# Unit 8: Undertake Blacksmithing Processes

**Unit reference number:** A/602/0499

**QCF Level 3:** BTEC National

**Credit value:** 10

**Guided learning hours:** 60

## Aim and purpose

This unit aims to introduce learners to the skills and knowledge for blacksmithing processes and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or on to further/higher education.

## Unit introduction

Blacksmithing processes are the essential requirements used in the production of the tooling and motifs that are the foundation of the blacksmith's vocabulary.

Tooling production is a core skill of the blacksmith's craft, not only when making forging tools but also when producing tools and equipment for customers working in other crafts such as woodworking.

The motifs that will be included in this unit are common throughout the history of the blacksmith's craft, from both a practical joining and construction viewpoint to a generic aesthetic that recurs in decorative work over the centuries. A thorough knowledge of the production processes involved in the forging of these elements is essential, for example when producing reproductions or conserving forged ironwork artefacts. This unit allows learners the opportunity to develop abilities in these blacksmithing processes.

Learners are expected to develop an awareness of the standards of quality and production demanded by the industry as a whole. A deeper understanding of the materials used in the forging processes and working temperature ranges applicable to them will also be explored.

Learning outcomes 1 and 2 look at the principles and practice of the processes used to produce tooling and decorative elements/motifs.

Learning outcome 3 covers the principles and practice of heat treatment.

In learning outcome 4, learners will manage common blacksmithing faults.

## Learning outcomes

**On completion of this unit a learner should:**

1 Be able to demonstrate principles and practice of the processes used to produce tooling

2 Be able to demonstrate principles and practice of the processes used to produce and finish decorative elements/motifs

3 Be able to demonstrate principles and practice of the heat treatment processes

4 Understand common blacksmithing faults.

# Unit content

## 1 Be able to demonstrate principles and practice of the processes used to produce tooling

*Tooling used in the production of artefacts within the workshop*: types eg forge hand tools, anvil tools, press/power hammer tools; uses of tooling; health and safety; risk assessment

*Methods of producing tooling*: development of tools, equipment required; materials used; production methods; health and safety; risk assessment

## 2 Be able to demonstrate principles and practice of the processes used to produce and finish decorative elements/motifs

*Production processes in the forge*: for scrolls eg ribbon, fishtail; wraps; collars eg welded, forged; simple tennons; forged square corner; decorative twists; health and safety; risk assessment

*Techniques used to finish forged metalwork*: use of abrasives, filing, brushing; waxing; oiling; health and safety; risk assessment

## 3 Be able to demonstrate principles and practice of the heat treatment processes

*Heat treatment*: processes and effects on the metal structure in the heat treatment of tool steels eg normalising, annealing, hardening, tempering, case hardening; physical properties; the effects of hot and cold working on different metals eg steel, iron, copper, bronze, brass, aluminium; health and safety; risk assessment

## 4 Understand common blacksmithing faults

*Faults*: types eg scaling, burns, galls, internal/external cracking, surface defects, coldshuts, over/under forging, bends, kinks, incomplete/open jointing; causes of faults; effects of faults; remedial action for common faults; health and safety; risk assessment

*Quality control*: methods used to identify unsatisfactory work; reasons for quality control

## Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

| Assessment and grading criteria | | |
|---|---|---|
| **To achieve a pass grade the evidence must show that the learner is able to:** | **To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:** | **To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:** |
| **P1** produce a hand tool using blacksmithing processes to meet a given specification | **M1** select and combine forging techniques and processes to produce a complex tool, component or artefact that is fit for purpose with appropriate construction, heat treatment and finish | **D1** evaluate the process used to produce the finished complex tool/ component/artefact making recommendations for improvement to meet craft standard. |
| **P2** produce an anvil tool using blacksmithing processes to meet a given specification | | |
| **P3** produce a press/power hammer tool using blacksmithing processes to meet a given specification | | |
| **P4** forge decorative elements/ motifs using blacksmithing processes to meet given specifications [TW, SM] | **M2** discuss the issues of health and safety, forging and fault correction when forging, heating and heat treating high carbon steels and non ferrous metals in the blacksmith's workshop. | |
| **P5** join decorative elements/ motifs using blacksmithing processes to meet given specifications | | |
| **P6** finish decorative elements/ motifs using blacksmithing processes to meet given specifications | | |
| **P7** use selected heat treatment processes on steel to meet given specifications<br>**P8** describe the process and effects of heat treatment on selected high carbon steel tools [RL] | | |

| Assessment and grading criteria | | | |
|---|---|---|---|
| **To achieve a pass grade the evidence must show that the learner is able to:** | | **To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:** | **To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:** |
| **P9** | recognise causes of common production faults in selected decorative elements and motifs | | |
| **P10** | explain the causes of common production faults in selected decorative elements and motifs. [IE] | | |

**PLTS**: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

| **Key** | IE – independent enquirers | RL – reflective learners | SM – self-managers |
|---|---|---|---|
| | CT – creative thinkers | TW – team workers | EP – effective participators |

# Essential guidance for tutors

## Delivery

Delivery of this unit will involve practical assessments, written assessment, visits to suitable collections and will have links to industrial experience placements.

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. Lectures, discussions, seminar presentations, site visits, supervised forge workshop practicals, research using the internet and/or library resources and the use of personal and/or industrial experience would all be suitable. Delivery should stimulate, motivate, educate and enthuse learners.

Work placements should be monitored regularly in order to ensure the quality of the learning experience. It would be beneficial if learners and supervisors were made aware of the requirements of this unit prior to any work-related activities so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to use heat treatment processes and they should be encouraged to ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Pearson website.

Whichever delivery methods are used, it is essential that tutors stress the importance of sound environment management and the need to manage the resource using legal methods.

Visiting expert speakers could add to the relevance of the subject for learners. For example, experienced blacksmiths could talk about their work, the situations they face and the methods they use.

Health and safety issues relating to working in the forge environment must be stressed and regularly reinforced, and risk assessments must be undertaken prior to practical activities. Adequate personal protective equipment (PPE) must be provided and used following the production of suitable risk assessments.

Tutors should consider integrating the delivery, private study and assessment for this unit with other relevant units and assessment instruments learners are taking as part of their programme of study.

Learning outcomes 1 and 2 look at the principles and practice of the processes used to produce tooling and decorative elements/motifs. Learners should undertake practical exercises in the forge environment. Explanation and demonstration will be followed by opportunities for learners to practise and develop their techniques and finish quality. As learners become more competent in individual techniques they could be encouraged to design artefacts for themselves requiring the use of several techniques. Supporting knowledge should be delivered in the workshop and classroom environment via set and learner project work.

Learning outcome 3 covers the principles and practice of the heat treatment processes. Using industrially relevant workshops and forge equipment learners need to research the properties of a range of materials and gain knowledge of managing different working environments. Differing sections and sizes of metals should be used to produce the samples in order to stretch learners' range of experiences.

In learning outcome 4, learners will look at the management requirements of common blacksmithing faults. This is likely to be delivered through formal lectures, discussion, site visits, supervised forge practicals and independent learner research.

## Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives **an indication of the volume of learning it would take learners** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value.**

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

| **Topic and suggested assignments/activities and/assessment** |
|---|
| Introduction and overview of the unit. |
| **Assignment 1: Producing Blacksmithing Tooling** (P1, P2, P3, P7, M1, D1)<br>Tutor introduces the assignment.<br>Following the introduction of tutor-set tooling including specifications, the learner produces tooling using the required forging processes within the tolerances.<br>Learners should be given the opportunity to select process and equipment. |
| Tutor demonstrations of tool production as appropriate during the project. |
| Learner practice and production of tooling. |
| Learner research and production of workshop records. |
| Learner assessment/feedback. |
| **Assignment 2: Producing Decorative Elements/Motifs** (P4, P5, P6, M1, D1)<br>Tutor introduces the assignment.<br>Following the introduction of tutor-set decorative elements/motifs including specifications, the learner produces elements/motifs using the required forging processes within the tolerances.<br>Learners should be given the opportunity to select process and equipment. |
| Tutor demonstrations of decorative elements/motifs as appropriate during the project. |
| Learner practice and production of decorative elements/motifs. |
| Learner research and production of workshop records. |
| Learner assessment/feedback. |
| **Assignment 3: Process and Effects of Heat Treatment** (P8, P9, P10, M2)<br>Tutor introduces the assignment.<br>Learners are asked to produce a presentation describing the process and effects of heat treatment on selected carbon steel tools and the recognition and explanation of the causes of common production faults in selected decorative elements and motifs.<br>Including a discussion of the issues of health and safety, forging and fault correction when forging, heating and heat treating high carbon steels and non-ferrous metals in the blacksmith's workshop. |
| Tutor theory presentations as appropriate during the project. |
| Learners provide evidence for at least two items of tooling and two examples of forged decorative elements/motifs.<br>Evidence could be in the form of actual examples and written assignment or presentation. |
| Learner research and assignment preparation/writing. |
| Learner assessment/feedback. |

| Topic and suggested assignments/activities and/assessment |
| --- |
| **Assignment 4: Project** (M1, D1)<br><br>Tutor introduces the assignment.<br><br>Learners are asked to produce an assignment or presentation outlining their reasons for their selections of forging techniques and process during Assignment 1 and 2. Learners should reference to any forge tooling and components produced during Assignments 1 and 2.<br><br>An evaluation should be included of what was learned during the making process and recommendations for improvement if the task was repeated. |
| Tutor theory presentations as appropriate during the project. |
| Learners provide evidence of selection and evaluation of forging techniques and process (either orally, written or presentation) for producing a simple component/artefact by heating and forging. |
| Learner research and assignment preparation/writing. |
| Leaner assessment/feedback. |
| Unit review. |

## Assessment

For P1, P2 and P3, learners must produce tools using blacksmithing processes to meet a given specification. Tutors should identify the specification or agree it through discussion with learners. The specification should cover normal factors that can be found in industry, eg design criteria, measurements, materials, finish tolerances and any relevant standards. Where possible, to ensure fairness of assessment, the size and complexity of the task should be the same for all learners.

P1, P2 and P3, could be assessed directly by the tutor during practical activities. If this format is used then suitable evidence from guided activities would be observation records completed by learners and the tutor, accompanied by appropriate worklogs or other relevant learner notes. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

For P4, P5 and P6, learners must produce and finish decorative elements/motifs using blacksmithing processes to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specification should cover normal factors that can be found in industry, eg design criteria, measurements, materials, finish tolerances and any relevant standards. Where possible, to ensure fairness of assessment, the size and complexity of the tasks should be the same for all learners. Learners are expected to provide evidence for at least four types of element/motif. Evidence could be in the same form as for P1, P2 and P3.

P7 and P8 require learners to use selected heat treatment processes on steel to meet given specifications. Tutors should identify the heat treatment processes and specifications or agree them through discussion with learners. Where possible, to ensure fairness of assessment, the size and complexity of the tasks should be the same for all learners. Learners are expected to provide evidence for at least four types of heat treatment. Evidence could be in the same form as for P1, P2 and P3, and linked to other grading criteria.

For P9 and P10, learners must recognise and explain the causes of selected common blacksmithing faults. Tutors should identify the blacksmithing faults. Where possible, to ensure fairness of assessment, the size and complexity of the tasks should be the same for all learners. Learners are expected to provide evidence for at least six types of common fault. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector) or an assignment.

M1 requires learners to select and combine blacksmithing processes to produce a complex tool, component or artefact to meet a given specification. Tutors should identify the complex tool, component or artefact to be produced and the specification or agree them through discussion with learners. The specification should cover normal factors that can be found in industry, eg design criteria, measurements, materials, finish tolerances and any relevant standards. Where possible, to ensure fairness of assessment, the size and complexity of the task should be the same for all learners. Evidence could be in the same form as for P1, P2, P3, P4, P5 and P6.

For M2, learners must discuss the issues of health and safety, forging and fault correction when forging, heating and heat treating high carbon steels and non-ferrous metals to meet given specifications. Tutors should identify the metals and the specifications or agree them through discussion with learners. Where possible, to ensure the fairness of assessment, the size and complexity of the tasks should be the same for all learners. Evidence could be in the same form as for P1, P2, P3, P4, P5, P6, P7, P8 and P9.

For D1, learners must evaluate a selected complex tool/component/artefact produced to meet a given specification and make recommendations for improvement. Tutors should identify the forge tool and the specification or agree them through discussion with learners. The forge tool and the specification may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment, the size and complexity of the task should be the same for all learners. Recommendations for improvement must be appropriate and viable—these could be identified during the making process. Where appropriate, improvements to making quality should be demonstrated within the components/artefacts produced. Evidence could be in the same form as for M1 and M2.

### Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Pearson assignments to meet local needs and resources.

| Criteria covered | Assignment title | Scenario | Assessment method |
|---|---|---|---|
| P1, P2, P3, P7, M1, D1 | Producing Blacksmithing Tooling | You have just received confirmation that you have been accepted to make a pair of traditionally forged gates and railings for which you need to produce appropriate tooling for the production of related elements and motifs. | Practical production of forge tooling.<br>Observation records completed by learners and the tutor.<br>Work logs or other relevant learner notes and drawings.<br>Witness statements. |

| Criteria covered | Assignment title | Scenario | Assessment method |
|---|---|---|---|
| P4, P5, P6, M1, D1 | Producing Decorative Elements/Motifs | As a blacksmith working within the fields of restoration or reproduction you need to produce historically accurate samples of forged elements and motifs in order to develop efficient process, to highlight any quality issues that may arise and to inform the quoting process. | Practical production of elements and motifs.<br>Observation records completed by learners and the tutor.<br>Work logs or other relevant learner notes and drawings.<br>Witness statements. |
| P8, P9, M2 | Process and Effects of Heat Treatment | As a working Blacksmith you need to understand the issues involved with working safely in the forge. Effective heat treatment and forging process are critical when making tools and forged elements. This needs to be related to the potential materials that can be used in a variety of situations. | Oral questioning.<br>Written assignment or presentation.<br>Forged examples.<br>Visual records.<br>Work logs or other relevant learner notes and drawings.<br>Research. |
| M1, D1 | Project | As part of a consultancy contract with English Heritage you have been asked to inspect a restoration project completed by another smith. You should outline your thoughts on the selected techniques used (including your alternatives) and make recommendations for improvement. | Oral questioning<br>Written assignment or presentation.<br>Forged examples.<br>Visual records.<br>Work logs or other relevant learner notes and drawings.<br>Research. |

## Links to other BTEC units

This unit forms part of the BTEC land-based sector suite. This unit has particular links with:

| Level 2 | Level 3 |
|---|---|
| | Understanding and Using Forging Techniques for Blacksmithing and Metalworking |
| | Undertake Drawing Practice for Blacksmithing and Metalworking |
| | Undertake Forge Practice for Blacksmithing and Metalworking |
| | Understanding and Using Blacksmithing and Construction Skills |
| | Understanding and Using Blacksmithing Installation Skills |
| | Undertake Fabrication Drawing for Blacksmithing and Metalworking |

## Essential resources

Learners will need supervised access to workshops and classrooms appropriate to their specialist pathways. These should contain a comprehensive range of blacksmithing and forge tools, including solid fuel forge hearths, anvils, leg vices, power hammers supported by a range of tongs, hammers, swages, fullers and other ancillary equipment. Areas for fitting and finishing should be available, with access to suitable application and coating facilities.

Health and safety considerations require that sufficient facilities be provided to allow for one forging station per learner. Health and safety information and support must be provided.

Learners must have access to a sufficiently diverse range of materials and stock sizes/sections to explore this unit fully, eg mild steel, tool steels, alloys, both ferrous and non-ferrous, eg copper, bronze, brass, stainless steel, aluminium.

This unit requires vocationally specific craft knowledge and demands appropriately qualified tutors to deliver it.

## Employer engagement and vocational contexts

This unit focuses on introducing and developing the practical skills and underpinning knowledge associated with tool making and the production and historically focused elements and motifs. Tutors are encouraged to promote learner awareness of the history and background of the craft via site visits to historical ironwork sites and museums.

## Delivery of personal, learning and thinking skills (PLTS)

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

| Skill | When learners are … |
|---|---|
| **Creative thinkers** | considering the process used to produce the finished complex tool/ component/artefact and making recommendations for improvement to meet craft standard |
| **Independent enquirers** | exploring the causes of common production faults in selected decorative elements and motifs |
| **Reflective learners** | researching the process and effects of heat treatment on selected high carbon steel tools |
| **Team workers** | working with others when forging, heating and heat treating high carbon steels and non-ferrous metals in the blacksmith's workshop |
| **Self-managers** | organising time and resources when creating forge decorative elements/motifs using blacksmithing processes. |

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

| Skill | When learners are … |
|---|---|
| **Effective participators** | selecting and combining forging techniques and processes to produce a complex tool, component or artefact that is fit for purpose with appropriate construction, heat treatment and finish. |