/or the assembly of the part(s).

Assessment guidelines

Candidate responses may be checked using an appropriately devised checklist.

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Administrative Information

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Superclass category:	VF
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SQA Advanced Unit specification: support notes

Unit title: Engineering Drawing

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit has been written in order to allow candidates to develop their knowledge, understanding and skills in the following areas:

- 1 Interpret and modify engineering drawings.
- 2 Create two-dimensional engineering drawings from which manufacture and/or assembly will be possible.
- 3 Prepare a parts list and add instructions for manufacture and/or assembly.

In designing this Unit, the Unit writers have identified the range of topics expected to be covered by lecturers. The writers have also given recommendations as to how much time should be spent on each Outcome. This has been done to help lecturers to decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for centres to use this list of topics it is strongly recommended that they do so to ensure continuity of teaching and learning. The assessment exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

A list of topics is given below. Lecturers are advised to study this list of topics in conjunction with the assessment exemplar pack to gain a clear indication of the standard of achievement expected of candidates in this Unit.

1 Interpreting, editing and modifying drawings (12 hours)

Convention recognition such as:

Simplified representations; square ends of shafts; knurling; splines and serrations; screw threads; general convention for rolling bearings; gears; springs.

Representations of:

- ◆ Partial views: for example, enlarged; symmetrical parts; interrupted views; repetitive features (circular or linear pitch)
- ◆ Auxiliary Views
- ◆ Section Views: for example, cutting planes; hatching; adjacent parts; large areas; thin material; half section; local or part section; revolved & removed section; including parts and features not normally sectioned

Abbreviation recognition such as:

AF; CRS; CL; CHAM; CH HD; CSK; CBORE; DIA; DRG; EXT; HEX HD; INT; MATL; PCD; RAD; R; RD HD; SCR; SFACE; SQ; STD; UCUT.

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Symbol recognition such as:

- ◆ First or third angle projection; diameter on a dimension (\varnothing or S \varnothing); centre line
- ◆ Surface texture & machining symbol with and without indications added
- ◆ For example indication of: surface texture; manufacturing method; machining allowance
- ◆ Elementary welding symbols: for example square butt, single and double v-butt, u-butt, j-butt, backing run, fillet etc
- ◆ Supplementary welding symbols: for example, flat, concave, convex, backing strip
- ◆ Reference lines and other information: for example, all round, site weld, and weld process
- ◆ Fluid power and/or electrical symbols could also be considered

Modifications such as:

- ◆ Recording on the template title block the changes made to the prepared drawing
- ◆ Such changes could be:
 - additional and/or partial views of components
 - increase in size of one or more dimensions/parts on the drawing
 - producing an enlargement view on the drawing
 - producing a section view on the drawing
 - adding a new part to the drawing such as a gear, pulley, bearing, etc

2 Producing component drawings and a sub-assembly or assembly drawing (22 hours)

The candidate will have access to drawing equipment and materials and/or CAD facilities. The candidate should have access to “Engineering Drawing Practice: Part 1 and Part 2: A guide for schools and colleges to BS 8888: 2000, Technical product documentation.” The standards for producing the component drawings and assembly/sub-assembly drawings should be within the scope of this guide. Although BS 8888: 2000 has been superseded by BS 8888: 2002 the changes should not affect the guide. The change to standards is an ongoing process. The above guide may be changed in the years after the writing of this Unit. Candidates should be made aware of the need to conform to the current standard.

The candidate should be made aware of the proper use of drawing equipment and the importance of a well laid out drawing for a good presentation of the finished drawing.

A template containing a border and incomplete title box may be provided along with an explanation of the layout of the template. However, if time allows, the candidate could produce a title block and border in accordance with current standards.

The emphasis should be that there is enough detailed information to allow the manufacture of the components. The dimensioning should also include tolerancing, eg its application for both linear and angular tolerancing and/or geometrical tolerancing. ISO system of limits and fits using the current ISO/BS standards should be applied to the drawing. The candidate should make use of BS 4500A: 1970 ISO limits and fits. Data sheet: selected ISO fits — hole basis

(At time of writing this data sheet is still current although the BS 4500: Part 1: 1969 ISO limits and fits has been withdrawn and superseded. Ref. <http://bsonline.techindex.co.uk>)

Although the candidate should make reference to the current guides for schools and colleges for drawing practice, it may be appropriate to refer the candidate to other current standards.

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At time of writing they include:

- ◆ BS 8888: 2002: Technical product documentation (TPD) — Specification for defining, specifying and graphically representing products
- ◆ BS 499-2c: 1999: European Arc Welding Symbols
- ◆ BS EN 22553: 1995/ISO 2553: 1991 Welded brazed and soldered joints — Symbolic representation on drawings
- ◆ BS 4500A: 1970 ISO limits and fits. Data sheet: selected ISO fits — hole basis
- ◆ BS 4500B: 1970 ISO limits and fits. Data sheet: selected ISO fits — shaft basis
- ◆ BS EN 20286-2: 1993/ISO 286-2: 1988 ISO limits and fits. ISO system of limits and fits. Tables of standard tolerance grades and limit deviations for holes and shafts

3 Identifying associated information (6 hours)

Preparation of a parts list: including the importance of standard drawing office procedures in the release and updating of drawings and specifications. The assessment for this Outcome can be integrated with Outcome 2 using the assembly/sub-assembly and component drawings to produce the parts list containing the part number; description of part; stock materials; standard parts; (sourced and selected from manufacturers' catalogues or online catalogues). The addition to the drawing of Assembly and or Manufacturing Instructions.

The Unit is designed to enable the candidate to gain skills in communication by graphical means, gain knowledge of standards used in graphical communications and apply this knowledge to producing working drawings to enable the manufacture of components. It is also expected that the candidate will be able to read and interpret engineering drawings with manufacture and assembly in mind.

Guidance on the delivery and assessment of this Unit

It is intended that this Unit be delivered in an environment suitable for engineering drawing and that the candidate is provided with appropriate draughting equipment and/or access to CAD facilities. They also should be provided with the current BS for drawing practice for reference during practice exercises. (At time of writing: "Engineering Drawing Practice: Part 1 and Part 2: A guide for schools and colleges to BS 8888: 2000, Technical product documentation. and BS 499-2c: 1999: European Arc Welding Symbols"). The candidate should be made aware of the importance of looking after drawing equipment, a properly laid-out drawing, cleanliness of the drawing and the need to add enough information to the drawing to allow for manufacture.

Outcome 1 could be delivered using extracts from the current BS and with the use of exemplar drawings as guides to good practice. It is expected that Outcome 1 assessments will be 'open-book' In the event that a re-sit of the assessment is required a set of new questions based on different items from the previous assessment should be used.

For Outcome 2 and 3 the candidate should have access to current British Standards extracts. The expected paper size for this assessment is A3. Observation of the candidate's progress is important in this case to prevent the candidate from straying too far from the acceptable standard. This should reduce the need for a re-sit, but if one is considered necessary, then the candidate will need to be informed at an early stage to allow the Unit to be completed in the time available. It is expected that a different sketch of an assembly or sub-assembly with basic outline dimensions and constraints will be issued to the candidate for each assessment occasion.

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Opportunities for developing Core Skills

There may be opportunities to gather evidence towards Core Skills in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Open learning

In the event that the delivery of this Unit is considered for Open Learning the candidate should attend the centre for a minimum of 2 hours. The candidate will be expected to prove that, from a sample of the knowledge and/or skills, they are competent in performing tasks, which give evidence to support their achievement of the Outcomes. This is simply to demonstrate their competence in producing a drawing for manufacture in a supervised environment and can be achieved by bringing along their partially completed drawing and demonstrating their competence by completing it at the centre. Achievement of the Outcomes should also be by the candidate providing a 'witness statement' from a responsible and competent person who can confirm that the evidence presented is the candidate's own work. (For guidance on 'witness statements' refer to the SQA document '*Guide to Assessment and Quality Assurance*')

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

General information for candidates

Unit title: Engineering Drawing

This Unit has been designed to provide you with the knowledge and skills that will enable you to read and understand modern two dimensional (2D) engineering drawings whether produced by manual or computer means. You will be introduced to the latest Standards related to 2D engineering drawing and given opportunities to practise the use of them. You will also be shown how to modify and record changes to 2D engineering drawings using current practice to maintain a good quality system and use 2D drawing as a means of communication in manufacture.

This Unit will introduce you to conventions, symbols and abbreviations used in current 2D engineering drawings. Most engineers are involved in the process of development and the need to make modifications. It is therefore important to be made aware of the need to communicate any changes that you might make and have an understanding of the system for passing on any changes made.

The assessment for Outcome 1 consists of one short answer paper covering conventions, symbols and abbreviations from current standards and one graphical assignment covering a practical drawing exercise in modifying, recording and adding a separate view to a prepared drawing. All parts of this assessment will be conducted under open-book conditions in which you will be allowed to take appropriate material into the assessment. Normally you will be expected to have completed this assessment within one hour.

The assessment for Outcome 2 will require you to demonstrate your knowledge and skills by producing component and assembly drawings using manual drawing techniques and will occupy the majority of your time spent on this Unit. This assessment should be completed with reference to current standards relating to engineering drawing.

The assessment for Outcome 3 will then be integrated with the assessment for Outcome 2. You will be expected to add to the drawings that you produce relevant parts list, manufacture instructions etc, with the aim being that the finished drawings will enable the manufacture and/or assembly of the component(s).

By the end of the Unit you should have developed your knowledge and skills in Engineering Drawing and be able to identify a range of conventions, symbols, abbreviations and terms used and you will have applied modifications to drawings. You will have developed confidence in producing drawings that can be sent to the workshop for manufacture.