



National Unit Specification: general information

UNIT Engineering Workshop Skills (SCQF level 6)

CODE F5KE 12

SUMMARY

This Unit may form part of a National Qualification Group Award or may be offered on a free standing basis.

This predominantly practical Unit is designed to provide candidates with knowledge and skills in complex engineering workshop handskills. During delivery of the Unit, candidates will learn to interpret and extract information from engineering drawings and other sources in relation to performing engineering workshop skills. They will also learn to select and use tools to mark out complex profiles for given specifications. Candidates will also learn how to complete planning documentation, and develop the knowledge and skills to select and use engineering tools to produce components and an assembly to given specifications. Throughout the delivery of the Unit candidates will learn and apply current health and safety requirements and safe working practices as they produce the components and assembly.

This Unit is suitable for candidates training to be manufacturing, mechanical or multi-disciplinary engineering technicians. It is also suitable for craftspersons who wish to develop more advanced engineering workshop skills.

OUTCOMES

- 1 Interpret engineering information in relation to engineering workshop skills.
- 2 Carry out marking out procedures to produce complex profiles to given specifications.
- 3 Manufacture components and an assembly to given specifications.
- 4 Comply with current Health and Safety regulations and safe working practices while manufacturing components and an assembly.

Administrative Information

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National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

Whilst entry is at the discretion of the centre candidates would normally be expected to have attained one of the following, or equivalent:

- ◆ the NQ Unit *Engineering Workshop Skills* (SCQF level 5)
- ◆ appropriate industrial experience in the field of engineering workshop skills

CREDIT VALUE

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6).

**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 Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit. This Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- ◆ Problem Solving (SCQF level 6)
- ◆ Numeracy (SCQF level 6)
- ◆ Working with Others (SCQF level 6)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Interpret engineering information in relation to engineering workshop skills.

Performance Criteria

- (a) Drawing conventions and abbreviations are identified correctly in terms of current British Standards.
- (b) Complex dimensional and tolerance information is interpreted correctly from given component drawings.
- (c) Detailed technical information relating to the manufacture and assembly of given components using engineering workshop skills is extracted successfully from specialised sources.

OUTCOME 2

Carry out marking out procedures to produce complex profiles to given specifications.

Performance Criteria

- (a) Prepare work piece materials correctly for marking out procedures.
- (b) Select and use equipment correctly to mark out profiles accurately.
- (c) Check profiles to ensure they conform to given engineering drawing specifications.

OUTCOME 3

Manufacture components and an assembly to given specifications.

Performance Criteria

- (a) Complete a planning document correctly for the manufacture of components.
- (b) Select and use tools correctly to manufacture components and assembly to given specifications.
- (c) Select and use measuring equipment correctly to verify that components and an assembly conform to given specifications.

National Unit Specification: statement of standards (cont)

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OUTCOME 4

Comply with current Health and Safety regulations and safe working practices while manufacturing components and an assembly.

Performance Criteria

- (a) Use appropriate Personal Protective Equipment (PPE) correctly.
- (b) Use machine guards correctly dependent on engineering workshop operations.
- (c) Comply fully with safety requirements, good housekeeping and appropriate tool/equipment storage.
- (d) Cooperate effectively with others in an engineering workshop.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral, product and performance evidence supplemented with an assessor observation checklist(s) should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria.

The assessment of Outcome 4 must always be integrated with Outcomes 2 and 3. Outcomes 1, 2, 3 and 4 may be assessed by a single, holistic assessment covering the Performance Criteria in all 4 Outcomes or Outcome 1 may be assessed separately from Outcomes 2, 3 and 4.

Outcome 1 (Written and/or Recorded Oral Evidence)

Outcome 1 may be assessed as part of a holistic assessment or separately at a single assessment event lasting 30 minutes. Assessment must be conducted under supervised, closed-book conditions in which candidates may use reference materials provided by the centre but are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment.

With regard to Outcome 1:

- ◆ candidates must correctly identify four drawing conventions and abbreviations from a given selection
- ◆ candidates must be given a component drawing and asked to extract a minimum of six pieces of complex information relating to dimensions, dimensional tolerances and geometric tolerances
- ◆ candidates must source and extract information on internal and external threads and drill speeds from charts and technical data sheets for a minimum of five given thread sizes

National Unit Specification: statement of standards (cont)

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Outcomes 2, 3 and 4 (Written and/or Recorded Oral, Product and Process Evidence)

The assessment of Health and Safety and safe working practices in Outcome 4 must always be integrated with the practical assessments in Outcomes 2 and 3 and all other practical work activities undertaken by candidates while taking this Unit.

For Outcomes 2, 3 and 4 each candidate will require to prepare, mark out, manufacture and assemble a minimum of three components from given engineering drawings to a general engineering manufacturing tolerance of $\pm 0.25\text{mm}$. The manufacture of each component and assembly of the components should be carried out at suitable times during the delivery of the Unit. The components should be prepared, marked out, manufactured and assembled under supervised conditions. Fasteners may be used in the assembly.

With regard to Outcome 2:

- ◆ candidates should prepare the work piece material using a hand file and engineer's square to ensure work piece material is deburred and square. The candidate is also required to select appropriate datum face(s)/edge(s) to suit given specifications and where appropriate a marking out ink should be applied.
- ◆ candidates should mark out a minimum of three components with the following features: eight straight lines, four circles and four angles. Candidates must use, as a minimum, the following marking out equipment: scribe, rule, surface gauge, angle plate, dividers, protractor and radius gauges.

With regard to Outcome 3:

- ◆ for Outcome 3 each candidate will require to manufacture components from given engineering drawings which have as a minimum the following features: four parallel faces, six flat faces, four square faces, two angles, two radii and eight drilled holes, of which two should be tapped, two reamed, one counter-bored and one counter sunk. These components should form part of an assembly. During manufacture of the components candidates must use, as a minimum, the following tools: files, hack saw, engineer's square, drills and reamers, pedestal drill, counter-boring tool, countersink, centre punch, ball pein hammer and sets of taps.
- ◆ candidates must use, as a minimum, the following measuring equipment: surface table, vernier height gauge, angle plate, radius gauges, vernier calliper, micrometer and a vernier protractor, to check a minimum of eight dimensions on the final assembly. These dimensions must be recorded on an appropriate inspection document.
- ◆ candidates must finalise a partially completed planning document in which at least six operations have to be completed for a given component(s) to be manufactured.

For Outcome 4 an observation checklist must be used to record evidence that candidates have complied with the Performance Criteria in the Outcome while undertaking the marking out and manufacturing work in Outcomes 2 and 3.

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

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

Whilst 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 forms part of the National Qualification Group Award (NQGA) in Manufacturing Engineering at SCQF level 6, but may also be offered on a free standing basis.

This Unit is particularly suitable for those candidates who have successfully completed the Unit *Engineering Workshop Skills* at SCQF level 5.

The overall aim of this Unit is to provide candidates with the opportunity to develop advanced engineering workshop handskills. On successful completion of the Unit candidates will be able to interpret and extract information from engineering drawings and other sources in relation to performing engineering workshop skills. They will also be able to select and use tools to mark out complex profiles for given specifications. Candidates will also be able to complete planning documentation, and will have the knowledge and skills to select and use engineering tools to produce components and an assembly to a given specification(s). They will also be able to use appropriate measuring equipment to verify component dimensions conform to given specification(s). Candidates will also be able to apply current health and safety requirements and safe working practices while manufacturing components and an assembly.

Outcome 1 requires candidates to interpret complex dimensional and tolerance information from engineering drawings and extract information on internal and external threads and drill speeds from charts and technical data sheets.

Outcome 2 involves the candidates in preparing work piece materials correctly for marking out purposes and in selecting and using marking out equipment to produce and verify complex profiles. During the delivery of this Outcome candidates should learn to use such marking out equipment as a scribe, ruler, surface gauge, angle plate, dividers, protractor and radius gauges.

Outcome 3 is intended to allow candidates to develop their engineering hand skills while producing a range of components. During the delivery of the Outcome candidates should learn to use such tools as files, hack saw, engineer's square, drills, reamers, pedestal drill, taps, dies, centre punch and ball pein hammer. As part of this Outcome candidates should also learn to select and use a range of measuring equipment such as surface table, vernier height gauge, angle plate, radius gauges, vernier calliper and vernier protractor.

In Outcome 4 emphasis should be placed on getting candidates to apply good Health and Safety procedures and practices while performing marking out and manufacturing skills. Such procedures and practices should include the wearing of Personal Protective Equipment, using guards correctly where appropriate (eg with pedestal drill), using and storing all tools correctly and cooperating with others in an engineering workshop.

National Unit Specification: support notes (cont)

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GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit. The Unit should be delivered in an engineering workshop environment suitably equipped with marking out tools, engineering tools and measuring equipment. Candidates should be provided with access to a range of engineering drawings so that they can develop their knowledge and skills in interpreting and extracting information from drawing. Delivery of Unit content should be principally by lecturer demonstration followed by candidates practising the skills demonstrated.

Centres may wish to provide candidates with instruction on Health and Safety regulations and safe working practices as part of Unit delivery. Alternatively, such instructions may be given as part of another Unit such as the Unit *Health and Safety* at SCQF level 5. Where this approach is taken it is important that sufficient attention is paid to Health and Safety and safe working practices as these apply to engineering workshop handskills.

A large range of paper based and electronic materials exist on Health and Safety. Centres may wish to show candidates Health and Safety videos/DVDs to highlight, for example, the dangers of working in engineering workshops.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill of *Problem Solving*, that is, Critical Thinking, Planning and Organising, will be developed as candidates undertake practical workshop activities. They have to interpret engineering drawings and complete a planning document. Components are prepared, marked out, manufactured and assembled safely. The ability to accurately interpret, evaluate and apply complex written and graphic information and to check and measure dimensions accurately is integral to achievement. Contextualised reference and support materials could be provided by the centre to develop Numeracy skills.

Although candidates have to demonstrate practical skills independently, formative group activities could enhance skills in working with others. Good practice in using and sharing engineering workshop areas, tools and equipment could be discussed in terms of the nature and scope of team goals, roles and responsibilities. Candidates could be given constructive feedback to encourage review and evaluation of their approaches to practical work including their contribution to team working.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Formative assessment exercises involving candidates in interpreting complex information on engineering drawings, sourcing and extracting thread and drill speed information from specialist sources and practising marking out and workshop handskills to produce components and assemblies will play a particularly important role in building candidate knowledge, understanding, skills and confidence of Unit content.

National Unit Specification: support notes (cont)

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Unit assessment may be carried out using a single, holistic assessment in the form of a practical assignment. Individual parts of the assignment could be carried out at appropriate points during Unit delivery. Alternatively, Outcome 1 may be assessed by a separate assessment paper while Outcomes 2, 3 and 4 may be assessed by a series of practical exercises.

With regard to Outcome 1 any assessment paper should comprise an appropriate engineering drawing(s), specialist documentation and a question paper comprising a balance of short answers/restricted response questions. More specifically each candidate could be provided with a series of detailed drawings with certain complex features highlighted. Each candidate could be required to identify the highlighted features. A specialised source(s) of information may be a detailed manufacturer's chart for uncommon tapping drill sizes for different threaded holes. Candidates would be required to complete a prepared question sheet which allows the candidates to demonstrate a knowledge and understanding of how to identify and extract information from such a specialist source.

In Outcomes 2 and 3 it is recommended that the time taken to mark out, manufacture and assemble the components to meet the assessment requirements should not exceed eight hours. It is also recommended that any checklist(s) and inspection record(s) used as part of the assessment of Outcomes 2 and 3 should be cross referenced to the following:

- ◆ the selection and use of marking out equipment to produce complex component features
- ◆ the planning of the manufacture of the components and assembly
- ◆ the selection and use of the correct tools/equipment to produce particular complex component features
- ◆ measurement and verification of component dimensions against specifications
- ◆ completion of appropriate planning and inspection documentation

so that the finished components and assembly can be assessed in terms of compliance with dimensions, tolerances and functionality.

Candidate evidence for Outcome 4 should be recorded by completing an appropriate observation checklist.

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

National Unit Specification: support notes (cont)

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DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements