



National Unit Specification: general information

UNIT Engineering Assembly Skills (SCQF level 6)

CODE F5KA 12

SUMMARY

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

This predominantly practical Unit is designed to provide candidates with knowledge, understanding and skills to perform complex engineering assembly operations in a safe manner. During the delivery of the Unit, candidates will learn to identify, select and use different types of mechanical fasteners and identify a range of seals and bearings. They will also develop the knowledge and understanding to identify engineering component parts from various engineering information sources and complete requisition documentation to order component parts. Candidates will develop the knowledge and skills to perform complex assembly operations. They will also learn to apply current health and safety requirements and safe working practices while performing engineering assembly operations and complete a risk assessment on a given engineering assembly.

This Unit is suitable for candidates training to be manufacturing, mechanical or multi-disciplinary engineering technicians. It is also suitable for crafts persons who wish to develop more advanced knowledge and skills in engineering assembly skills.

OUTCOMES

- 1 Identify, select and use mechanical components in engineering assemblies.
- 2 Interpret given engineering assembly information and source component parts.
- 3 Carry out complex assembly operations on given engineering assemblies.
- 4 Comply with current Health and Safety regulations and safe working practices and complete a risk assessment involving a given engineering assembly.

Administrative Information

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National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

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

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

CREDIT VALUE

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

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

CORE SKILLS

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

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

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

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

National Unit Specification: statement of standards

UNIT Engineering Assembly Skills (SCQF level 6)

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 mechanical components in engineering assemblies.

Performance Criteria

- (a) Identify correctly mechanical fasteners, seals and bearings.
- (b) Select mechanical fasteners correctly for the required assembly operations.
- (c) Use mechanical fasteners in accordance with health and safety requirements.

OUTCOME 2

Interpret given engineering assembly information and source component parts.

Performance Criteria

- (a) Interpret correctly complex engineering assembly information in terms of current British Standards.
- (b) Identify component parts correctly to be used in a given engineering assembly.
- (c) Source and cost mechanical component parts for a given engineering assembly and complete requisition documentation correctly.

OUTCOME 3

Carry out complex assembly operations on given engineering assemblies.

Performance Criteria

- (a) Select tools correctly and use them safely to perform assembly operations.
- (b) Perform assembly operations correctly following a logical sequence and using appropriate fastening and sealing methods, locking devices and tightening sequences.
- (c) Carry out necessary bench checks and tests on the completed engineering assembly to ensure that it functions correctly.

National Unit Specification: statement of standards (cont)

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OUTCOME 4

Comply with current Health and Safety regulations and safe working practices and complete a risk assessment involving a given engineering assembly.

Performance Criteria

- (a) Select and use appropriate Personal Protective Equipment correctly.
- (b) Comply fully with safety requirements, good housekeeping and appropriate tool/equipment storage.
- (c) Carry out correctly safe manual handling, lifting and transportation of assemblies.
- (d) Complete a partially-completed risk assessment correctly for a given engineering assembly.
- (e) Co-operate effectively with others in an engineering workshop.

EVIDENCE REQUIREMENTS FOR THIS UNIT

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

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

Outcomes 1, 2, 3 and 4 may be assessed by a single, holistic assessment or Outcomes 1 and 2 may each be assessed separately from Outcome 3. The assessment of Outcome 4 must always be integrated with the practical assembly exercises for Outcome 3 and the selecting and using fasteners exercise in Outcome 1 Performance Criteria (b) and (c) (if this is assessed separately from Outcome 3).

Outcome 1 (Written and/or Oral Recorded, Product and Performance Evidence)

Assessment for Outcome 1 Performance Criterion (a) must take place at a single assessment event lasting 15 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. The assessment must involve candidates in physically identifying

- ◆ five different types of mechanical fastening methods
- ◆ three different types of seals
- ◆ three different types of bearing

National Unit Specification: statement of standards (cont)

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The assessment of Outcome 1 Performance Criteria (b) and (c) must be conducted under supervised conditions. Candidates must select and use a minimum of four different mechanical fastening methods chosen from the following:

- ◆ riveting
- ◆ threading
- ◆ pinning
- ◆ spline
- ◆ keying
- ◆ thermal processes (eg soldering, brazing or welding)
- ◆ shrink fitting
- ◆ press fitting

Outcome 2 (Written and/or Recorded Evidence)

The assessment for Outcome 2 must take place at a single assessment event lasting 45 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. Candidates must be supplied with an appropriate engineering drawing (s) and/or assembly diagram(s), and/or parts-list, and/or job card, and/or manufacturer's catalogue and/or Standard Operating Procedure (SOP) as part of this assessment.

With regard to Outcome 2:

- ◆ candidates must correctly identify six drawing conventions and abbreviations from a given selection
- ◆ candidates must correctly identify a minimum of six individual assembly component parts (excluding mechanical fasteners) from the following: assembly drawing/diagram, parts-list, job-card, manufacturer's catalogue(s) and/or (SOP)
- ◆ candidates must complete requisition documentation correctly for a minimum of three mechanical component parts (eg bearings, fasteners and seals). Details of individual parts must include:
 - quantity
 - serial number
 - description of part
 - unit price
 - total price

The requisition document must indicate correctly the total price of the parts required.

National Unit Specification: statement of standards (cont)

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Outcomes 3 and 4 (Product and Performance Evidence)

The assessment of Outcome 3 must comprise candidates producing two engineering assemblies on an individual basis. Centres can allow candidates to work on sub-assemblies which form part of a larger assembly. Each assembly, or sub-assembly, must involve a minimum of nine separate parts (excluding mechanical fasteners). Assessment should be conducted under supervised conditions and should take candidates no longer than three hours per assembly to complete.

With regard to Outcome 3:

Between the two assemblies candidates must demonstrate the following:

- ◆ the selection and use of specialist assembly tools
- ◆ the use of correct torque settings when following any tightening sequence

For Outcome 4 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 work.

For Outcome 4 Performance Criterion (d) candidates must record information on a partially completed Risk Assessment form. Candidates should identify a minimum of four hazards associated with undertaking a given engineering assembly. They should also estimate the level of risk associated with each hazard and identify steps to minimise the risk(s) associated with each hazard.

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

National Unit Specification: support notes

UNIT Engineering Assembly Skills (SCQF level 6)

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 aim of this Unit is to allow candidates to develop their knowledge, understanding and skill in engineering assembly operations. On successful completion of the Unit candidates will be able to identify, select and use different types of mechanical fasteners and identify a range of seals and bearings. They will also have developed the knowledge and understanding to identify engineering component parts from various engineering information sources and complete requisition documentation to order component parts. Candidates will have developed the knowledge and skills to perform complex assembly operations and will have learnt to apply current health and safety requirements and safe working practices while performing engineering assembly operation. They will also be able to complete an already partially-completed risk assessment on a given engineering assembly.

Outcome 1 involves candidates in identifying, selecting and using a range of different mechanical fasteners such as bolt/washers/nuts, screws, studs, rivets, pins, splines or thermal joining methods such as soldering, brazing or welding. Candidates will be introduced to press and shrink fitting techniques. Candidates will also learn to identify different types of seals and bearings (eg plain, ball and roller bearings).

Outcome 2 requires candidates to interpret information from engineering assembly drawings, diagrams (including exploded assembly diagrams) and instructions (including where applicable SOP). Candidates will also learn to identify the individual parts of assemblies and complete requisition documentation to order component parts from assembly drawing/diagram, parts-list, job-card, manufacturer's catalogue(s) and/or SOP.

In Outcome 3 candidates will develop the knowledge and skills to undertake a range of complex engineering assembly operations. While undertaking these activities candidates must make the correct selection and safe use of tools including specialist assembly tools. They should also be encouraged to make safe use of sealants, cleaning fluids and lubricants when undertaking assembly work. Candidates should also be provided with opportunities to develop their knowledge and skill in the following:

- ◆ the application of sealing methods and locking devices
- ◆ the use of matching techniques
- ◆ the application of tightening sequences using correct torque settings
- ◆ the correct disposal of sealing fluids and lubricants

National Unit Specification: support notes

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Candidates should develop knowledge and skills in visually checking and testing completed assemblies to ensure correct functionality.

In Outcome 4 emphasis should be placed on getting candidates to comply with Health and Safety procedures and practices while performing assembly operations. Such procedures and practices should include the wearing of Personal Protective Equipment, using and storing all tools correctly, lifting and transporting tools, equipment and assemblies in a correct and safe manner, using and disposing of sealing fluids and lubricants correctly and working cooperatively with others in engineering workshop areas.

Candidates should complete an already partially-completed risk assessment associated with a given engineering assembly. It is important that candidates correctly identify hazards associated with producing assemblies, the level of risk associated with each hazard and methods for minimising risks associated with each hazard.

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. This Unit should be delivered in a practical workshop environment and candidates should have access to a full range of tools and equipment while performing assembly operations. Candidates should also be able to access a range of assembly drawings and diagrams, parts-lists, job cards, SOP and/or manufacture catalogues either in hardcopy or via the Internet. Candidates should also be provided with an opportunity to view a range of assembly drawings and diagrams so that they can learn about the different conventions and abbreviations used in such drawings and diagrams.

Candidates should be taught safe and logical approaches to producing assemblies. Candidates may be introduced to Standard Operating Procedures as used in industry. Good wall charts involving the assembly of equipment may also aid learning.

Videos, DVDs etc. on aspects of health and safety, such as correctly and safely lifting and transporting tools, equipment or assemblies, may also support learning.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill of *Problem Solving*, that is, Critical Thinking, Planning and Organising, will be naturally developed as candidates apply knowledge and skills to plan and undertake a practical work. They have to consider all the factors affecting workshop practice as they produce engineering assemblies to a given specification. After conducting a risk assessment they select and use appropriate tools to complete the work to safety requirements within an agreed time.

Although candidates have to demonstrate practical skills independently, skills in working with others could be enhanced during formative group activities. Approaches to working practice could be discussed and the nature and scope of team goals, roles and responsibilities, particularly with regard to safety, could be identified. Candidates could be given constructive feedback during assembly work to encourage review and evaluation of the process, including their personal contribution to team working.

National Unit Specification: support notes (cont)

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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 can play a particularly important role in helping candidates to interpret and extract information from various sources and in developing the necessary knowledge and skills to perform complex assembly operations in a safe and correct manner.

Outcome 1 Performance Criterion (a) may be assessed by asking candidates to identify mechanical fasteners, seals and bearings which have been located on a display board. A checklist may be used to record evidence that candidates have identified fasteners, seals and bearings correctly or not.

Outcome 1 Performance Criteria (b) and (c) may be assessed by candidates undertaking practical exercises in which they select and use a minimum of four different mechanical fastening methods. Alternatively, these Performance Criteria may be assessed as part of the assessment for Outcome 3.

Outcome 2 may be assessed by an assessment paper and the completion of appropriate requisition documentation (eg a requisition form). The assessment paper may comprise short answer and 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.

Outcome 3 may be assessed by practical exercises in which candidates produce two engineering assemblies on an individual basis.

Outcome 4 Performance Criteria (a), (b), (c) and (e) should be evidenced throughout the whole time candidates are engaged in assembly operations in an engineering workshop. An observation checklist(s) should be used to record candidate evidence. With regard to the risk assessment in Outcome 4, centres may use their own standard forms.

National Unit Specification: support notes (cont)

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In assessing if the candidate has completed the assessment to Outcomes 3 and 4 correctly, or not, centre staff may take account of the following questions:

- ◆ Was the correct Personal Protective Equipment used at all times in the engineering workshop?
- ◆ Were tools (including specialist assembly tools) selected correctly and used safely during assembly operations?
- ◆ Were all tools and equipment stored safely during and after assembly operations?
- ◆ Did the candidate comply with all workshop safety requirements and good house keeping guidance?
- ◆ Were all tools, equipment and assemblies lifted and transported in a correct and safe manner?
- ◆ Did the candidate follow the correct sequence of activities in undertaking the assemblies?
- ◆ Were all fastenings, seals and locking devices correctly located and secured?
- ◆ Were tightening sequences applied correctly using the correct torque settings?
- ◆ Were all sealing fluids and lubricants disposed of properly?
- ◆ Were faults correctly identified and appropriate repairs or replacements made?
- ◆ On completion of the assessment task were assemblies put together correctly?
- ◆ Were visual checks and tests conducted on the completed assembly correctly?
- ◆ Did the assemblies function correctly?
- ◆ Have candidates worked cooperatively at all times while working in engineering workshops?

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