



**ENGINEERING SKILLS**  
**Intermediate 2**

**First edition — published April 2008**



## National Course Specification

### Engineering Skills (Intermediate 2)

**COURSE CODE**      **C253 11**

#### COURSE STRUCTURE

This Course has four mandatory 40 hour Units.

The mandatory Units are:

F39B 11	<i>Engineering Skills: Mechanical and Fabrication</i>	<i>1 credit</i>	<i>(40 hours)</i>
F39C 11	<i>Engineering Skills: Electrical and Electronic</i>	<i>1 credit</i>	<i>(40 hours)</i>
F39D 11	<i>Engineering Skills: Maintenance</i>	<i>1 credit</i>	<i>(40 hours)</i>
F39E 11	<i>Engineering Skills: Design and Manufacture</i>	<i>1 credit</i>	<i>(40 hours)</i>

#### 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 Course demonstrated:

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

#### PROGRESSION

This Course or its Units may provide progression to:

- ◆ SVQs and Modern Apprenticeships in Engineering areas
- ◆ relevant programmes in Further Education colleges
- ◆ suitable training/employment

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#### Administrative Information

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## National Course Specification: (cont)

**COURSE**      Engineering Skills (Intermediate 2)

### CREDIT VALUE

The Intermediate 2 Course in Engineering Skills is allocated 24 SCQF credit points at SCQF level 5\*.

*\*SCQF points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification 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

Achievement of this Course gives automatic certification of the following:

Complete Core Skill	None
Core Skill component	Critical Thinking at SCQF level 4

Opportunities for developing aspects of Core Skills are highlighted in the Support Notes of the Unit Specifications for this Course.

### LINKS TO NATIONAL OCCUPATIONAL STANDARDS

National Occupational Standards (NOS) are developed by the key employment sectors of the United Kingdom. These standards set the competences required for job roles within a particular employment sector.

The Engineering Skills (Intermediate 2) Course has been designed to link broadly to National Occupational Standards, and the standards required of first-year apprentices in the Engineering Industry are broadly comparable with those in this Course.

This Course provides a useful preparation for employment or further training in the engineering industry. The general tolerance required for the practical activities in this Course should be  $\pm 1\text{mm}$ . The specific tolerances required for practical Unit assessments are specified in the National Assessment Bank (NAB) item.

## **National Course Specification: Course details (cont)**

**COURSE**     Engineering Skills (Intermediate 2)

### **RATIONALE FOR SKILLS FOR WORK COURSES**

Skills for Work Courses are designed to help candidates to develop:

- ◆ skills and knowledge in a broad vocational area
- ◆ Core Skills
- ◆ an understanding of the workplace
- ◆ positive attitudes to learning
- ◆ skills and attitudes for employability

A key feature of these Courses is the emphasis on *experiential learning*. This means learning through practical experience and learning by reflecting on experience.

#### **Learning through practical experience**

- ◆ Teaching/learning programmes should include some or all of the following:
  - learning in real or simulated workplace settings
  - learning through role play activities in vocational contexts
  - carrying out case study work
  - planning and carrying out practical tasks and assignments

#### **Learning through reflecting at all stages of the experience**

- ◆ Teaching/learning programmes should include some or all of the following:
  - preparing and planning for the experience
  - taking stock throughout the experience — reviewing and adapting as necessary
  - reflecting after the activity has been completed — evaluating and identifying learning points

## National Course Specification: Course details (cont)

### COURSE     Engineering Skills (Intermediate 2)

The Skills for Work Courses are also designed to provide candidates with opportunities for developing *Core Skills* and enhancing skills and attitudes for *employability*.

#### Core Skills

The **five** Core Skills are:

- ◆ Communication
- ◆ Numeracy
- ◆ Information Technology
- ◆ Problem Solving
- ◆ Working with Others

#### Employability

The skills and attitudes for employability, including self-employment, are outlined below:

- ◆ *generic skills/attitudes valued by employers*
  - understanding of the workplace and the employee's responsibilities, for example time-keeping, appearance, customer care
  - self-evaluation skills
  - positive attitude to learning
  - flexible approaches to solving problems
  - adaptability and positive attitude to change
  - confidence to set goals, reflect and learn from experience
- ◆ *specific vocational skills/knowledge*
  - Course Specifications highlight the links to National Occupational Standards in the vocational area and identify progression opportunities

Opportunities for developing these skills and attitudes are highlighted in each of the Course and Unit Specifications. These opportunities include giving young people direct access to workplace experiences or, through partnership arrangements, providing different learning environments and experiences which simulate aspects of the workplace. These experiences might include visits, visiting speakers, role play and other practical activities.

*A Curriculum for Excellence* (Scottish Executive 2004) identifies aspirations for every young person. These are that they should become:

- ◆ successful learners
- ◆ confident individuals
- ◆ responsible citizens
- ◆ effective contributors

The learning environments, the focus on experiential learning and the opportunities to develop employability and Core Skills in these Courses contribute to meeting these aspirations.

## National Course Specification: Course details (cont)

### COURSE      Engineering Skills (Intermediate 2)

#### RATIONALE FOR INTERMEDIATE 2 ENGINEERING SKILLS COURSE

The *Engineering Skills (Intermediate 2)* Course has been designed to provide a basis for progression into further education or for moving directly into training in employment within an engineering sector. The overall purpose of the Course is to ensure that candidates start to develop the generic and practical skills, knowledge and understanding, and employability skills needed within an engineering sector.

The engineering sector includes the following:

Mechanical	Manufacture	Maintenance
Fabrication	Welding	Electrical
Electronic	Foundry	Automotive
Control	Transport	Aeronautical
Communications	Space	Energy Generation
Conservation	Marine	Water
Desalination	Oil/Gas	Petroleum

This Course focuses on the broad areas of Mechanical, Fabrication, Electrical, Electronic, Maintenance, Manufacture, and an element of Design. This will allow the candidates to gain transferable skills which can be applied to any of the above engineering areas.

The primary target group for this Course is school candidates in S3 and above. It may be suitable for candidates entering engineering for the first time but also for those who have completed the *Engineering Skills (Intermediate 1)* Course. This Course will build on the skills and knowledge developed in the *Engineering Skills (Intermediate 1)* Course and will introduce candidates to a wider range of engineering applications.

It is anticipated that, for this group of candidates, the Course will rely on and build on existing partnerships between schools and colleges and employers (or other agencies). This may be particularly pertinent in the case of the Engineering Skills Course due to the specialist expertise and facilities available in, for example, further education colleges and training providers. Nevertheless, the Engineering Skills Course is designed at a level and scope such that it can be delivered in schools, if the school has suitable facilities and teaching expertise. A partnership approach would still be necessary in order to provide the contact with the workplace which is an essential part of the experience for candidates. The Course is also suitable for adult candidates who are seeking to enhance their employability and develop introductory vocational skills in an engineering sector.

## National Course Specification: Course details (cont)

### COURSE      Engineering Skills (Intermediate 2)

The general aims of the *Engineering Skills (Intermediate 2)* Course are to:

- ◆ widen participation in vocationally-related learning for school candidates from S3 upwards
- ◆ allow candidates to experience vocationally-related learning
- ◆ provide candidates with a broad introduction to the engineering vocational sector
- ◆ encourage candidates to foster a good work ethic, including timekeeping, a positive attitude, and other relevant employability skills
- ◆ provide opportunities to develop a range of Core Skills in a vocational context
- ◆ encourage candidates to take charge of their own learning and development
- ◆ provide a range of teaching, learning, and assessment styles to motivate candidates to achieve their full potential
- ◆ facilitate progression to further education and/or training
- ◆ encourage candidates to plan their work and review their progress
- ◆ encourage candidates to develop a positive attitude to waste minimisation and environmental issues

In particular, the aims of the *Engineering Skills (Intermediate 2)* Course are to:

- ◆ encourage candidates to consider a career in the engineering industry
- ◆ develop an awareness of what opportunities there may be within engineering in terms of the types and range of career options
- ◆ enable candidates to develop and apply practical, technical, and communication skills as a foundation for future learning and progression
- ◆ develop the candidates' awareness of their individual strengths and weaknesses in relation to the requirements of engineering, and to reflect on how this affects their employability potential
- ◆ give candidates the technical knowledge, skills, and understanding associated with a range of skills in engineering at this level
- ◆ give candidates an introduction to the design cycle
- ◆ encourage candidates to apply their knowledge and understanding of engineering by using skills of evaluation and problem solving in a vocational context
- ◆ develop an awareness that health and safety issues are integral to the world of work generally and engineering in particular
- ◆ prepare candidates for further learning opportunities, study, and training for employment in engineering and related occupations

The *Engineering Skills (Intermediate 2)* Course has been designed with National Occupational Standards in mind. The standards set for first-year apprentices in the engineering industry, and the standards set out in the Intermediate 2 Course, are broadly comparable in terms of skills and tolerances.

## National Course Specification: Course details (cont)

### **COURSE**      Engineering Skills (Intermediate 2)

While no formal entrance qualifications are required for this Course, it would be expected that candidates embarking on the Course would have the following:

- ◆ basic proficiency in literacy
- ◆ basic proficiency in numeracy
- ◆ some aptitude for graphical forms of communication (the reading of basic engineering drawings is developed in the Course)
- ◆ motivation to work as part of a team

This Course supports progression into appropriate further education, training, or employment. The Course provides the basis for candidates to gain an insight into engineering occupations such as Mechanical, Fabrication, Automotive, Aeronautical, Electrical, and Electronic, Marine, Control, Maintenance, and Manufacture and to use their studies to help them decide the career they wish to follow. Candidates studying this Course in Engineering and choosing a skills option, may be aiming to progress into an apprenticeship in industry. Candidates who are uncertain which trade to follow may undertake vocational courses at further education colleges.

The Intermediate 2 Course should facilitate progression to a relevant vocational Course or an appropriate National Certificate/Qualification programme.



## National Course Specification: Course details (cont)

### COURSE     Engineering Skills (Intermediate 2)

#### COURSE CONTENT

##### Summary of Course content

This Course comprises four mandatory 40 hour Units. The content of the Course focuses on the development of basic hand skills across the disciplines of Mechanical, Fabrication, Electrical, Electronic, Control, Maintenance, and Manufacture. Central to the content are the generic employability skills valued by employers in an engineering sector. These skills are developed in each of the four Units and are assessed at least twice during the Course. These add value to the development of the specific vocational skills.

All the Engineering Skills Units, while focusing on specific skill areas, also address generic skills related to:

- ◆ engineering communications
- ◆ engineering materials
- ◆ measurement and marking
- ◆ working to tolerances
- ◆ Core Skills

In addition to the specific vocational skills developed in this Course, students will have opportunities to develop and apply their knowledge and understanding of employability skills such as:

- ◆ maintaining good timekeeping and attendance
- ◆ showing health and safety awareness — to include wearing Personal Protective Equipment (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
- ◆ interpreting engineering drawings and specifications
- ◆ working cooperatively with others — to include seeking advice, following instructions and working in a team
- ◆ planning and preparing for work — to include selection of correct tools and equipment
- ◆ applying time management — to include working to schedule and undertaking a correct sequence of work
- ◆ awareness of environmental considerations — to include safe and correct disposal of waste/hazardous materials, waste minimisation and fume and dust control
- ◆ 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



## **National Course Specification: Course details (cont)**

**COURSE**      Engineering Skills (Intermediate 2)

### **ASSESSMENT**

To achieve the Course award the candidate must successfully complete the four mandatory Units.

#### **Assessment objectives**

Assessment across the Units in this Course will primarily test practical skills but will also address the technical knowledge and understanding associated with those skills in engineering at Intermediate 2. In particular, assessment will focus on:

- ◆ practical vocational skills
- ◆ skills for employment in an engineering context

#### **Unit assessment**

##### **All Units**

All of the Units focus on the development of specific engineering skills. Assessment follows a similar pattern involving a range of practical activities which will produce evidence for all the Outcomes. The evidence will be confirmed by the use of an assessor checklist which will cover:

- ◆ interpretation of a drawing or specification
- ◆ the appropriate use of tools, materials, and equipment
- ◆ successful involvement in the completion of a task, product, or assembly
- ◆ quality checking of their own work
- ◆ attention to health and safety aspects of working in a workshop type of environment

The assessment of employability skills is integrated in all of the Units and is based on assessor checklists and the completion of a candidate review sheet on one occasion within each Unit of the Course. This review allows the candidate to record development of employability skills in the context of different skill areas.

Further details about Unit assessment for this Course can be found in the Unit Specifications and the National Assessment Bank (NAB) materials.

### **QUALITY ASSURANCE**

The Units of all National Courses are subject to internal verification and may also be chosen for external verification by SQA. This is to ensure that national standards are being applied across all subjects.

To assist centres, Senior Verifier reports are published on SQA's website [www.sqa.org.uk](http://www.sqa.org.uk).

## National Course Specification: Course details (cont)

**COURSE**      Engineering Skills (Intermediate 2)

### **GUIDANCE ON LEARNING/TEACHING AND ASSESSMENT APPROACHES FOR THIS COURSE**

#### **Suggested order for sequence of delivery**

The Course has four Units which offer a broad range of different engineering experiences. It is recommended that the Unit *Engineering Skills: Mechanical and Fabrication (Intermediate 2)* is attempted and completed initially as some aspects of the content of this Unit are incorporated in all of the other Course Units. The *Engineering Skills: Design and Manufacture (Intermediate 2)* Unit should only be attempted after successful completion of the other three Units.

It is important that a well planned induction to the Course is delivered, emphasising its integrated nature, and stressing the importance of generic employability skills throughout.

Employability skills should span the Course, allowing candidates ample opportunity to develop and review employability skills and attitudes over a range of engineering skills and over a reasonable period of time.

#### **Key features in teaching and learning approaches**

The Course has been designed to ensure that candidates learn through practical experiences. The main focus in each of the skills specific Units is on practical work. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical engineering activities within the Units.

Health and safety is integral to all practical tasks and should be emphasised at the start of, and during, each practical activity.

Workshop protocol should also be included in each practical activity to enable candidates to appreciate engineering industry requirements.

Teaching and learning approaches will 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. Given the practical nature of teaching/learning and assessment, centres should ensure that teaching blocks are of sufficient time to allow a meaningful experience for candidates.

Reflecting on practical experiences and learning from them is an approach which is embedded in the Course. Throughout the learning experiences, the emphasis should be on helping candidates to develop an awareness of the employability skills and attitudes needed for the engineering industry, for example, good timekeeping, cooperating with others, taking instructions, and a positive attitude to learning. Opportunities to develop these skills and attitudes arise naturally in the work of the Course. Candidates should be aware that these generic skills are just as important as the practical engineering skills they are developing.

## National Course Specification: Course details (cont)

### COURSE      Engineering Skills (Intermediate 2)

For example, it is important for workshop activities to be carried out to effective schedules; candidates will have opportunities to demonstrate good timekeeping in the context of these schedules. Candidates will have to cooperate with others regarding shared workspace, tools, and equipment. They will have to cooperate and communicate regarding the transfer of materials, tools, and equipment safely around and across the workshop. Candidates will be encouraged to develop a positive attitude to waste minimisation and environmental issues regarding the use of materials.

The work of the Course will increase awareness that health and safety issues are important in the world of work generally and in engineering in particular.

The *Engineering Skills Course (Intermediate 2)* Course consists of four mandatory Units designed to give an insight into the general world of engineering. The practical activities of the Units can be integrated where appropriate, however, centres should ensure that they have the correct facilities, tools, and equipment to do so.

In carrying out engineering activities, candidates will learn that there are correct and incorrect ways to use tools and equipment. Teachers/lecturers/tutors will have ample opportunity to demonstrate good practice and correct procedures to candidates, who will learn the importance to self and others of following instructions. Such positive experiences will foster a positive attitude to learning.

Teaching and learning approaches should impart enthusiasm and help to inform candidates of realistic prospects in the engineering sector or in industry generally. They should become aware of steps to employment or further training. Through their experiences of the various practical skills in the Course, they should become better equipped to make valid personal choices regarding careers and further study.

Opportunities to develop aspects of Core Skills should be used where they arise naturally. For example, in order to carry out engineering activities in a workshop environment, candidates will develop aspects of numeracy when making engineering calculations and taking measurements. They will also have to communicate simple engineering terms with teachers/lecturers/tutors and fellow candidates regarding skills practices, materials and tools, health and safety and working together in the workplace. Aspects of Problem Solving will arise through their participation in practical work.

The nature of the practical activities within the Units will allow centres to complete a larger project using groups of candidates to satisfy the Performance Criteria across a number of Units. The project would have to have a complexity to allow each candidate to contribute in equal measure to the overall task.

Teaching and learning approaches should encourage candidates to take responsibility for their own learning and development. Throughout the Course, candidates need to carry out quality checks on their own work. This provides a good opportunity to motivate candidates to take pride in their work.

The integration of employability skills into each practical Unit, in particular self evaluation skills will allow candidates to take responsibility for seeking feedback and identifying action points for improvement in their own performance. This should help to develop confidence in taking advice and in asking for direction and assistance where necessary.

## **National Course Specification: Course details (cont)**

### **COURSE      Engineering Skills (Intermediate 2)**

#### **Preparation for practical activities, visiting speakers, visits**

Throughout the Course, the need for correct preparation for practical activities should be stressed. However, such preparation should not take excessive time to complete. Teaching correct skills practice, effective use of tools and equipment and a positive view of health and safety should help to ensure that preparation for practical work is comprehensive.

Candidates will require supervision during practical work — both on a skills level and for health and safety. The learning environment should be designed to minimise risks and provide a safe context for carrying out tasks. For example, when undertaking the task of Thermal Joining, candidates should be made aware of the risk from fire, fumes, and harmful rays to themselves and others.

It is recommended that each practical session be preceded by a ‘tool box’ talk on an aspect of health and safety relevant to the work in hand. It is recommended that candidates be given regular, but short, practice sessions in the correct use of the materials to be used in each session as well as coaching in the correct use of associated tools and equipment.

Centres are encouraged to establish links with local industry. Local engineering companies, trade associations, Sector Skills Councils (SSCs), Institutes and Chambers of Commerce may be prepared to offer support, for example, in the form of visits from representatives of their organisations. Visitors from industry will be able to give candidates a realistic view of jobs and conditions in the engineering industry.

It may be possible for centres to arrange visits to engineering works as part of the candidates’ learning experience. Visits to local industry are often particularly useful because work in progress will be at different stages and candidates can see various different trades working at the same time. Industrial visits should be carefully arranged, organised, and authorised. It would be preferable for those responsible for such visits to have prior knowledge of the industry in question.

#### **Approaches to assessment**

Approaches to assessment that promote the efficient and effective gathering of evidence are to be encouraged. This could include, for example, team working and integrated practical activities.

The development and assessment of generic employability skills is a key feature of this Course and is integrated with the skills specific Units. Candidates can readily gather evidence for assessment during their work in these practical skills Units. Reviewing progress with engineering employability skills and attitudes will take place in the practical context of work in the different activities. Candidates will complete a review in the different practical activities attached to each Unit, requiring a total of four reviews throughout the duration of the Course. Assessment of interpreting drawings and specifications and materials should also take place during the work in skills specific practical Units. An employability skills profile for the Course is included in Appendix A and this gives a clear indication of where assessment evidence is gathered for generic employability skills.

Within the skills specific practical Units, the candidate will produce evidence as a natural part of the learning and teaching process. Candidates will first learn and practise the correct techniques and methods for each of the skills they undertake. Assessment of the various practical tasks will take place at appropriate points throughout the Course, allowing time for candidates to make quality checks of their finished products against the prescribed tolerances, before being submitted for assessment.

## National Course Specification: Course details (cont)

### **COURSE**      Engineering Skills (Intermediate 2)

In the *Engineering Skills: Design and Manufacture* Unit candidates **can, if appropriate**, work in teams to complete a project involving the design, manufacture and assembly of a product from a given brief. The project completed by such a team must be of sufficient complexity and scope to allow all members of the team to make an equal contribution to the design, manufacture and assembly of the product. The product, designed and manufactured by a team can be, for example, part of a community based project for the school, college, or a youth group. Where this occurs each candidate's contribution to the completion of the task must be identified to ensure that all Outcomes and Performance Criteria have been met.

#### **Health and Safety**

Risk assessment and compliance with health and safety legislation is of paramount importance in this Course. Due to the health and safety implications involved in working in engineering, the Units have been designed so that they can be taught and assessed in a workshop environment.

It is the centre's responsibility to produce risk assessments which set out the safe working/teaching and learning arrangements for teachers/lecturers/tutors, support staff and candidates. Centres will need to be familiar with the requirements of the Health and Safety at Work Act, The Management of Health and Safety at Work Regulations, Control of Substances Hazardous to Health, Provision and Use of Work Equipment Regulations and other legislative requirements where risk assessments are required. (This list of statutes is not intended to be exhaustive, and centres must comply with all current relevant legislation whether listed, or otherwise.)

The *Engineering Skills (Intermediate 2)* Course requires access to safe and suitably equipped, classrooms, workshops, or work areas to deliver and assess the vocational skill options. These workshops or work areas should be of an appropriate size and have sufficient tools, equipment, and resources to deliver and assess the Units for the number of learners in the class group. This may take the form of a combined workshop/project area divided into suitable work areas for each skill, or separate workshops. Storage areas for materials and PPE should also be provided. It is recognised that some centres will not have facilities available to deliver all of the options in these qualifications; in these cases, appropriate partnership arrangements would provide the learning environments and/or expertise necessary to deliver the Course. Liaison and agreements regarding health and safety and safe systems of work would be a priority for partners involved.

#### **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 this Course. 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)).

## National Course Specification: Course details (Appendix A)

**COURSE:** Engineering Skills (Intermediate 2)

### Appendix: Employability Skills Profile

In addition to the specific, vocational skills developed and assessed in this Course, employability skills are addressed as detailed in the table below. For the purposes of the table, the Units are referred to as A, B, C and D as indicated.

#### Engineering Skills (Intermediate 2)

<b>Mechanical and Fabrication</b>	= A
<b>Electrical and Electronic</b>	= B
<b>Maintenance</b>	= C
<b>Design and Manufacture</b>	= D

<b>Employability skills/attitude</b>	<b>Evidence</b>
◆ maintaining good timekeeping and attendance	A, B
◆ showing health and safety awareness	A, B, C, D
◆ selecting and using engineering tools and materials	A, B
◆ interpreting engineering drawings and specifications	B, C, D
◆ working cooperatively with others	C, D
◆ planning and preparing for work	C, D
◆ applying time management	D
◆ awareness of environmental considerations	B, C
◆ quality checking own work	A, B, C, D
◆ self review and evaluation	A, B, C, D

#### Assessment evidence in all Units:

Assessor observation checklists of practical activities and candidate review sheets.





## 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)).



## National Unit Specification: general information

**UNIT**            Engineering Skills: Electrical and Electronic (Intermediate 2)

**CODE**            F39C 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 electrical, electronic, or employment experience. Candidates will learn to select and safely use the correct tools and components required to construct extra low voltage functional circuits.

Candidates will have the opportunity to review the employability skills they have developed across the range of practical experiences.

### OUTCOMES

- 1 Identify, select, and use a range of tools to terminate and test electrical cables and accessories.
- 2 Identify, select, and use a range of tools to terminate and test electronic cables and components.
- 3 Construct and test circuits from given diagrams.
- 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: Electrical and Electronic (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**

Achievement of this Unit gives automatic certification of the following:

Complete Core Skill                      None

Core Skill component                      Critical Thinking at SCQF level 4

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: Electrical and Electronic (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, select, and use a range of tools to terminate and test electrical cables and accessories.

##### **Performance Criteria**

- (a) Identify and state the use of cables and accessories used in electrical circuits correctly.
- (b) Identify and safely use tools correctly.
- (c) Terminate cables and accessories correctly.
- (d) Complete tests to ensure cable and accessory continuity and integrity.
- (e) Correctly observe safe working practices in all practical activities.

#### **OUTCOME 2**

Identify, select, and use a range of tools to terminate and test electronic cables and components.

##### **Performance Criteria**

- (a) Identify and state the use of cables and components used in electronic circuits correctly.
- (b) Identify and safely use tools correctly.
- (c) Terminate cables and components correctly.
- (d) Complete tests to ensure cable and component continuity and integrity.
- (e) Correctly observe safe working practices in all practical activities.

#### **OUTCOME 3**

Construct and test circuits from given diagrams.

##### **Performance Criteria**

- (a) Construct an electrical circuit from given diagrams and specifications correctly.
- (b) Construct an electronic circuit from given diagrams and specifications correctly.
- (c) Complete a quality check to test and record each circuit function.
- (d) Correctly observe safe working practices in all practical activities.

#### **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

### UNIT      Engineering Skills: Electrical and Electronic (Intermediate 2)

#### EVIDENCE REQUIREMENTS FOR THIS UNIT

Performance 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 construction of extra low voltage electrical and electronic circuits in a safe manner, which should conform to current legislation, will cover:

- ◆ interpretation of simple diagrams and specifications
- ◆ identification and use of the following electrical and electronic cables:
  - single core, multi core, twin and earth, screened, co-axial, and ribbon
- ◆ identification and use of the following electrical accessories:
  - consumer Unit, switches, lamp holders, sockets, and protective devices
- ◆ identification and use of the following electronic components:
  - resistors, capacitors, inductors, diodes, transistors, ICs, and audio/visual devices
- ◆ selection, function, and use of the following tools:
  - screwdrivers (various), wire strippers, wire cutters, pliers, crimping tool, solder irons, circuit assembly aids, and digital test instruments

The electrical circuit will be constructed:

- ◆ using any cable(s)
- ◆ using at least three different types of accessory
- ◆ using four tools

The electronic circuit will be constructed:

- ◆ using any cable(s)
- ◆ using at least four different types of component
- ◆ using four tools

The circuits should be tested using suitable test instruments and the results recorded.

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

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

### **UNIT      Engineering Skills: Electrical and Electronic (Intermediate 2)**

#### **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 Personal Protective Equipment (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
- ◆ interpreting engineering drawings and specifications
- ◆ awareness of environmental considerations — to include safe and correct disposal of waste/hazardous materials, waste minimisation and fume and dust control
- ◆ 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: Electrical and Electronic (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 electrical and electronic 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 electrical and electronic 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 electrical circuit and an electronic circuit. During the process of practical work the candidate will become accustomed to electrical and electronic 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, wearing PPE including protective clothing, when required.

Relevant aspects of current health and safety legislation, current COSHH (Control of Substances Hazardous to Health) 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: Electrical and Electronic (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 electrical and electronic activities within the Unit. The electrical circuits should include both power and lighting circuits. The electronic circuits could include analogue and/or digital circuits. Centres may wish to introduce some terminology relating to control circuits when referring to electronic circuits. Where this Unit is being taught as part of the Course this may be of benefit to candidates during the completion of the Unit: *Engineering Skills: Design and Manufacture (Intermediate 2)*.

Each constructed circuit should be protected by an appropriate protective device such as a fuse, relay, Residual Current Device (RCD), or Miniature Circuit Breaker (MCB). 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 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 practice 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 firms could be arranged if appropriate. Equally, visiting speakers from local firms should be encouraged. Additional useful material and employment opportunities can be resourced from the research of local engineering firms or from the internet.



## National Unit Specification: support notes (cont)

### UNIT        Engineering Skills: Electrical and Electronic (Intermediate 2)

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

### 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.

Achievement of this Unit gives automatic certification of the Core Skill component of *Critical Thinking* at SCQF level 4.

### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

The Unit assessment will include electrical skills, electronic skills and employability skills. It is recommended that the stated electrical skills, electronic skills, and employability skills are assessed throughout the Unit.

The electrical and electronic skills assessed in this Unit are:

- ◆ interpret diagrams and specifications
- ◆ cut
- ◆ terminate
- ◆ select and fit accessories
- ◆ select and fit components
- ◆ select and use tools
- ◆ complete appropriate tests
- ◆ preparation planning
- ◆ construct circuits to specification

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
- ◆ interpreting engineering drawings and specifications
- ◆ awareness of environmental considerations
- ◆ quality checking own work
- ◆ self review and evaluation

## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Electrical and Electronic (Intermediate 2)

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 electrical skills will be evidenced by practical assignments involving the construction and test of, for example, a lighting circuit and these will be supported by assessor observation checklists.

The assessment of electronic skills will be evidenced by practical assignments involving the construction and test of, for example, an analogue or digital circuit on a suitable type of circuit board, and these will be supported by assessor observation checklists.

The assessment for both electrical and electronic could be integrated into the construction and test of combined electrical and electronic circuitry, for example, a power source or alarm system.

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

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 test readings. Candidates themselves are required to carry out a quality check against these same standards. 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)*.



## National Unit Specification: general information

**UNIT**            Engineering Skills: Maintenance (Intermediate 2)

**CODE**            F39D 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, materials, and equipment required to test, disassemble, repair, and reassemble an engineering part.

Candidates will have the opportunity to review the employability skills they have developed across the range of practical experiences.

### OUTCOMES

- 1 Identify, select, and use tools and equipment to assess the functionality of an engineering part.
- 2 Identify, select, and use tools and equipment to maintain an engineering part.
- 3 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: Maintenance (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**

Achievement of this Unit gives automatic certification of the following:

Complete Core Skill	None
Core Skill component	Critical Thinking SCQF level 4

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: Maintenance (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, select, and use tools and equipment to assess the functionality of an engineering part.

##### **Performance Criteria**

- (a) Interpret and use manufacturers' drawings and specifications.
- (b) Identify, select, and use tools and equipment to test an engineering part.
- (c) Correctly determine whether the engineering part is functional.
- (d) Correctly observe safe working practices in all practical activities.

#### **OUTCOME 2**

Identify, select, and use tools and equipment to maintain an engineering part.

##### **Performance Criteria**

- (a) Interpret and use manufacturers' drawings and specifications correctly.
- (b) Identify, select, and use tools and equipment to disassemble an engineering part correctly.
- (c) Identify, select, and use tools and equipment to repair an engineering part correctly.
- (d) Identify, select, and use tools and equipment to reassemble an engineering part correctly.
- (e) Correctly observe safe working practices in all practical activities.

#### **OUTCOME 3**

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

### UNIT      Engineering Skills: Maintenance (Intermediate 2)

#### EVIDENCE REQUIREMENTS FOR THIS UNIT

Performance 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 maintenance activities which include testing, disassembly, repair, and reassembly of an engineering part (an engineering part can be defined as a system, subsystem, item, or component) in a safe manner will cover:

- ◆ interpretation of manufacturers' drawing and specifications
- ◆ identification, selection, and use of tools and equipment to test an engineering part:
  - mechanical and/or electrical
- ◆ identification, selection, and use of any three of the following tools and equipment for disassembly:
  - screwdrivers, spanners, hammer, holding devices, extractors, pliers
- ◆ identification, selection, and use of any three of the following tools and equipment for repair:
  - files, scrapers, pliers, hammer, holding devices, drills, taps, dies, reamer
- ◆ identification, selection, and use of any three of the following tools and equipment for assembly:
  - screwdrivers, spanners, hammer, holding devices, insertion tool, extractors, pliers

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

The standard for the final assessment is expressed in the National Assessment Bank (NAB) material, in which the reassembled engineering part must conform to the manufacturer's original specification.

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

### **UNIT      Engineering Skills: Maintenance (Intermediate 2)**

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

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

- ◆ showing health and safety awareness — to include wearing Personal Protective Equipment (PPE), safe working practices, and understanding a basic risk assessment
- ◆ interpreting engineering drawings and specifications
- ◆ working cooperatively with others — to include seeking advice, following instructions and working in a team
- ◆ planning and preparing for work — to include selection of correct tools and equipment
- ◆ awareness of environmental considerations — to include safe and correct disposal of waste/hazardous materials, waste minimisation, and fume and dust control
- ◆ 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: Maintenance (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 maintenance activities at a basic level. 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. Basic 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 maintenance 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 the disassembly, repair, and reassembly of an engineering part. An engineering part can be defined as a system, subsystem, item or component.

During the process of practical work the candidate will become accustomed to maintenance terminology and will be able to demonstrate a basic 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, wearing personal protective equipment (PPE) including protective clothing when required.

Relevant aspects of current health and safety legislation, current COSHH (Control of Substances Hazardous to Health) 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.

In particular the Health and Safety requirements needed during the set up, test, disassembly, and assembly of engineering parts should be stressed.



## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Maintenance (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 maintenance activities within the 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.

The functional test, disassembly, and reassembly of the following examples may be beneficial in the development of candidate ability:

◆ Washing Machine/Component(s)	◆ Kitchen Appliance
◆ Motor Vehicle Component(s)	◆ Bicycle
◆ Domestic Fan	◆ Electric Motor
◆ Industrial Valves or Pumps	◆ Motor Cycle
◆ Vacuum Cleaner	◆ Lawn Mower

The list is not designed to be exhaustive but merely an indication of the type of engineering part that would be suitable for maintenance.

Centres may wish to introduce some terminology relating to control circuits when referring to maintenance. Where this Unit is being taught as part of the Course this may be of benefit to candidates if an integrated approach is selected for the Unit: *Engineering Skills: Design and Manufacture (Intermediate 2)*.

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 practice 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.

## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Maintenance (Intermediate 2)

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

### 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. In addition this Unit will provide each candidate with many different problems and this will enable development of the Core Skill of *Problem Solving*.

Achievement of this Unit gives automatic certification of the Core Skill component of *Critical Thinking* at SCQF level 4.

### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

The Unit assessment will include a functionality test, disassembly, repair, and assembly of an engineering part and employability skills. It is recommended that the stated maintenance and employability skills are assessed throughout the Unit.

The maintenance skills assessed in this Unit are:

- ◆ test — mechanical
- ◆ test — electrical
- ◆ test — visual
- ◆ disassembly
- ◆ repair
- ◆ assembly
- ◆ preparation planning
- ◆ select materials
- ◆ interpret simple drawings
- ◆ select tools
- ◆ maintain to manufacturer's specification

## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Maintenance (Intermediate 2)

The employability skills assessed in this Unit are:

- ◆ showing health and safety awareness
- ◆ interpreting engineering drawings and specifications
- ◆ working cooperatively with others
- ◆ planning and preparing for work
- ◆ awareness of environmental considerations
- ◆ 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 maintenance skills will be evidenced by a practical assignment involving the functionality test, disassembly, repair, and assembly of an engineering part. Typical examples would be a calliper brake system, a hydraulic valve or cylinder, a pneumatic valve or cylinder and these will be supported by assessor observation checklists.

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

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. 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)*.



## National Unit Specification: general information

**UNIT**            Engineering Skills: Design and Manufacture (Intermediate 2)

**CODE**            F39E 11

**COURSE**        Engineering Skills (Intermediate 2)

### SUMMARY

This Unit is a mandatory Unit of the *Engineering Skills (Intermediate 2)* Course and has been designed to be taken as part of that Course but can also be taken as a free-standing Unit. It is suitable for candidates with no previous engineering or employment experience.

In this Unit candidates will develop Computer Aided Draughting (CAD) skills and then integrate the skills of mechanical, fabrication, electrical, and electronic developed in the other Units of this Course. Candidates will select and use the correct tools and materials required to design, manufacture/construct, test, evaluate and report their findings on the manufacture/construction of a project selected from a given brief.

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

### OUTCOMES

- 1 Design a product from a given project brief.
- 2 Identify, select, and use tools, materials, and equipment to manufacture/construct the product.
- 3 Evaluate the results of practical tests on the product.
- 4 Review and evaluate own employability skills in practical engineering contexts.

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#### Administrative Information

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## National Unit Specification: general information (cont)

**UNIT**      Engineering Skills: Design and Manufacture (Intermediate 2)

### RECOMMENDED ENTRY

Entry is at the discretion of the centre but it is recommended that candidates have successfully completed the following Units or equivalent:

F39B 11      *Engineering Skills: Mechanical and Fabrication (Intermediate 2)*  
F39C 11      *Engineering Skills: Electrical and Electronic (Intermediate 2)*  
F39D 11      *Engineering Skills: Maintenance (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

Achievement of this Unit gives automatic certification of the following:

Complete Core Skill	None
Core Skill component	Critical Thinking at SCQF level 4

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: Design and Manufacture (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**

Design a product from a given project brief.

##### **Performance Criteria**

- (a) Produce a design specification for the product in accordance with the given brief.
- (b) Correctly add dimensions and manufacturing instructions to the design specification.
- (c) Produce a CAD drawing of a product part of the design specification to relevant standards.
- (d) Produce a hard copy of the CAD drawing.

#### **OUTCOME 2**

Identify, select, and use tools, materials, and equipment to manufacture/construct the product.

##### **Performance Criteria**

- (a) Identify, select, and safely use a range of relevant tools, materials and equipment.
- (b) Safely and correctly manufacture/construct the product from the design specification.
- (c) Correctly observe safe working practices in all practical activities.

#### **OUTCOME 3**

Evaluate the results of practical tests on the product.

##### **Performance Criteria**

- (a) Identify and use dimensional checks on the completed product correctly.
- (b) Test that the functional use of the completed product conforms to the given brief.
- (c) Produce a report which includes a valid conclusion on the functionality of the product.
- (d) Communicate the findings of the report to a specified audience.

#### **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: Design and Manufacture (Intermediate 2)

#### EVIDENCE REQUIREMENTS FOR THIS UNIT

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

**Performance and product evidence** will be supported by assessor checklists. This evidence will be generated from a project consisting of practical activities carried out under supervised conditions.

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

Candidates will be assessed on the practical activities in the manufacture/construction of a product in a safe manner. The product will be selected from **ONE** of the following project briefs:

1    Design a project which incorporates at least **THREE** component parts that will **LIFT** a 1kg weight to a height of 500mm and **LOCK** the weight at that height.

**or**

2    Design a circuit diagram and component layout of an electrical/electronic project that will move an object from a horizontal to vertical position and give an audible and visual indication.

**or**

3    Design a control system that will measure a physical parameter, give an audible and visual warning when the physical parameter changes and activate an output transducer.

**or**

4    Design a project that will incorporate a minimum of any **TWO** from the following: Mechanical; Fabrication; Electrical; Electronic; Control.

Whichever project brief is selected, candidates are required to:

- ◆ produce a design specification suitable for manufacture
- ◆ produce a hard copy of a CAD drawing of a product part to include:
  - two views
  - three line types
  - dimensions
  - orthographic symbol
  - title block
- ◆ select and use the correct tools, materials, and equipment, as required, to safely manufacture and assemble the product
- ◆ complete dimensional checks on the completed product
- ◆ complete functionality tests on the completed product to check for quality, robustness, fitness for purpose before submitting their work for final assessment

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

### UNIT Engineering Skills: Design and Manufacture (Intermediate 2)

Where candidates choose to complete option 4 (the integrated project) they can, if appropriate, work in teams. It is essential that the project produced by such a team will be of sufficient complexity and scope to allow all members of the team to make a contribution equal to the manufacture and assembly of a project by an individual candidate.

Where this occurs the assessor must be satisfied that each individual candidate has produced evidence to demonstrate achievement of all Outcomes and Performance Criteria.

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

#### Written/Oral Evidence

Candidates are required to:

- ◆ complete an evaluation on the functionality of the project using a given pro forma checklist
- ◆ complete a short report of between 250 and 400 words, that includes a valid conclusion on the functionality of the project
- ◆ communicate the findings of the report to a peer group
- ◆ complete a self evaluation review of their own performance against the following employability skills:
  - showing health and safety awareness — to include wearing PPE, safe working practices and understanding a basic risk assessment
  - interpreting engineering drawings and specifications
  - working cooperatively with others — to include seeking advice, following instructions and working in a team
  - planning and preparing for work — to include selection of correct tools and equipment
  - applying time management — to include working to schedule and undertaking a correct sequence of work
  - 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 candidate review sheet, assessor checklists and functionality pro forma. 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: Design and Manufacture (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 the design, manufacture, test, evaluation, report, and presentation of a project at a basic level. The candidate is required to select materials, tools and equipment correctly and safely in the manufacture/construction and assembly of the product.

It is likely that this Unit will be delivered as part of the Intermediate 2 Engineering Skills Course. In this context, candidate will build on the content covered in the other mandatory Units:

F39B 11	<i>Engineering Skills: Mechanical and Fabrication (Intermediate 2)</i>
F39C 11	<i>Engineering Skills: Electrical and Electronic (Intermediate 2)</i>
F39D 11	<i>Engineering Skills: Maintenance (Intermediate 2)</i>

This Unit provides candidates with the opportunity to integrate some of the skills developed in those Units and be introduced to some applications of the design cycle. These should concentrate on functional aspects such as: fit for purpose, dimensional, material, and the manufacture/construction method.

It is important that the learning takes place in a supervised workshop environment for both CAD and practical activities. Basic safe working practices will be included in the content as it is important that candidates adhere to these at all times.

Candidates will work on a range of activities which will enable them to become familiar with a variety of dimensional and functionality tests. During the process of the project design and manufacture the candidate will use engineering terminology and will be able to demonstrate a basic knowledge and understanding of the terminology in everyday practice.

It would be beneficial if candidates were introduced to basic presentation and reporting techniques in order to plan, prepare, and deliver a short report and presentation to their peers on the use and functionality of the project.

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

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

### **UNIT      Engineering Skills: Design and Manufacture (Intermediate 2)**

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

Relevant aspects of current health and safety legislation, current COSHH (Control of Substances Hazardous to Health) 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.

#### **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 presentation activities in the manufacture, assembly, and testing of a project. 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 manufacturing and test tools and equipment, are integrated within the 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 functionality and usage tests by tutors. Short lessons on specific aspects of industrial practice and the correct use of tools and equipment will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the candidates practice the testing skills emphasised by demonstrations.

The design incorporates a CAD drawing of a part of the product and it is important that only a reasonable length of time is apportioned to this activity. The recommended time allocated should be no more than 14 hours and the CAD package can be either 2D, 3D or equivalent, depending on centre resources.

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.

Teaching and learning on reporting and presentation skills such as recording of relevant test data, valid conclusions derived from test data, selection and use of the appropriate presentation techniques, planning and preparation of a simple presentation, and use of basic presentation equipment, if appropriate, should also be covered.

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.

## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Design and Manufacture (Intermediate 2)

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

### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates will perform simple calculations and take measurements. These activities provide good opportunities to develop the Core Skill of *Numeracy*. 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. Candidates will develop written and/or oral communications skills when reporting on the functionality. Candidates will use IT equipment and skills when operating a CAD package. Candidates will also have the opportunity to develop practical *Problem Solving* skills when working on the design, manufacture and assembly of a project.

Achievement of this Unit gives automatic certification of the Core Skill component of *Critical Thinking* at SCQF level 4.

### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

The Unit assessment will include the design, manufacture, and assembly of a product, test evaluation of the product, a report and presentation on the functionality of the product, and a candidate review of employability skills. The design, manufacture, assembly, test, report and presentation of a product and the employability skills are assessed throughout the Unit.

The practical skills assessed in this Unit may be:

◆ Design	◆ CAD
◆ Manufacture	◆ Assembly
◆ Mechanical	◆ Fabrication
◆ Electrical	◆ Electronic
◆ Control	◆ Reporting

## National Unit Specification: support notes (cont)

### UNIT      Engineering Skills: Design and Manufacture (Intermediate 2)

The design of the project will be assessed by candidates producing a copy of their design specification. In addition, candidates will produce a CAD drawing of a part of the product. Candidates can produce the whole project specification on the CAD package, if they choose to do so.

The assessment of the manufacture and assembly of the product will be evidenced by assessor observation checklists on the practical activities.

It is anticipated that candidates will be given practice in design, manufacture, and assembly techniques prior to assessment. The assessment activities should also make an important contribution to the learning process.

The test evaluation skills assessed in this Unit are:

- ◆ dimensional
- ◆ functional

The assessment of the test evaluation will be evidenced by a practical exercise supported by assessor observation checklists.

It is recommended that a pro forma is used for the evaluation of test results. Candidates should use the data to prepare and present a short report to a peer group. The report should be between 250–400 words.

The employability skills assessed in this Unit are:

- ◆ showing health and safety awareness
- ◆ interpreting engineering drawings and specifications
- ◆ working cooperatively with others
- ◆ planning and preparing for work
- ◆ applying time management
- ◆ 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 judgement.

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

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

### **UNIT        Engineering Skills: Design and Manufacture (Intermediate 2)**

#### **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)).