National Unit Specification: general information

UNIT Material Removal Practice: Turning (SCQF level 6)

CODE F5KG 12

SUMMARY

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

This Unit is designed to allow candidates to develop the knowledge and skills to perform advanced lathe turning operations. During the delivery of the Unit candidates will develop the knowledge, understanding and skills to interpret complex features on engineering drawings and source and extract turning related information from specialist sources. They will also learn to complete planning and inspection documentation. Candidates will have an opportunity to develop the knowledge and skills to identify and use specialist lathe cutting tools and equipment, as used in advanced centre lathe techniques, to manufacture a complex component(s). They will also measure and record component(s) dimensions to verify if the component(s) complies with a given specification(s). An essential aspect of Unit delivery will be that candidates comply with current Health and Safety legislation and safe working practices while performing turning operations. Candidates will also complete a risk assessment associated with producing a component on a lathe.

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

OUTCOMES

1 Interpret complex information from engineering sources in relation to turning operations.
2 Use a centre lathe to manufacture a component(s) to a given specification.
3 Comply with current Health and Safety regulations and safe working practices and conduct a risk assessment involving turning operations on a component(s).

Administrative Information

Superclass: XF

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National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

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

- the NQ Unit *Material Removal Practice: Turning* (SCQF level 5)
- appropriate Industrial Experience in the field of manufacturing engineering or machining

CREDIT VALUE

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

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

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

This Unit provides opportunities for candidates to develop aspects of the following Core Skills:

Problem Solving (SCQF level 6)

Numeracy (SCQF level 5)

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

National Unit Specification: statement of standards

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

OUTCOME 1

Interpret complex information from engineering sources in relation to turning operations.

Performance Criteria

(a) Drawing conventions and abbreviations are identified correctly in terms of current British Standards.
(b) Complex dimensioning, tolerances and surface finishes are interpreted correctly from given component drawings.
(c) Detailed technical information relating to the manufacture of given component(s) using turning processes is extracted successfully from specialised sources.

OUTCOME 2

Use a centre lathe to manufacture a component(s) to a given specification.

Performance Criteria

(a) Complete a planning document correctly for the manufacture of a component(s).
(b) Select and use correct work-holding methods and tooling to manufacture a component(s).
(c) Use measuring equipment correctly to verify component(s) conform to a given specification.
(d) Record measurement results correctly on inspection documentation and identify any non-conforming measurement(s) correctly.

OUTCOME 3

Comply with current Health and Safety regulations and safe working practices and conduct a risk assessment involving turning operations on a component(s).

Performance Criteria

(a) Use machine guards correctly during turning operations.
(b) Use appropriate Personal Protective Equipment correctly.
(c) Comply fully with safety requirements, good housekeeping and appropriate tool/equipment storage.
(d) Complete a partially completed risk assessment correctly for a turning process.
(e) Cooperate effectively with others in an engineering workshop.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

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

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

Outcomes may be assessed by a single, holistic assessment covering all three Outcomes or assessed as a combination of Outcomes (eg Outcome 1 on its own and Outcomes 2 and 3 together).

Outcome 1 (Written and/or Recorded Oral Evidence)

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

With regard to Outcome 1:

- candidates must correctly identify four drawing conventions and abbreviations from a given selection
- candidates must be given a turning component drawing and asked to extract a minimum of six pieces of complex information relating to dimensions, dimensional tolerances, geometric tolerances and surface finishes
- candidates must source and extract information on tool types, tool materials, speeds and feeds and coolant types from charts and technical data sheets for a minimum of two different materials

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

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

For Outcome 2 each candidate will require to manufacture a component(s) from a given engineering drawing(s) which has as a minimum the following features: 2 internal diameters, three external diameters, three lengths, one taper, one undercut and one radius. One of the internal diameters should be produced using a boring tool. The component(s) will be manufactured throughout the delivery of the Unit and must be manufactured under supervised conditions.

National Unit Specification: statement of standards (cont)

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Candidates should manufacture a component, or components, to the following tolerances:

- general engineering manufacturing tolerance of ±0.25mm
- one specified length within ±0.2mm
- one specified external diameter within ±0.1mm
- one specified internal diameter within ±0.2mm (boring tool diameter)
- one specified taper within ±0.5°
- one specified internal diameter to a depth within ± 1 mm
- surface finish of 1.6–3.2 µm (microns)

With regard to Outcomes 2 and 3:

Candidates must be asked to finalise a partially completed planning document in which at least 6 operations have to be added for the given component(s) to be manufactured.

Measuring equipment must include as a minimum the use of an external micrometer, radius gauge, a vernier caliper, a vernier protractor and surface texture comparison gauges. A minimum of eight dimensions should be recorded on the inspection documentation provided.

For Outcome 3 an observation checklist must be used to record evidence that candidates have complied with Performance Criteria (a), (b), (c) and (e) while undertaking all practical turning work.

For Outcome 3 Performance Criterion (d) candidates must record information on a partially completed Risk Assessment form. Candidates should identify a minimum of four hazards associated with using a lathe to produce a component. They should also estimate the level of risk associated with each hazard and identify steps to minimise the risk(s) associated with each hazard.

National Unit Specification: support notes

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

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

This Unit is particularly suitable for those candidates who have successfully completed the Unit *Material Removal Practice: Turning* at SCQF level 5.

The overall aim of this Unit is to provide candidates with the opportunity to develop advanced centre lathe turning skills. On successful completion of the Unit candidates will be able to interpret complex information on engineering drawings relevant to turning operations and be capable of sourcing and extracting turning related information on such subjects as tool types, tool materials, feeds, speeds and coolant types from charts and technical data sheets for a minimum of two different materials. Candidates will have developed a range of specialised turning skills. These will include the selection and care of complex cutting tools to perform specialised tasks such as the manufacture of internal and external diameters, lengths, tapers and detailed forms. Candidates will also have developed the knowledge and understanding to complete planning and inspection documentation fully and accurately. Candidates will also have learnt to apply appropriate Health and Safety procedures and safe working practices while undertaking turning activities and be able to undertake a risk assessment involving the use of a lathe to produce a component.

Outcome 1 involves candidates in interpreting complex dimensioning, tolerance, geometric tolerances and surface finish information on engineering drawings and sourcing and extracting turning related information from specialist sources such as detailed manufacturer's charts and technical data sheets.

Outcome 2 provides candidates with an opportunity to develop advanced turning skills which include making decisions on machining processes and selection of specialised tools. Candidates will learn the techniques to produce complex profiles. The emphasis should always be placed on correct tool and feed and speed selection taking into account tool type, materials being turned and lathe capability and maintenance. Candidates should complete both planning and inspection documentation recording operations and component dimensional information as appropriate.

Outcome 3 involving Health and Safety regulations and safe working practices should be integrated with all practical turning activities. Candidates should complete a risk assessment associated with a component being manufactured on a lathe. It is important that candidates correctly identify hazards associated with producing a component on a lathe, the level of risk associated with each hazard and methods for minimising risks associated with each hazard.

National Unit Specification: support notes (cont)

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GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit. Delivery of Unit content should be principally by lecturer demonstration followed by candidates practising the skills demonstrated. It is recommended that the same components are used throughout the delivery and assessment of the Outcomes (ie from initial drawing stage to final manufacture of components). The components manufactured by candidates should, as far as possible, reflect their current or future areas of employment and their own personal interests and must cover the machining features listed in Outcome 2.

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

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

Wall charts of lathes, lathe tools etc. may also assist candidate learning.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill of *Problem Solving*, that is, Critical Thinking, Planning and Organising, can be developed naturally as candidates learn to interpret and apply complex information from a range of sources including engineering drawings. They consider all factors affecting the use of a centre lathe to manufacture a component to a given specification. They complete a planning document and take account of regulations and requirements for safety. Adhering to these they select specialist equipment and apply methods and techniques needed to manufacture components from a given engineering drawing(s). Feedback from assessors could encourage on going critical evaluation of both process and product.

Numeracy skills will be enhanced as the Unit is undertaken. Candidates have to interpret and translate accurately a range of complex data essential to turning operations. They record and verify component information against given specifications. Formative activities should be contextualised, with a focus on the practical interpretation, use and application of number and graphics in engineering situations.

National Unit Specification: support notes (cont)

UNIT Material Removal Practice: Turning (SCQF level 6)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

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

Formative assessment exercises involving candidates in interpreting complex information on engineering drawings, sourcing and extracting turning related information from specialist sources and practising specialist turning activities will play a particularly important role in building candidate knowledge, understanding, skills and confidence of Unit content.

Outcome 1 may be assessed by an assessment paper consisting of appropriate engineering drawings, specialist documentation and a question paper comprising of a balance of short answers/restricted response questions or objective questions (eg multi-choice questions) or a combination of both. The assessment paper may be suitable for on-line delivery. More specifically each candidate could be provided with a series of detailed drawings with certain complex features highlighted. Each candidate could be required to identify the highlighted features. Specialised sources of information may include detailed manufacturer's chart(s) and technical data sheets containing information on tool types, tool materials, recommended cutting speeds and feeds and recommended coolants relating to different materials to be turned. A prepared sheet of 8 to 10 questions can then be completed by candidates to demonstrate they can recognise and extract information from specialist sources of information.

Outcome 2 may be assessed by a practical exercise, or exercises, in which candidates manufacture a component or components which meets, at least, the minimum features and tolerances stated under the Evidence Requirements for Outcome 2. Centres may choose to limit the time candidates have to complete the manufacture of a components(s) to a maximum of 6 hours. It is also recommended that any checklist(s) and inspection record(s) used as part of the assessment of Outcome 2 should cross reference component features to the following:

- tools/equipments
- feeds/speeds selection
- advanced machining operations
- inspection and making accurate machine adjustments
- safe working practices

so that the finished component(s) can be assessed in terms of compliance with tolerances, surface finish requirements and functionality.

Candidate evidence for Performance Criteria (a), (b), (c) and (e) in Outcome 3 should be recorded by completing an appropriate observation checklist. With regard to the risk assessment in Outcome 3, centres may use their own standard forms.

National Unit Specification: support notes (cont)

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DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

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

History of changes to Unit

Version	Description of change	Date
02	Text referring to Assessment Support Pack (ASP) has been removed. There is no ASP for this Unit specification.	02/06/2015