

## National Unit Specification: general information

<b>UNIT</b>	Machine Processes – Metal (Intermediate 2)
<b>NUMBER</b>	D179 11
<b>COURSE</b>	Engineering Craft Skills (Intermediate 2)

### SUMMARY

Candidates will learn how to operate a range of machine tools and manufacture an artefact involving their use.

### OUTCOMES

- 1 Use marking-out tools and equipment.
- 2 Demonstrate knowledge of common machine tools and equipment.
- 3 Perform a range of operations on a pedestal drill and a centre lathe.
- 4 Manufacture an artefact from a working drawing.

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have had some previous experience of practical skills, including reading engineering drawings. This may be evidenced by one of the following:

- Standard Grade Craft and Design
- Engineering Craft Skills at Intermediate 1

### CREDIT VALUE

1 credit at Intermediate 2.

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#### Administrative Information

<b>Superclass:</b>	XF
<b>Publication date:</b>	December 1999
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<b>Version:</b>	03

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

**UNIT**        Machine Processes – Metal (Intermediate 2)

### **CORE SKILLS**

There is no automatic certification of core skills or core skills components in this unit.

Additional information about core skills is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

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

### **UNIT        Machine Processes – Metal (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 the Scottish Qualifications Authority.

#### **OUTCOME 1**

Use marking-out tools and equipment.

##### **Performance criteria**

- (a) The construction of datums is correct.
- (b) The workpiece is marked out correctly in accordance with the given working drawing.
- (c) Three functional dimensions are within the permitted limits.

##### **Evidence requirements**

Performance evidence that the candidate can mark out a workpiece to meet the performance criteria, on three functional sizes, with tolerances of  $\pm 0.5$  mm on three linear sizes.

#### **OUTCOME 2**

Demonstrate knowledge of common machine tools and equipment.

##### **Performance criteria**

- (a) Identification of common machine tools and their related equipment is correct.
- (b) Machines and equipment are correctly matched to applications.

##### **Note on range for the outcome**

Machine tools: centre lathe, milling machine, grinder, pedestal drill.

##### **Evidence requirements**

Written and/or oral evidence that the candidate can score a minimum of 16/20 in identifying types of machine equipment and processes associated with them.

#### **OUTCOME 3**

Perform a range of operations on a pedestal drill and a centre lathe.

##### **Performance criteria**

- (a) Drilling and countersinking on the pedestal drill meets specified requirements.
- (b) The centre lathe operations of parallel and taper turning, facing, chamfering and parting-off are performed to specified standards.

##### **Evidence requirements**

Performance evidence that the machines have been operated to meet the requirements of the performance criteria.

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

### **UNIT           Machine Processes – Metal (Intermediate 2)**

#### **OUTCOME 4**

Manufacture an artefact from a working drawing.

##### **Performance criteria**

- (a) The artefact produced is in accordance with the working drawing.
- (b) Appropriate machines and equipment are used correctly.
- (c) The accuracy achieved is within specified tolerances.
- (d) The quality of the machined finish complies with stated standards.
- (e) All safety practices and procedures are observed correctly in the use of machine tools and in the manufacture of an artefact.

##### **Evidence requirements**

Performance evidence that the candidate can manufacture an artefact to meet the performance criteria. For PC (c) the required accuracy should be achieved on at least three functional sizes, to tolerances of  $\pm 0.2$  mm on diameter and  $\pm 0.5$  mm on linear. Compliance with safe practices and procedures should be recorded from observation.

## National Unit Specification: support notes

### UNIT Machine Processes – Metal (Intermediate 2)

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

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

This unit develops knowledge and skills in metalworking machines, equipment and their uses.

Candidates attempting this unit will mainly be in post-16 education, although it may also be undertaken by some adult returners and perhaps some candidates in the 14 to 16 curriculum.

Candidates require little prior experience, but will be expected to produce good practical work. Artefacts produced should have a personal appeal to the client group, but must provide challenge and stimulation.

Apart from developing basic machining skills, this unit should emphasise the need for safe working practices and a disciplined approach to achieving quality work. As part of a course in the post-16 curriculum, the candidates should be required to act and perform as adults and, accordingly, the tasks set should be challenging to the candidates at the level at which they are working. The candidates will be required to operate machinery and equipment to a code of practice with a degree of independence, and it is essential that a mature and responsible approach is taken by the candidate.

Artefacts will be produced to working drawings and should where possible involve integration of previous experience, for example *Bench Skills – Metal (Int 2)*.

Prior knowledge of reading drawings is assumed.

### GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Content:

- marking off tolerances of  $\pm 0.5$  mm on functional dimensions
- machine tools: knowledge of centre lathe, milling machine, bench grinder, pedestal drill
- equipment: knowledge of cutting, parting, and boring tools, diamond and straight knurling tools, three and four jaw chucks, chuck keys, morse tapers, morse taper sleeves, revolving centres, machine vices, safety equipment
- applications: knowledge of slotting, parallel turning, facing, chamfering, taper turning using the compound slide, drilling, boring, countersinking, surface levelling, centre drilling, grinding

This unit tries to balance practical activity with knowledge and understanding that can be transferred to more complex machinery in industrial situations at a later date. The context should relate to industrial applications whenever possible.

Through these practical activities the candidate should develop respect for codes of practice and develop a healthy attitude to safety regulations.

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

### **UNIT            Machine Processes – Metal (Intermediate 2)**

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

This unit seeks to broaden the candidates' knowledge of workshop machinery available in an industrial situation. An industrial visit is an essential part of this course. The candidates should be offered the opportunity to see CNC machine tools, such as capstan lathes and vertical milling machines, in action. Industrial standards for surface finish should also be a feature of the visit and opportunities should be taken to view machine tools such as surface grinders in action. If access cannot be gained to an appropriate industrial centre, then videos should be used to emphasise the use of these machines, although it must be stated that there can be no substitute for the real-life experience.

#### ***Using special marking-out techniques***

The need for special marking-out techniques for certain precision work and irregular components should be discussed. Marking-out of larger products, and repetitive marking-out should also be discussed.

#### ***Demonstrating knowledge of common machine tools and equipment***

Candidates should be made aware of different metal-cutting situations and should match these to particular machines. If milling and shaping machines are not available in the centre, these should be covered by an industrial visit, by visiting another centre or by video.

#### ***Performing routine user checks on tools and machinery prior to their use***

The candidate should be responsible for ensuring that the machinery to be used is set up appropriately, with all safety equipment in place prior to use. Similarly, the inspection of hand tools and reporting of defects should become a routine event in this course.

#### ***Operating common machine tools in accordance with safe working practice***

The candidate should use as many machines and items of equipment as possible (a minimum of two), and artefacts that are produced to given working drawings should embody as wide a range as possible.

If a milling machine is not available to the candidates for actual use, then drilling-machine operations should involve at least one activity whereby the machine vice is clamped to the table. This will ensure that the candidates have practical experience of work holding of this type.

Morse tapers should be used to hold larger drills, rather than the 'Jacobs' chuck.

Turning operations should include: plain parallel turning, facing, taper turning using a compound slide, centre drilling and drilling, and knurling, although this range might well be extended, according to needs, to include boring and parting off. Machined finishes should be without significant defects, and probably best gauged against exemplar pieces, visually and by thumbnail check.

#### ***Adhering to safe working practices at all times***

Safe working practices will be demonstrated and highlighted by the teacher/lecturer throughout the course, but the opportunity should be taken here to ensure that the candidates are aware that their approach to this topic is being monitored and will continue to be monitored throughout the course.

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

### **UNIT            Machine Processes – Metal (Intermediate 2)**

Care of tools and recognition of the hazards of tool defects with regard to quality of work and possible hazard to the user will be a recurrent theme in the course, and the topic should be further reinforced in this unit.

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

Whenever possible, the dynamic nature of this course should not be hindered by overburdening assessment of the candidate.

The candidate should be aware that certain performances are being monitored constantly and recorded on an observation checklist, and that finished artefacts will be tested against the stated criteria for accuracy and quality. Lengthy written tests are not required for tool, process or equipment recognition and use. Short-answer tests that are mainly of a visual nature will be provided. Another technique would be to display the tools and equipment, and ask the candidates to write or state their names and uses.

#### ***Approaches to generating evidence***

Assessment evidence for this unit should be able to be drawn from the manufacture of one or two artefacts that perhaps also include reinforcement and additional evidence for other units in the course. Examples of this might be additional practice and evidence in reading drawings, measuring, and marking-out and fitting skills. A manufacturing plan could also be produced as a matter of good practice, but would not be required for assessment purposes in this unit. In situations where candidates fail to achieve the required standard of performance in one area, this weakness can be targeted in the next part of the course, when the next artefact is manufactured, or perhaps in the course assessment project itself.

In situations where candidates fail to achieve the required standard of performance in more than one area, it may be necessary to provide tasks aimed specifically at the areas to be reassessed.

Some candidates may require additional support and help to ensure success in the manufacturing process, but candidates must also be aware that the overall course assessment takes into account the amount of practical assistance given by the teacher/lecturer, and that ultimately a degree of independence is expected from the candidate.

#### **SPECIAL NEEDS**

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs/Candidates whose First Language is not English* (SQA, 1998).