

Unit 3: Undertake Drawing Practice for Blacksmithing and Metalworking

Unit reference number: D/602/0494

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

● Aim and purpose

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

● Unit introduction

When translating two-dimensional drawings into a three-dimensional form, whether as a forged item or a fabrication, it is essential to understand and communicate visual information.

Learners will be taught about the technical and freehand methods that designers/makers use to communicate visual information within the metalworking industry, particularly in relation to the production of working patterns or specifications for the workshop environment.

Learning outcomes 1 and 2 relate to fabrication drawing. This emphasises orthographic viewing, ie 2D viewing of 3D objects, and presenting a number of them to communicate a 3D shape and its dimensions. It also introduces surface development, using 'parallel line' development, where the 2D shape of a 3D sheet metal component is developed on drawing paper enabling it to be transferred to a metal surface at a later time.

In learning outcomes 3 and 4 learners' artistic skills can be directed and developed into recording ideas which can be adapted and later translated into metal. Organic and geometric forms are drawn using various media, and diminishing perspective is explored, with the intention of leading to design ideas. Learners will gain skills in a largely practical situation, using a range of drawing equipment and mediums. These skills add another dimension when communicating information to architects/designers, potential customers and possibly third parties.

● Learning outcomes

On completion of this unit a learner should:

- 1 Be able to produce simple technical drawings in a format that conforms to relevant industrial conventions
- 2 Be able to apply the parallel line and radial line surface development methods to produce a working pattern
- 3 Be able to produce observed drawings
- 4 Be able to apply scale, proportion and perspective to effect and produce presentational/working drawings.

Unit content

1 Be able to produce simple technical drawings in a format that conforms to relevant industrial conventions

Industrial conventions within the chosen specialism: working drawings; specifications appropriate to the workshop environment eg orthographic projections, pictorials, geometric construction; use of drawing boards and equipment; measurement; scaling; mark-marking; presentation

2 Be able to apply the parallel line and radial line surface development methods to produce a working pattern

Pattern development techniques: radial and parallel-line surface development; understanding of templates; 2D shapes; production of hollow forms; sources of error

3 Be able to produce observed drawings

Line, tone and colour: methods used to translate directly observed shapes, form, texture and colour to a 2D format

Basic media: pencil; graphite stick; charcoal; pastel; ink; paint

Drawing practice: understanding; measurement methods; sight sizing; use of grids

Visual resources: forms in nature; structural artefacts; architectural forms

4 Be able to apply scale, proportion and perspective to effect and produce presentational/working drawings

Scale, proportion and perspective: effects of scale, proportion and perspective on directly observed objects; viewpoint; possible design proposals

Accurate communication: observed elements from the natural and constructed worlds; possible design proposals and presentational drawings

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 simple technical drawing in orthographic format that conforms to relevant industrial conventions and meets given specifications [RL, SM] | | |
| P2 produce a simple technical drawing in a pictorial format that conforms to relevant industrial conventions and meets given specifications [RL, SM] | | |
| P3 use the parallel line method of surface development for a set task and produce a working pattern to meet given specifications [RL, SM] | M1 identify and discuss potential sources of error in the production of working patterns using the parallel and radial line methods of surface development | |
| P4 use the radial line method of surface development for a set task and produce a working pattern to meet given specifications [RL, SM] | | |
| P5 produce observed drawings of simple natural and geometric forms using line to meet given specifications [IE, CT, RL, SM] | M2 use a range of drawing media to produce drawings, applying scaling, proportion and multiple perspectives to given specifications. | D1 fully utilise the skills of technical and freehand drawing to produce a representational image of a specified, complex forged artefact to presentational standard. |
| P6 produce observed drawings of simple natural and geometric forms using tone to meet given specifications [IE, CT, RL, SM] | | |

| 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: |
| <p>P7 use scale, proportion and perspective when producing an observed drawing to meet given specifications [IE, CT, RL, SM]</p> | | |
| <p>P8 use scale, proportion and perspective when producing a presentational drawing to meet given specifications. [IE, CT, RL, SM]</p> | | |

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 CT – creative thinkers | RL – reflective learners TW – team workers | SM – self-managers EP – effective participators |
|------------|--|---|--|

Essential guidance for tutors

Delivery

Delivery of this unit will involve practical assessments, written assessment, visits to suitable collections and will link to work 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 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 before any work-related activities are undertaken, so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to produce drawings, and they should 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 Edexcel website.

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

Health and safety issues relating to working with blacksmithing and metalworking materials must be stressed and reinforced regularly, and risk assessments must be undertaken before any practical activities. Adequate personal protective equipment (PPE) must be provided and used following the production of suitable risk assessments.

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

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.

This unit should be delivered mainly in the classroom where a practical, hands-on approach to learning should be adopted wherever possible, with tutors demonstrating techniques and providing relevant examples of the application of theory in practice.

There should be, wherever possible, links to work in progress in order to reinforce the relationship of the unit to the production process. The most likely way to achieve this is through a series of tasks covering the main topic areas. Learners' practice/project work outside of the centre environment will also be beneficial in broadening their experience and enhancing their drawing abilities.

Learning outcomes 1 and 2 are directly linked. These are likely to be delivered through formal lectures, discussions, site visits, supervised practicals and independent learner research. This is likely to be delivered within the drawing office or studio but there should be directed and personal opportunities for research, for example via information and learning technologies supported by some formal classroom activity.

For learning outcomes 3 and 4 learners have the opportunity to produce observed drawings and apply scale, proportion and perspective to effect and produce presentational/working drawings. These are likely to be delivered through formal lectures, discussions, site visits, supervised 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 the average learner** 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 Orthographic and Pictorial Drawings (P1, P2) |
| Tutor introduces the assignment. |
| Introduce the principles of orthographic viewing. |
| Practical application of orthographic viewing. |
| Introduce the principles of pictorial viewing. |
| Practical application of pictorial viewing. |
| Assignment 2: Parallel Line and Radial Line Templates (P3, P4, M1) |
| Tutor introduces the assignment. |
| Introduce the principles of parallel line development. |
| Practical application of parallel line development. |
| Introduce the principles of radial line development. |
| Practical application of radial line development. |
| Undertake analysis of surface development work and discuss opportunities for improvement. |
| Assignment 3: Observed Drawing (P5, P6, P7, M2) |
| Tutor introduces the assignment. |
| Introduce the principles of observed drawing. |
| Practical application of observed drawing. |
| Assignment 4: Presentational Drawing (P8, D1) |
| Tutor introduces the assignment. |
| Introduce the principles of producing presentational drawings. |
| Practical application of the principles of producing presentational drawings. |
| Undertake a presentational drawing proposal combining freehand and technical drawing. |
| Unit review. |

Assessment

For P1, learners must produce a simple technical drawing in orthographic format that conforms to relevant industrial conventions and meets given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria. They should cover usual factors that would be found in industry, for example design criteria, measurements, materials, finish tolerances and any relevant standards.

Where possible, to ensure assessment is fair, the size and complexity of the task should be the same for all learners. P1 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 work logs or other relevant learner notes. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

Alternatively, evidence for P1 could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector) or a written assignment.

For P2, learners must produce a simple technical drawing in pictorial format that conforms to relevant industrial conventions and meets given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria. They should cover usual factors that would be found in industry, for example design criteria, measurements, materials, finish tolerances and any relevant standards.

Where possible, to ensure assessment is fair, the size and complexity of the task should be the same for all learners. P2 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 work logs or other relevant learner notes. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

Alternatively, evidence for P2 could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector) or a written assignment.

For P3, learners must use the parallel line method of surface development for a set task and produce a working pattern to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria.

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, and accompanied by appropriate work logs 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, learners must use the radial line method of surface development for a set task and produce a working pattern to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria.

P4 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, and accompanied by appropriate work logs or other relevant learner notes. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

P5 requires learners to produce observed drawings of simple natural and geometric forms using effective and appropriate line to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

P6 requires learners to produce observed drawings of simple natural and geometric forms using effective and appropriate tone to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

For P7, learners must use scale, proportion and perspective when producing an observed drawing to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

For P8, learners must use scale, proportion and perspective when producing a presentational drawing to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

M1 requires learners to identify and discuss potential sources of error in the production of working patterns using the parallel and radial line methods of surface development. Learners could use, as examples, situations that they have seen or been involved with during delivery of this unit. Evidence could be in the same form as for P1.

For M2, learners must use a range of drawing media and apply scale, proportion and multiple perspectives to produce presentational drawings to meet given specifications. Tutors should identify the specifications or agree them through discussion with learners. The specifications may be the same as those used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

For D1, learners must fully utilise the skills of technical and freehand drawing to produce a representational image of a specified complex forged artefact to a presentational standard. Tutors should identify the specifications or agree them through discussion with learners. The technical and freehand drawings and specifications may be the same as those used to provide evidence for other grading criteria. Learners are expected to provide evidence for both areas of skill in their collective presentation.

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 Edexcel assignments to meet local needs and resources.

| Criteria covered | Assignment title | Scenario | Assessment method |
|------------------|---|--|--|
| P1, P2 | Producing Orthographic and Pictorial Drawings | You intend to sub-contract the making of a fabricated steel component. Produce orthographic and pictorial drawings of the design. | Practical observation and assessment. |
| P3, P4, M1 | Parallel Line and Radial Line Templates | The final stage of a forge chimney, ie the last pipe and a 'chinaman's hat' are needed. Produce templates for them and discuss the potential sources of error in the production of these working patterns. | Practical observation and assessment. Written work. |
| P5, P6, P7, M2 | Observed Drawing | Produce an observed drawing as directed, using a wide range of professional skills and media. | Practical observation and assessment. |
| P8, D1 | Presentational Drawings | You are competing for a contract to supply a complex forged steel artefact to a potential customer. Produce presentational drawings of your proposal, utilising technical and freehand drawing. | Practical observation and assessment |

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

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

| Level 2 | Level 3 |
|--------------------------------------|---|
| Working with 3D Design Briefs | Undertake Fabrication Drawing for Blacksmithing and Metalworking |
| Working with 3D Design Crafts Briefs | Understanding and Using Fabrication Skills for Blacksmithing and Metalworking |
| | Understanding and Using Fabrication Techniques for Blacksmithing and Metalworking |
| | Understanding Principles and Methods of Design for Blacksmithing and Metalworking |
| | Undertake Large-scale Design for Blacksmithing and Metalworking |

This unit also has links with Level 3 National Occupational Standards in Fabrication and Welding.

Essential resources

Learners will need access to a drawing office/studio space suitable for the observational and technical drawing activities. The principal features and items of equipment include technical drawing equipment and art materials, for example drawing boards, compasses, set squares, measuring equipment and consumables.

Library and IT facilities should be available with access to unit-specific examples of drawing practice and internet facilities to enable research into techniques, materials, equipment and work examples.

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

Employer engagement and vocational contexts

This unit focuses on developing the practical skills and underpinning knowledge associated with successfully communicating ideas by means of technical and freehand drawings. Tutors are encouraged to make links with local blacksmiths, architects, fabrication drawing offices and art galleries. A visit to a successful artist/blacksmith is also advised so that learners can appreciate the conversion process within an industrial context.

Indicative reading for learners

Textbooks

Blandford P – *Practical Blacksmithing and Metalworking 2nd Edition* (TAB Books, 1988) ISBN 9780830628940

Cooper K and Greenwood T – *Technician Fabrication and Welding* (Cassel, 1979) ISBN 9780304300273

Dickason A – *The Geometry of Sheet Metal Work* (Longman, 1987) ISBN 9780582009615

Flood C – *Fabrication Welding and Metal Joining Processes* (Butterworth-Heinemann, 1981)
ISBN 9780408004480

Ross R – *Metallic Materials Specification Handbook* (Kluwer Academic Publishers, 1991)
ISBN 9780412369407

Rural Development Commission – *Wrought Ironwork Gates* (Countryside Agency, 1992)
ISBN 9781869964221

Smith F – *Basic Fabrication and Welding Engineering* (Longman Higher Education, 1975)
ISBN 9780582424319

Yarwood A – *Sheet Metal Drawing and Development* (Thomson Learning, 1983) ISBN 9780304309559

Journals

Artist Blacksmith

Forge

The Worshipful Company of Blacksmiths newsletter

Websites

en.wikipedia.org/wiki/Engineering_drawing

Engineering drawing

[en.wikipedia.org/wiki/Fabrication_\(metal\)](http://en.wikipedia.org/wiki/Fabrication_(metal))

Fabrication metal

en.wikipedia.org/wiki/Sheet_metal_forming

Sheet metal forming

en.wikipedia.org/wiki/Technical_drawing

Technical drawing

www.roytech.co.uk/Useful_Tables/Drawing/Drawing.html

Drawing standards

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

| Skill | When learners are ... |
|------------------------------|---|
| Independent enquirers | producing observed drawings producing a presentational drawing |
| Creative thinkers | producing observed drawings producing a presentational drawing |
| Reflective learners | producing orthographic and pictorial drawings producing templates producing observed drawings producing a presentational drawing |
| Self-managers | producing orthographic and pictorial drawings producing templates producing observed drawings producing a presentational drawing |

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 ... |
|----------------------|---|
| Team workers | discussing potential sources of error in working patterns |
| Self-managers | discussing potential sources of error in working patterns |

● Functional Skills – Level 2

| Skill | When learners are ... |
|--|--|
| ICT – Develop, present and communicate information | |
| Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> • text and tables • images • numbers • records | producing written work including templates for work, with information about potential sources of error and how these can be overcome |
| Bring together information to suit content and purpose | producing written work including templates for work, with information about potential sources of error and how these can be overcome |
| Present information in ways that are fit for purpose and audience | producing written work including templates for work, with information about potential sources of error and how these can be overcome |
| Evaluate the selection and use of ICT tools and facilities used to present information | producing written work including templates for work, with information about potential sources of error and how these can be overcome |
| Mathematics | |
| Use appropriate checking procedures and evaluate their effectiveness at each stage | discussing potential sources of error in working patterns. |