



## National Unit Specification: general information

**UNIT** Engineering Skills: Mechanical and Fabrication (Intermediate 2)

**CODE** F39B 11

**COURSE** Engineering Skills (Intermediate 2)

### SUMMARY

This Unit has been designed as a mandatory Unit of the *Engineering Skills (Intermediate 2)* Course but can also be taken as a free-standing Unit. It is suitable for candidates with no previous engineering or employment experience. Candidates will learn to select and use the correct tools, equipment, and materials required to manufacture an artefact. Candidates will also develop and use basic engineering skills including measuring, marking, cutting, shaping, drilling, tapping, forming, and joining.

Candidates will have the opportunity to develop employability skills across the range of practical activities.

### OUTCOMES

- 1 Identify and use tools to measure and mark selected engineering materials.
- 2 Identify, select, and use a range of metal working tools.
- 3 Manufacture an artefact from given drawings.
- 4 Review and evaluate own employability skills in practical engineering contexts.

### RECOMMENDED ENTRY

Entry is at the discretion of the centre but, while no formal entry qualifications are required, it would be beneficial if candidates embarking on the Unit demonstrated:

- ◆ an interest in engineering
- ◆ an ability in numeracy and literacy at SCQF level 4
- ◆ some aptitude for graphical forms of communication

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#### Administrative Information

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## **National Unit Specification: general information (cont)**

**UNIT**      Engineering Skills: Mechanical and Fabrication (Intermediate 2)

### **CREDIT VALUE**

1 credit at Intermediate 2 (6 SCQF credit points at SCQF level 5\*).

*\*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.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

## **National Unit Specification: statement of standards**

### **UNIT      Engineering Skills: Mechanical and Fabrication (Intermediate 2)**

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**

Identify and use tools to measure and mark selected engineering materials.

##### **Performance Criteria**

- (a) Identify engineering materials and state a reason for use.
- (b) Identify a range of measurement tools correctly and clearly state their function.
- (c) Mark out work pieces accurately from drawings and material specifications.
- (d) Complete a quality check to ensure marked dimensions are within specified tolerances.
- (e) Correctly observe safe working practices in all practical activities.

#### **OUTCOME 2**

Identify, select, and use a range of metal working tools.

##### **Performance Criteria**

- (a) Identify a range of metal working tools correctly and clearly state their function.
- (b) Select and use a range of metal working tools correctly for given tasks.
- (c) Correctly observe safe working practices in all practical activities.

#### **OUTCOME 3**

Manufacture an artefact from given drawings.

##### **Performance Criteria**

- (a) Produce an artefact from given working drawings and material specifications.
- (b) Functional dimensions of the artefact are within specified tolerances.
- (c) The quality and finish of the completed artefact complies with the specification.
- (d) Correctly observe safe working practices in all practical activities.
- (e) Complete a quality check on own finished artefact.

#### **OUTCOME 4**

Review and evaluate own employability skills in practical engineering contexts.

##### **Performance Criteria**

- (a) Review and evaluate own employability skills.
- (b) Seek and record feedback on own performance in employability skills.
- (c) Make a judgement on own strengths, weaknesses and learning points in relation to employability skills.
- (d) Identify action points for improvement in relation to employability skills.

## National Unit Specification: statement of standards (cont)

### UNIT Engineering Skills: Mechanical and Fabrication (Intermediate 2)

#### EVIDENCE REQUIREMENTS FOR THIS UNIT

Performance evidence and written/oral evidence is required to show that all Outcomes and Performance Criteria have been achieved.

**Performance evidence** will be supported by assessor checklists. This evidence will be generated from an integrated assignment consisting of practical activities carried out in supervised workshop conditions.

The evidence may be gathered at different points throughout the Unit.

The practical activities in the preparation, planning, and manufacture of an artefact in a safe manner will cover:

- ◆ identification, selection, and a reason for use of each of the following engineering materials:
  - low carbon steel
  - copper
  - stainless steel
  - aluminium
  - non metallic
- ◆ interpretation of engineering drawings and specifications
- ◆ selection, function and use of the following tools to measure and mark out:
  - rule, scribe, square, dividers, calliper, protractor, micrometer, and any one digital instrument
- ◆ selection and use of the following tools to cut and shape:
  - hammer, chisel, hacksaw, tin snips, shears, files, drills, and taps
- ◆ selection and use of the following tools to form:
  - heat source, anvil, vice, formers, hammers, mallets, stakes, rolls, and folders
- ◆ selection and use of the following methods to join:
  - riveting (pop or solid); bolting, screwing; MIG/MAG welding; adhesives (any recognised engineering adhesive)

## **National Unit Specification: statement of standards (cont)**

### **UNIT      Engineering Skills: Mechanical and Fabrication (Intermediate 2)**

The artefact(s) will be completed:

- ◆ using any material(s)
- ◆ using any six measuring and marking tools
- ◆ using any four cutting and shaping tools
- ◆ using any three forming tools
- ◆ using any two joining methods

Dimensions must be within the stated tolerance of  $\pm 1\text{mm}$ , as expressed in the National Assessment Bank (NAB) material.

Candidates will be required to carry out a quality check before submitting their work for final assessment.

#### **Written/Oral Evidence**

Candidates will complete a self evaluation review of their own performance against the following employability skills:

- ◆ maintaining good timekeeping and attendance
- ◆ showing health and safety awareness — to include wearing PPE, safe working practices, and understanding a basic risk assessment
- ◆ selecting and using engineering tools and materials — source and use tools in a correct and safe manner, use tools solely for the purpose for which they are designed and selection of engineering materials
- ◆ quality checking own work
- ◆ self review and evaluation — to include identifying strengths and weaknesses, identifying learning points from practical experiences, and having a positive attitude to learning

A signed record of the review must be retained by the assessor as assessment evidence.

The National Assessment Bank (NAB) item for this Unit provides an appropriate practical assignment, an appropriate candidate review sheet and assessor checklists. These exemplify the national standard. Centres wishing to develop their own assessments should refer to the NAB to ensure a comparable standard.

## National Unit Specification: support notes

### UNIT      Engineering Skills: Mechanical and Fabrication (Intermediate 2)

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 covers practical engineering activities. The candidate will develop the ability to select and use tools correctly and safely in the different activities in the Unit. It is therefore important that the learning takes place in a supervised workshop environment. Safe working practices will be included in the content as it is important that candidates learn to adhere to these at all times.

Candidates will work on a range of practical engineering tasks, which will enable them to become familiar with a variety of tools and materials in the workshop. Lecturers/teachers may include a wide range of short practical activities to equip candidates with the skills necessary to complete an artefact. During the process of practical work the candidate will become accustomed to engineering terminology and will be able to demonstrate a knowledge and understanding of the terminology in everyday practice. Candidates should learn good working practices at each stage and how to carry out quality checks on their own work.

This Unit provides opportunities to develop engineering employability skills such as:

- ◆ maintaining good timekeeping and attendance
- ◆ showing health and safety awareness
- ◆ selecting and using engineering tools and materials
- ◆ interpreting engineering drawings and specifications
- ◆ working cooperatively with others
- ◆ planning and preparing for work
- ◆ applying time management
- ◆ awareness of environmental considerations
- ◆ quality checking own work
- ◆ self review and evaluation

The context for learning should include the requirement to be clean, presentable and appropriately dressed for the workshop, PPE, including protective clothing when required.

Relevant aspects of current health and safety legislation, current Control of Substances Hazardous to Health (COSHH) Regulations and any systems of work relevant to the candidates' workshop/workplace should be explained and adhered to as part of the work of this Unit.

## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Mechanical and Fabrication (Intermediate 2)

#### GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is important there is an induction to the Unit which will include employability skills and health and safety awareness. This Unit involves experiential learning through the various practical experiences and activities. Candidates should experience workshop conditions and should be encouraged to perform tasks and conduct themselves in a manner appropriate to the workplace. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical engineering activities within the *Mechanical and Fabrication (Intermediate 2)* Unit. As well as carrying out practical tasks, candidates will also learn from brief lessons on health and safety and workshop protocol. Teaching and learning approaches will also include demonstrations of practical work by teachers/lecturers/tutors. Short lessons on specific aspects of industrial practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the candidates practise the skill emphasised by the demonstration.

Where centres authorise the use of power tools for candidates, this should only be allowed after suitable training and the completion of a risk assessment, and in accordance with current legislation for that candidate age group. Particular attention should be made to specific legislative requirements where school age candidates are involved.

Where centres opt to use power tools it is essential that the safe and correct use of power tools is demonstrated before candidate use. In addition, candidates must be made aware of the dangers of misuse or usage without proper training or associated PPE.

Some centres may be able to arrange demonstrations by local firms or power tool manufacturers to emphasise correct and safe usage of power tools.

Integrated into the Unit are the employability skills that employers value. It should be stressed that all the employability skills are developed in this Unit, but only specified employability skills will be assessed. Employability skills are a focus of this Unit and should be promoted from Unit induction to Unit completion.

In order to raise the candidates' awareness of local industries and the realities of the workplace, visits to local engineering firms could be arranged, if appropriate. Equally, visiting speakers from local engineering firms should be encouraged. Additional useful material and employment opportunities can be resourced from the research of local engineering firms or from the internet.

This Unit should be delivered by a combination of teaching and learning approaches which could include:

- ◆ Lecturing
- ◆ Demonstrations
- ◆ Practical activities
- ◆ Group discussions
- ◆ Tutorials
- ◆ Site visits
- ◆ Audio visual
- ◆ Guest speakers

## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Mechanical and Fabrication (Intermediate 2)

#### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates will perform calculations and take measurements by the interpretation of diagrams and specifications. These activities provide good opportunities to develop the Core Skills of *Numeracy* and *Communication*. Candidates will also share workspace, tools and equipment. This will provide them with a good context in which to learn to work cooperatively with others.

#### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

The Unit assessment will include both practical engineering skills and employability skills. It is recommended that the stated practical engineering and employability skills are assessed throughout the Unit.

The practical engineering skills assessed in this Unit are:

- ◆ measure
- ◆ mark
- ◆ cut
- ◆ shape
- ◆ form
- ◆ join
- ◆ preparation planning
- ◆ select materials
- ◆ interpret drawings and specifications
- ◆ select and use tools
- ◆ manufacture to stated tolerances

The employability skills assessed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ showing health and safety awareness
- ◆ selecting and using engineering tools and materials
- ◆ quality checking own work
- ◆ self review and evaluation

The assessment of employability skills will be evidenced by a candidate review sheet supported with assessor observation checklists of the practical activities. It is recommended that the candidate review sheet should be completed towards the end of the Unit when the candidate and assessor will have had a reasonable time to make a judgement.

The assessment of the engineering skills will be evidenced by a practical assignment involving the manufacture of an artefact. A typical example would be a bicycle clamp or small engineers vice and this will be supported by assessor observation checklists.

It is anticipated that candidates will be given as much practice as possible in engineering techniques prior to assessment. The assessment activities should also make an important contribution to the learning process.



## **National Unit Specification: support notes (cont)**

### **UNIT      Engineering Skills: Mechanical and Fabrication (Intermediate 2)**

While evidence may be generated by the manufacture of one artefact, centres may decide to complete more than one artefact but must ensure that the Outcomes, Performance Criteria and Evidence Requirements are satisfied.

If candidates are working as a team on practical assignments, assessors must satisfy themselves that candidates are competent in each aspect of the given task.

Assessors are required to check the quality of candidates' work against prescribed standards and tolerances. Candidates themselves are required to carry out a quality check against these same standards. It is recommended that candidates must carry out their own quality check prior to the assessor check.

#### **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 communications 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)* and *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

#### **CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS**

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* ([www.sqa.org.uk](http://www.sqa.org.uk)).