SQA Advanced Unit Specification

General information for centres

Unit title: Fabrication Forming Processes

Unit code: HV3V 47

Unit purpose: This Unit is designed to enable candidates to develop knowledge and understanding and apply basic concepts to the production processes that produce shaped, curved and cylindrical work on various materials and thicknesses. The Unit also provides candidates with the opportunity to develop knowledge and understanding of production processes that produce shaped, curved and circular work on section/bar material of various cross sections.

On completion of the Unit the candidate should be able to:

1 Describe the processes and techniques adopted in the manufacture of fabricated components in thick plate material.
2 Describe the processes and techniques adopted in the manufacture of fabricated components in thin plate and sheet material.
3 Describe the processes and techniques adopted in the manufacture of fabricated components in section/bar material.

Credit points and level: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*).

**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 National 1 to Doctorates.*

Recommended prior knowledge and skills: The candidate should possess a basic/general knowledge of material preparation and forming processes. This may be evidenced by an appropriate cluster of NC Units.

Core skills: There may be opportunities to gather evidence towards the Core Skills of Communication, Numeracy and Problem Solving in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: The assessment for this Unit should be in the form of an end of Unit test such that it covers the Outcome content with the candidate answering a selection of questions. This should be in two sections: Section 'A' 10 compulsory questions worth four marks each and Section 'B' any three from five questions worth 20 marks each.

The assessment should be constructed in such a way that it reflects at least 60% of all the evidence requirements within this Unit descriptor.

The assessment should be conducted under controlled and supervised conditions.

This integrated assessment should last two hours.

An assessment exemplar will be available for this Unit.

SQA Advanced Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Describe the processes and techniques adopted in the manufacture of fabricated components in thick plate material

Knowledge and/or skills

- machine types
- bending and forming theory
- double curvature work
- spiral blade forming
- safe working practice

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions. Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above. In any assessment of this Outcome at least 60% of the knowledge and/or skills items should be sampled.

A different sample question should be asked each time the Outcome is assessed. Candidates must provide a satisfactory response to assessed questions

Assessment guidelines

- Short answer and structured questions on the selection of machinery for various tasks and the safety implication of those tasks.

Outcome 2

Describe the processes and techniques adopted in the manufacture of fabricated components in thin plate and sheet material

Knowledge and/or skills

- machine types
- bending and forming considerations
- double curvature work
- protection of materials during manufacture
- safe working practice

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions. Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above. In any assessment of this Outcome at least 60% of the knowledge and/or skills items should be sampled.

A different sample question should be asked each time the Outcome is assessed. Candidates must provide a satisfactory response to assessed questions.

Assessment guidelines

- Short answer and structured questions related to a given selection of formed structures such as boxes, trays, small cones, square to round transformers and sheet metal components formed in thin plate and sheet material.

Outcome 3

Describe the processes and techniques adopted in the manufacture of fabricated components in section/bar material.

Knowledge and/or skills

- machine types
- calculation of developed lengths
- hot working theory
- methods of checking formed components
- safe working practice

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions. Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above. In any assessment of this Outcome at least 60% of the knowledge and/or skills items should be sampled.

A different sample question should be asked each time the Outcome is assessed. Candidates must provide a satisfactory response to assessed questions.

Assessment guidelines

- structured questions in the form of a worksheet with given parameters
- short answer questions and calculations

Administrative Information

Unit code: HV3V 47

Unit title: Fabrication Forming Processes

Superclass category: XD

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit specification: support notes

Unit title: Fabrication Forming Processes

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

Outcome 1

- Machine types
  - hydraulic and mechanical presses and plate folding machines
  - machine capacity and limitations
  - comparisons of hydraulic and mechanical presses

- Simple mechanical or hydraulic power theory
  - line drawings of linkage
  - transmission of power to tooling
  - problems associated with fluid losses in hydraulic machines

- Angular bending theory
  - minimum internal radii
  - spring back allowances for ferrous and non ferrous materials

- Machine tooling
  - standard dies
  - gooseneck punches
  - workshop made tools and dies

- Standard die dimensions
  - vee block opening
  - top tool nose radii
  - minimum internal bend radii

- Forming cylindrical and curve rolling theory
  - three point bend principle
  - pyramid rolling machine
  - pinch rolling machine (three and four roll)
  - ensuring square entry of plate in machine
  - methods of removing completed cylinders

- Methods of pre-setting of leading trailing edges
  - extra or green material
  - use of spades
  - pressure plates

- Forming double curvature work cold and hot forming
  - gap presses
  - ring frame presses

- — hot working of plates using shop made jigs
- — cold working problems rising to cracks and work hardening problems

- ♦ Forming double curvature work petal plates
  - — development of shaped petals or courses
  - — problems of working with material ie holding whilst hot

- ♦ Universal forming machine with reciprocating hammer
  - — tooling available
  - — maximum capacity of machine ie thickness
  - — depth of radii considerations
  - — plates worked from outer edge to centre

- ♦ Tooling requirements four pillar press
  - — large shop made or bought in tooling
  - — special lifting requirements due to size of job
  - — jigs and fixtures used for forming in furnace work

- ♦ Forming spiral blades and ribbon plates
  - — forming spiral blade on pyramid rolls (top roll tilted)
  - — forming spiral blades in brake press with special tooling
  - — ribbon plates rolled in pinch or pyramid rolling machines

Outcome 2

- ♦ Machine types
  - — box and pan folder, press brake, double acting press, bench folder
  - — press brake tooling for light gauge material

- ♦ Bend radii considerations for all materials
  - — machine adjustment for thickness various thicknesses
  - — bend radii considerations for ferrous and non ferrous material
  - — springback allowances for commonly used materials

- ♦ Bending and folding sequences
  - — sequence of bending when producing boxes and trays
  - — consideration of safe edges and lock forming

- ♦ Protection of materials liable to be damaged during forming
  - — clad materials
  - — aluminium alloys, copper, brass, stainless steel

Outcome 3

- Machine types
  - angle rolls, horizontal pin press, frame bender

- Calculation of developed lengths using neutral axis of section
  - developed lengths and angle of end cut
  - joists, beams, columns, solid bridge rail
  - the need for excess (green) material where necessary

- Production of curved and circular work
  - shaping bars
  - the use of spacers and shop made aids

- Production of set irons, full size layouts for checking purposes
  - set irons from light flat bar
  - full sized layouts for part curves

- Tools and formers for hot working
  - flattening irons, wheezes, heavy hammers tongs
  - flat bed working benches

Guidance on the delivery and assessment of this Unit

This Unit should be delivered using a fabrication welding workshop for practical demonstrations of the processes involved. Where certain processes are not available in centres, industrial visits or video programmes should be used to show candidates practical applications of processes.

Safe working practices should be emphasised at all times throughout the delivery of the Unit.

Outcome 1 (14 Hours)

- machine types
- simple mechanical or hydraulic power theory
- angular bending theory
- machine tooling
- standard die dimensions
- forming cylindrical and curve rolling theory
- methods of pre-setting of leading trailing edges
- forming double curvature work cold and hot forming
- forming double curvature work petal plates
- universal forming machine with reciprocating hammer
- tooling requirements four pillar press
- forming spiral blades and ribbon plates

Outcome 2 (14 Hours)

- machine types
- bend radii considerations for all materials
- bending and folding sequences
- protection of materials liable to be damaged during forming

Outcome 3 (12 Hours)

- machine types
- calculation of developed lengths using neutral axis of section
- production of curved and circular work
- production of set irons, full size layouts for checking purposes
- tools and formers for hot working

Opportunities for developing Core Skills

There may be opportunities to gather evidence towards the Core Skills of Communication, Numeracy and Problem Solving in this Unit.

Open learning

Much of this Unit could be delivered by distance learning, which may incorporate some degree of online support. Arrangements would have to be made for the candidate to have supervised access to workshop machines — this may involve the candidate attending the centre. Alternatively special arrangements could be made for the candidate to be demonstrated the practical aspects.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

General information for candidates

Unit title: Fabrication Forming processes

This Unit has been designed to provide you with the knowledge and skills that will enable you to understand the types of processes and machines that are used in the fabrication industry to form plate, sheet and bars to produce a variety of structural fabrications. You will have the opportunity to study machines that bend and shape thick plate, thin sheet and bars into angular, cylindrical and double curved work. The fabrication workshop will be used to carry out investigations based on the above techniques to prove the basic principles involved in presswork, rolling and forming.

Formal assessment of this Unit will comprise an end of Unit assessment consisting of two sections. Section A will consist of 10 compulsory questions worth four marks each and Section B will consist of any three from five questions worth 20 marks each. The assessment will last two hours and will be conducted under supervised closed-book conditions.