

Level 3 Diploma in Blacksmithing (7168-03)

October 2017 Version 2.1





Qualification at a glance

| | |
|---------------------------------------|---|
| Subject area | Blacksmithing |
| City & Guilds number | 7168 |
| Age group approved | 16+ |
| Entry requirements | N/A |
| Assessment | Portfolio |
| Support materials | Qualification handbook |
| Registration and certification | Consult the Walled Garden/Online Catalogue for last dates |

| Title and level | GLH | TQT | City & Guilds number | Accreditation number |
|----------------------------------|------------|------------|---------------------------------|-----------------------------|
| Level 3 Diploma in Blacksmithing | 568 | 920 | 7168-03 | 601/2710/7 |

| Version and date | Change detail | Section |
|-------------------------|--------------------------------------|---|
| 2.0 April 2014 | Unit 209 amended | Units |
| 2.1 October 2017 | Added TQT details Deleted QCF | Qualification at a glance & Structure Throughout |

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1 Introduction

This document tells you what you need to do to deliver the qualification:

| Area | Description |
|---|--|
| Who is the qualification for? | <p>It is for learners who work or want to work as blacksmiths in the heritage craft sector. This qualification has four pathways;</p> <ul style="list-style-type: none"> • General Blacksmithing • Artistic Blacksmithing • Heritage Blacksmithing • Industrial Blacksmithing <p>Learners are likely to hold a Level 2 foundation blacksmithing qualification and/or previous practical experience. A level 2 vocationally specific qualification or equivalent experience is a recommended entry requirement.</p> |
| What does the qualification cover? | <p>Blacksmiths form, shape and join metal by hot forging, using both traditional tools and techniques and more modern methods of welding and metalworking.</p> <p>As part of the qualification they will make decorative items such as wrought iron gates, railings, sculptures and furniture. They will also need a good understanding of metallurgy and welding. A blacksmith also has to have contact with their customers to develop designs and do installations, so good communication skills are required. To become a blacksmith you need to be technically minded and enjoy problem solving as you are working and pay extremely high attention to detail.</p> <p>Blacksmiths use traditional tools such as hammers and anvils, as well as power tools, such as power hammers, drills, air chisels and hydraulic presses. Engineering machinery such as centre lathes, milling machines, grinders and welding equipment may also be used.</p> <p>Materials used include wrought iron, steel, steel alloys and non ferrous metals. Blacksmiths heat the metal to the correct temperature so that it can be shaped and, if necessary, joined to another piece of metal by a variety of methods for example welding and riveting. Once construction is complete, the surface of the metal is 'finished' in one or more of a variety of anti-corrosion and decorative finishes, for its required use.</p> |
| Is the qualification part of a framework or initiative? | The qualification forms part of the Blacksmithing apprenticeship framework. |

| Area | Description |
|---|---|
| Who did we develop the qualification with support from? | British Artist Blacksmiths Association (BABA), but also strongly supported by other interested organisations including Creative and Cultural Skills, the Blacksmiths Guild, Worshipful Company of Blacksmiths (WCB), Irish Artist Blacksmithing Association (IABA) British Farriers and Blacksmiths Association (BFBA), National Heritage Ironwork Group (NHIG) and several colleges, especially Hereford and Ludlow College. |
| What opportunities for progression are there? | <p>The qualification allows learners to progress into employment.</p> <p>There are opportunities for industrial blacksmiths in the armed forces, mining, docks, steel manufacture and engineering for maintenance, repair and production.</p> <p>Artist Blacksmiths for the most part tend to be self-employed in designing and making a wide range of products for domestic and architectural environments either through direct sale or to commission.</p> <p>Heritage Blacksmiths can work for larger conservation organisations or as self-employed specialists in ironwork conservation and replication.</p> <p>General blacksmiths are mostly self-employed or work for small family businesses. They often undertake a whole range of work comprising of repairs, forging and fabrication products that can be functional and/or decorative. In larger organisations there may be opportunities for blacksmiths to gain promotion to supervisor. Some overseas work may be available</p> |

Structure

To achieve the **Level 3 Diploma in Blacksmithing – General Blacksmithing**, learners must achieve a minimum of **624** credits;

- 532 credits from the mandatory units (201 – 204, 206 – 207, 211, 309, 313 – 314, 316 – 318, 320 – 321, 329)

Plus

- Minimum of 78 credits (2 units) from Optional Group A units (315, 319, 322)
- Minimum of 14 credits (1 unit) from Optional Group B units (208 - 210)

| Credit | GLH | Level | Unit no | Unit title |
|--|-----|-------|---------|--|
| Mandatory (all units required) | | | | |
| 4 | 30 | 2 | 201* | Obtain feedback from others to inform work and work practice in craft |
| 54 | 185 | 2 | 202* | Forging techniques for blacksmithing and metalworking |
| 14 | 64 | 2 | 203 | Cutting and shaping materials using thermal cutting equipment |
| 9 | 41 | 2 | 204* | Finishing surfaces by applying coatings or coverings |
| 7 | 60 | 2 | 206 | 2D Computer Aided Design |
| 15 | 68 | 2 | 207 | Preparing and using manual metal arc welding equipment |
| 7 | 60 | 2 | 211 | Fabricating sheet metalwork |
| 9 | 60 | 3 | 309* | Communicate effectively in craft |
| 80 | 145 | 3 | 313* | Blacksmithing forge practices using small forge assemblies |
| 11 | 29 | 3 | 314 | Blacksmithing forge practices using large forge machinery |
| 104 | 253 | 3 | 316 | Blacksmithing construction skills |
| 8 | 45 | 3 | 317* | Working safely in blacksmithing |
| 44 | 167 | 3 | 318 | Use hand tools to shape components by material removal in blacksmithing |
| 81 | 230 | 3 | 320 | Large scale blacksmithing construction and installation |
| 53 | 195 | 3 | 321* | Design processes for blacksmithing work |
| 32 | 111 | 3 | 329 | Using machine tools to shape components by material removal in blacksmithing |
| Optional Group A (2 units required) | | | | |
| 44 | 131 | 3 | 315 | Blacksmithing processes |
| 40 | 214 | 3 | 319 | Historical, decorative and sheet metal blacksmithing techniques |
| 38 | 168 | 3 | 322 | Blacksmithing work combining other materials and processes |
| Optional Group B (1 unit required) | | | | |

| | | | | |
|----|----|---|-----|--|
| 15 | 68 | 2 | 208 | Preparing and using manual TIG or plasma-arc welding equipment |
| 15 | 68 | 2 | 209 | Preparing and using semi-automatic MIG, MAG and flux cored arc welding equipment |
| 14 | 64 | 2 | 210 | Preparing and using manual oxy/fuel gas welding equipment |

To achieve the **Level 3 Diploma in Blacksmithing – Artistic Blacksmithing**, learners must achieve a minimum of **570** credits;

- 490 credits from the mandatory units (201 -204, 206 – 207, 309, 313 – 317, 319, 321 - 322)

Plus

- Minimum of 29 credits (2 units) from Optional Group C units (208 - 210)
- Minimum of 51 credits (2 units) from Optional Group D units (211, 318, 320, 329)

**NB – If unit 329 is taken from group D, unit 318 must be taken also

| Credit | GLH | Level | Unit no | Unit title |
|--|-----|-------|---------|--|
| Mandatory (all units required) | | | | |
| 4 | 30 | 2 | 201* | Obtain feedback from others to inform work and work practice in craft |
| 54 | 185 | 2 | 202* | Forging techniques for blacksmithing and metalworking |
| 14 | 64 | 2 | 203 | Cutting and shaping materials using thermal cutting equipment |
| 9 | 41 | 2 | 204* | Finishing surfaces by applying coatings or coverings |
| 7 | 60 | 2 | 206 | 2D Computer Aided Design |
| 15 | 68 | 2 | 207 | Preparing and using manual metal arc welding equipment |
| 9 | 60 | 3 | 309* | Communicate effectively in craft |
| 80 | 145 | 3 | 313* | Blacksmithing forge practices using small forge assemblies |
| 11 | 29 | 3 | 314 | Blacksmithing forge practices using large forge machinery |
| 44 | 131 | 3 | 315 | Blacksmithing processes |
| 104 | 253 | 3 | 316 | Blacksmithing construction skills |
| 8 | 45 | 3 | 317* | Working safely in blacksmithing |
| 40 | 214 | 3 | 319 | Historical, decorative and sheet metal blacksmithing techniques |
| 53 | 195 | 3 | 321* | Design processes for blacksmithing work |
| 38 | 168 | 3 | 322 | Blacksmithing work combining other materials and processes |
| Optional Group C (2 units required) | | | | |
| 15 | 68 | 2 | 208 | Preparing and using manual TIG or plasma-arc welding equipment |
| 15 | 68 | 2 | 209 | Preparing and using semi-automatic MIG, MAG and flux cored arc welding equipment |
| 14 | 64 | 2 | 210 | Preparing and using manual oxy/fuel gas welding equipment |
| Optional Group D (2 units required) | | | | |
| 7 | 60 | 2 | 211 | Fabricating sheet metalwork |

| | | | | |
|----|-----|---|-------|--|
| 81 | 230 | 3 | 320 | Large scale blacksmithing construction and installation |
| 44 | 167 | 3 | 318 | Use hand tools to shape components by material removal in blacksmithing |
| 32 | 111 | 3 | 329** | Using machine tools to shape components by material removal in blacksmithing |

To achieve the **Level 3 Diploma in Blacksmithing – Heritage Blacksmithing**, learners must achieve a minimum of **611** credits;

- 534 credits from the mandatory units (201 – 202, 204, 207, 309, 313, 315, 317, 319 – 321, 323 - 327)

Plus

- Minimum of 14 credits (1 unit) from Optional Group E units (203, 318, 328 – 329)
- Minimum of 49 credits (2 units) from Optional Group F units (314, 316, 322)
- Minimum of 14 credits (1 unit) from Optional Group G units (208 - 210)

**NB – If unit 329 is taken from group E, unit 318 must be taken also

| Credit | GLH | Level | Unit no | Unit title |
|---|-----|-------|---------|---|
| Mandatory (all units required) | | | | |
| 4 | 30 | 2 | 201* | Obtain feedback from others to inform work and work practice in craft |
| 54 | 185 | 2 | 202* | Forging techniques for blacksmithing and metalworking |
| 9 | 41 | 2 | 204* | Finishing surfaces by applying coatings or coverings |
| 15 | 68 | 2 | 207 | Preparing and using manual metal arc welding equipment |
| 9 | 60 | 3 | 309* | Communicate effectively in craft |
| 80 | 145 | 3 | 313* | Blacksmithing forge practices using small forge assemblies |
| 44 | 131 | 3 | 315 | Blacksmithing processes |
| 8 | 45 | 3 | 317* | Working safely in blacksmithing |
| 40 | 214 | 3 | 319 | Historical, decorative and sheet metal blacksmithing techniques |
| 81 | 230 | 3 | 320 | Large scale blacksmithing construction and installation |
| 53 | 195 | 3 | 321* | Design processes for blacksmithing work |
| 5 | 30 | 3 | 323 | Introduction to ethics and professional judgement for cultural heritage conservation |
| 30 | 100 | 3 | 324 | Working on conservation and restoration projects in the workplace |
| 52 | 173 | 3 | 325 | Repairing, restoring, conserving, replacing or maintaining forged heritage metalwork in the workplace |
| 23 | 77 | 3 | 326 | Cleaning, preparing and protecting heritage metalwork in the workplace |
| 27 | 90 | 3 | 327 | Heating, welding or soldering heritage metalwork in the workplace |
| Optional Group E (1 unit required) | | | | |
| 14 | 64 | 2 | 203 | Cutting and shaping materials using thermal cutting equipment |

| | | | | |
|--|-----|---|-------|--|
| 44 | 167 | 3 | 318** | Use hand tools to shape components by material removal in blacksmithing |
| 14 | 47 | 3 | 328 | Thermal cutting metal for heritage work |
| 32 | 111 | 3 | 329 | Use machine tools to shape components by material removal in blacksmithing |
| Optional Group F (2 units required) | | | | |
| 11 | 29 | 3 | 314 | Blacksmithing forge practices using large forge machinery |
| 104 | 253 | 3 | 316 | Blacksmithing construction skills |
| 38 | 168 | 3 | 322 | Blacksmithing work combining other materials and processes |
| Optional Group G (1 unit required) | | | | |
| 15 | 68 | 2 | 208 | Preparing and using manual TIG or plasma-arc welding equipment |
| 15 | 68 | 2 | 209 | Preparing and using semi-automatic MIG, MAG and flux cored arc welding equipment |
| 14 | 64 | 2 | 210 | Preparing and using manual oxy/fuel gas welding equipment |

To achieve the **Level 3 Diploma in Blacksmithing – Industrial Blacksmithing**, learners must achieve a minimum of **569** credits;

- 481 credits from the mandatory units (201 – 206, 211, 309, 313 – 314, 316 – 318, 321 – 322, 329)

Plus

- Minimum of 44 credits (3 units) from Optional Group H units (207 - 210)
- Minimum of 44 credits (1 unit) from Optional Group I units (315, 320)

| Credit | GLH | Level | Unit no | Unit title |
|--|-----|-------|---------|--|
| Mandatory (all units required) | | | | |
| 4 | 30 | 2 | 201* | Obtain feedback from others to inform work and work practice in craft |
| 54 | 185 | 2 | 202* | Forging techniques for blacksmithing and metalworking |
| 14 | 64 | 2 | 203 | Cutting and shaping materials using thermal cutting equipment |
| 9 | 41 | 2 | 204* | Finishing surfaces by applying coatings or coverings |
| 7 | 60 | 2 | 205 | Fabricating thick plate, bar and sections |
| 7 | 60 | 2 | 206 | 2D Computer Aided Design |
| 7 | 60 | 2 | 211 | Fabricating sheet metalwork |
| 9 | 60 | 3 | 309* | Communicate effectively in craft |
| 80 | 145 | 3 | 313* | Blacksmithing forge practices using small forge assemblies |
| 11 | 29 | 3 | 314 | Blacksmithing forge practices using large forge machinery |
| 104 | 253 | 3 | 316 | Blacksmithing construction skills |
| 8 | 45 | 3 | 317* | Working safely in blacksmithing |
| 44 | 167 | 3 | 318 | Use hand tools to shape components by material removal in blacksmithing |
| 53 | 195 | 3 | 321* | Design processes for blacksmithing work |
| 38 | 168 | 3 | 322 | Blacksmithing work combining other materials and processes |
| 32 | 111 | 3 | 329 | Using machine tools to shape components by material removal in blacksmithing |
| Optional Group H (3 units required) | | | | |
| 15 | 68 | 2 | 207 | Preparing and using manual metal arc welding equipment |
| 15 | 68 | 2 | 208 | Preparing and using manual TIG or plasma-arc welding equipment |
| 15 | 68 | 2 | 209 | Preparing and using semi-automatic MIG, MAG and flux cored arc welding equipment |
| 14 | 64 | 2 | 210 | Preparing and using manual oxy/fuel gas welding equipment |
| Optional Group I (1 unit required) | | | | |

| | | | | |
|----|-----|---|-----|---|
| 44 | 131 | 3 | 315 | Blacksmithing processes |
| 81 | 230 | 3 | 320 | Large scale blacksmithing construction and installation |

NB - There are 7 units common across all pathways (marked with *)

| | |
|------|---|
| 201* | Self evaluate and obtain feedback from others to inform work and work practice in craft |
| 202* | Forging techniques for blacksmithing and metalworking |
| 204* | Finishing surfaces by applying coatings or coverings |
| 309* | Communicate effectively in craft |
| 313* | Blacksmithing forge practices using small forge assemblies |
| 317* | Working safely in blacksmithing |
| 321* | Design processes for blacksmithing work |

Total Qualification Time

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

| Title and level | GLH | TQT |
|----------------------------------|------------|------------|
| Level 3 Diploma in Blacksmithing | 568 | 920 |



2 Centre requirements

Approval

There is no fast track approval for this qualification; existing centres who wish to offer this qualification must use the **standard** Qualification Approval Process.

To offer this qualifications, new centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual - Supporting Customer Excellence* for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification[s] before designing a course programme.

Resource requirements

Centre staffing

Staff delivering this qualification must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the areas for which they are delivering training and/or have experience of providing training. This knowledge must be to at least the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Centre staff may undertake more than one role, eg tutor and assessor or internal quality assurer, but cannot internally verify their own assessments.

Assessors and Internal Quality Assurer

Assessor/Internal Quality Assurer TAQA qualifications are valued as qualifications for centre staff, but they are not currently a requirement for the qualification.

Continuing professional development (CPD)

Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments.

Learner entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that learners have the potential and opportunity to gain the qualification successfully.

As part of the assessment for this qualification, learners must have access to a work based setting.

Age restrictions

City & Guilds cannot accept any registrations for learners under 16 as this qualification is not approved for under 16s.



3 Delivering the qualification

Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific training needs,
- support and guidance they may need when working towards their qualification.
- any units they have already completed, or credit they have accumulated which is relevant to the qualification.
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the learner fully understands the requirements of the qualification, their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.



4 Assessment

Candidates must:

- have a completed portfolio of evidence for each unit

Time constraints

The following must be applied to the assessment of this qualification:

- Candidates must finish their assessment within their period of registration

Assessment strategy

The assessment strategy for imported SEMTA welding units must be followed. The assessment strategy can be downloaded from the SEMTA website here <http://www.semta.org.uk/standards/qualifications>

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience or qualifications which have already been achieved to contribute to a new qualification. RPL is allowed for this qualification.



5 Units

Availability of units

All units within the qualification are listed in the following pages.

Structure of units

These units each have the following where appropriate;

- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- guided learning hours
- unit aim
- relationship to NOS
- endorsement by a sector or other appropriate body
- learning outcomes which are comprised of a number of assessment criteria
- evidence requirements
- notes for guidance.

Unit 201

Obtain feedback from others to inform work and work practice in craft

| | |
|--|--|
| UAN: | T/505/8089 |
| Level: | 2 |
| Credit value: | 4 |
| GLH: | 30 |
| Relationship to NOS: | Creative and Cultural Skills, Craft NOS, CR21 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | This unit enables learners to understand the importance of feedback on work progress, deal with feedback from others and monitor their own work and work practice. |

| |
|--|
| Learning outcome |
| The learner will: 1. understand the influence of feedback on progress at work |
| Assessment criteria |
| The learner can: 1.1 describe own work responsibilities and job role 1.2 state the kinds of feedback that can inform own work and work practice 1.3 explain how to check if own work is of the highest quality. |

| |
|--|
| Learning outcome |
| The learner will: 2. be able to use feedback from others on progress at work |
| Assessment criteria |
| The learner can: 2.1 agree objectives with line manager/employer and colleagues 2.2 identify what has been achieved against agreed objectives 2.3 use feedback from others to inform future work and work practice. |

| |
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| Learning outcome |
| The learner will: 3. be able to monitor own work and work practice |
| Assessment criteria |
| The learner can: 3.1 keep records and documents of feedback received 3.2 monitor own work in the light of feedback 3.3 check that own work and work practice is improving. |

Unit 202

Forging techniques for blacksmithing and metalworking

| | |
|--|--|
| UAN: | F/505/9990 |
| Level: | 2 |
| Credit value: | 54 |
| GLH: | 185 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCSBS1 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to provide the learner with the Forging techniques that are essential core elements of the blacksmithing industry, as well as the underpinning knowledge that is the basis of all blacksmithing production in the forge environment. |

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| Learning outcome |
| The learner will: 1. understand how to work to blacksmithing specifications |
| Assessment criteria |
| The learner can: 1.1 interpret requirements from specifications 1.2 explain drawing conventions 1.3 explain methods of working according to specification. |

| |
|---|
| Range |
| Specifications working drawings (2D representation, 3D representation), current relevant legislation, tolerances, standard drawing conventions - (welding, fabrication, engineering, architectural, forge work), written instructions (method statements, data sheets, manufacturers requirements, risk assessments), maquettes/models, samples |

| |
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| Learning outcome |
| The learner will: 2. understand the effects of heating in blacksmithing processes |
| Assessment criteria |
| The learner can: 2.1 analyse fuel performance in blacksmithing processes 2.2 explain areas of a fire and furnace 2.3 explain the design and operation of forge hearths and furnaces 2.4 explain the effects of hot working on metals |

| |
|---|
| Range |
| Fuel performance types (coal, coke, charcoal, gas, oil, electrical induction), advantages/disadvantages, costs |
| Areas of a fire and furnace oxidising, neutral, reducing/carburising |
| Forge hearths solid fuel forge hearth (side blast, bottom blast) |
| Furnaces gas and oil furnace, venturi and fan assisted, lining types |
| Forge hearth and furnaces control systems |
| Effects ferrous, non-ferrous, alloy, re-crystallisation, oxidation, heat treatments, heating and cooling, compaction/distortion, working heats, expansion and contraction |

| |
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| Learning outcome |
| The learner will: 3. understand working with common blacksmithing techniques |
| Assessment criteria |
| The learner can: 3.1 identify hand and fixed tools 3.2 explain the design and uses of hand tools 3.3 explain forging, forming, cutting and joining processes 3.4 explain the causes of common flaws in forging processes and tool making. |

| |
|---|
| Range |
| Hand tools tongs, top and bottom tools, anvil tools, spring tools, formers/jigs, measuring equipment, marking out equipment, punches, hammers, |

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|---|
| bending tools, chisels, press tools, holdfast/dogs |
| <p>Fixed tools anvils, swage block, mandrels, power hammers, setting out table/peg tables, hydraulic/fly press</p> |
| <p>Forging processes drawing down, upsetting, spreading, setting, fullering, swaging</p> |
| <p>Forming processes bending, twisting, dishing, raising chasing</p> |
| <p>Cutting processes splitting, punching, engraving</p> |
| <p>Joining processes riveting, forge welded joints (faggot, lap, straight scarf, branch, box, split core [e.g . cage], pocket / socket, cleft, corner, 'T', glut, gusset, collar, butt, chain link), flux types (silver sand, borax), fire brazing, collaring, mortice and tenon (straight tenon, upset tenon, offset tenon), pegs and wedges, wraps</p> |
| <p>Flaws cracks, burns, galls, oxidation, over worked, mushrooming</p> |

| |
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| Learning outcome |
| The learner will: 4. be able to carry out common forging, forming and cutting techniques |
| Assessment criteria |
| The learner can: 4.1 use hand forging techniques to meet a given specification 4.2 use hand forming techniques to meet a given specification 4.3 use hot cutting techniques to meet a given specification 4.4 use solid fuel forge hearths to meet given objectives. |

| |
|--|
| Range |
| <p>Hand Forging techniques upsetting, drawing down, spreading, sets, transitions, swaging, fullering</p> |
| <p>Specification time, accuracy to tolerance, drawing conventions, use and transfer working drawings.</p> |
| <p>Hand forming techniques bending, twisting, dishing, repoussé, chasing raising, pressing, using hand-operated tooling, using controlled heat techniques,</p> |
| <p>Hot cutting techniques punching (taper punching, parallel punching, slitter punching, slot punching), Drifting (parallel drifting, taper drifting, profiled drifting), chiselling (cutting, slitting, profiled edge)</p> |
| <p>Solid fuel coke, coal, charcoal,</p> |

Hearths

bottom blast, side blast

Learning outcome

The learner will:

5. Be able to make and maintain common forging tools

Assessment criteria

The learner can:

5.1 heat treat **forged metal** to meet a given **specification** via;

- a. normalising
- b. annealing,
- c. hardening,
- d. tempering,
- e. case hardening

5.2 carry out visual inspections and report **flaws** for forge **hand tools**

5.3 repair and maintain forge **hand tools**

5.4 make common forge **hand tools** to meet a given specification

Range

Forged metal

iron (wrought iron or pure iron), plain carbon steels, non-ferrous, alloys

Specification

timely completion, fit for purpose

Flaws

cracks, burns, galls, oxidation, over worked, mushrooming

Hand tools

tongs, chisels, punches, hammers, jigs, top and bottom tools, spring tools

Learning outcome

The learner will:

6. be able to use joining techniques to produce basic constructions, components or tools

Assessment criteria

The learner can:

6.1 select techniques, materials, tools and equipment to carry out blacksmithing tasks

6.2 use **joining techniques** to produce constructions, components or tools to meet a given **specification**.

Range**Joining techniques**

forge welding (faggot, lap, straight scarf, branch, box, split core [e.g. cage], pocket/socket, cleft, corner, 'T', glut, gusset, collar, butt, chain link), flux (silver sand, borax), riveting (countersunk, dome head, pan head, faceted, decorative, blind), collaring (forged, composite, profiled), mortice and tenon (straight tenon, upset tenon, offset tenon), pegs/wedges, wraps

Specification

timely completion, accuracy to tolerance, drawing conventions, use and transfer working drawings.

Unit 202 Forging techniques for blacksmithing and metalworking

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 2.4 Candidates must explain the effects on at least **one** of **each** from; Ferrous, non-ferrous and alloys.

AC 4.2 Candidates must use at least **four** of the ranged hand forming techniques.

AC4.3 Candidates must use at least **three** of the ranged punching techniques and **two** of the ranged drifting techniques. **All** of the ranged chiselling techniques are required.

AC 4.4 Candidates must use at least **one** of the solid fuel types ranged and at least **one** of the ranged hearth types.

AC 5.1 Candidates must use at least **two** of the ranged types of forged metal.

AC 5.2 Candidates must cover at least **three** of the ranged types of flaws.

AC 5.2 – 5.4 Candidates must report on, repair and maintain at least **four** of the ranged hand tools. Candidates must make at least **four** of the ranged hand tools including tongs.

AC 6.2 Candidates must use at least **four** types of forge welding, at least **one** type of flux, at least **two** types of riveting, at least **two** types of collaring and at least **two** types of mortice and tennon.

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Guidance

AC4.1 Hand forging techniques by hand or smith and striker

Assessment

This unit will be assessed by portfolio of evidence.

Unit 203

Cutting and shaping materials using thermal cutting equipment

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| UAN: | R/504/6404 |
| Level: | 2 |
| Credit value: | 14 |
| GLH: | 64 |
| Relationship to NOS: | SEMPEO2-24 |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA |

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| Learning outcome |
| The learner will: 1. cut and shape materials using thermal cutting equipment |
| Assessment criteria |
| The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 confirm that the equipment is safe and fit for purpose, by carrying out all of the following checks: a. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations b. the equipment selected is suitable for the operations to be performed c. regulators, hoses and valves are securely connected and free from leaks and damage d. the correct gas nozzle is fitted to the cutting torch e. a flashback arrestor is fitted to the gas equipment f. appropriate gas pressures are set g. the correct procedure is used for lighting, adjusting and extinguishing the cutting flame h. hoses are safely routed and protected at all times i. gas cylinders are handled and stored safely and correctly 1.3 plan the thermal cutting activities before they start them 1.4 produce thermal cuts in the following form of material (metal of 3mm and above): a. plate Plus one more from the following: b. rolled sections c. pipe/tube |

- d. structures
- 1.5 produce cut profiles for one type of material from the following:
 - a. mild steel
 - b. high tensile/special steel
 - c. stainless steel
 - d. other appropriate metal
- 1.6 obtain the appropriate tools and equipment for the cutting operations, and check that they are in a safe and usable condition
- 1.7 set up the thermal cutting equipment for the operations to be performed
- 1.8 use the following thermal cutting method:
 - a. hand-held oxy-fuel gas cutting equipmentPlus one more from the following:
 - b. hand-held plasma gas cutting equipment
 - c. simple, portable, track-driven cutting equipment (electrical or mechanical)
 - d. fixed bench gas cutting equipment
- 1.9 where appropriate, mark out the components for the required operations, using appropriate tools and techniques
- 1.10 operate the thermal cutting equipment to produce items/cut shapes to the dimensions and profiles specified
- 1.11 perform thermal cutting operations, to include all of the following:
 - a. down-hand straight cuts (freehand)
 - b. cutting regular shapes
 - c. making radial cutsPlus three more from the following:
 - d. making straight cuts (track guided)
 - e. making vertical cuts
 - f. making overhead cuts
 - g. cutting irregular shapes
 - h. making angled cuts
 - i. cutting chamfers
 - j. gouging/flushing
 - k. bevelled edge – weld preparations
 - l. cutting out holes
- 1.12 measure and check that all dimensional and geometrical aspects of the component are to the specification
- 1.13 produce thermally-cut components which meet all of the following:
 - a. dimensional accuracy is within the tolerances specified on the drawing/specification, or within +/- 3mm
 - b. angled/radial cuts are within specification requirements
 - c. cuts are clean and smooth, and free from flutes
- 1.14 deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve
- 1.15 shut down the equipment to a safe condition on conclusion of the machining activities
- 1.16 leave the work area in a safe and tidy condition on completion of the thermal cutting activities.

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| Learning outcome |
| The learner will: 2. know how to cut and shape materials using thermal cutting equipment |
| Assessment criteria |
| The learner can: 2.1 describe the specific safety precautions to be taken when working with thermal cutting equipment in a fabrication environment (including general workshop safety; protecting other workers by siting protective screens; fire and explosion prevention; safety in enclosed/confined spaces; fume control) 2.2 describe the personal protective clothing and equipment (PPE) to be worn when working with thermal cutting equipment (such as leather aprons and gloves, eye/ear protection) 2.3 describe the correct methods of moving or lifting plate and section materials 2.4 describe the hazards associated with carrying out thermal cutting activities (including trailing hoses, naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal, enclosed spaces), and how they can be minimised 2.5 describe the safe working practices and procedures for using thermal equipment, in line with British Compressed Gas Association (BCGA) codes of practice (to include setting up procedures, and emergency shutdown procedures) 2.6 describe the procedure for obtaining the required drawings, job instructions and other related specifications 2.7 explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.9 describe the basic principles of thermal cutting, the various types of thermal cutting equipment available, and typical applications 2.10 describe the accessories that can be used with hand-held thermal cutting equipment to aid cutting operations (such as cutting guides, trammels, templates); arrangements for attaching cutting aids to the equipment 2.11 describe the gases used in thermal cutting; gas identification and colour codes; their particular characteristics and safety procedures 2.12 explain how to set up the thermal cutting equipment (including connection of hoses, regulators and flashback arrestors, selection of cutting torch and nozzle size in relationship to material thickness and operations performed) 2.13 describe the preparations prior to cutting (including checking connections for leaks, setting gas pressures, setting up the material/workpiece, and checking the cleanliness of materials used) 2.14 describe the holding methods that are used to aid thermal cutting, and the equipment that can be used 2.15 describe the setting of operating conditions (including flame control, and the effects of mixtures and pressures associated with thermal cutting) 2.16 describe the correct procedure for lighting and extinguishing the flame (to include lighting the cutting torch and adjusting gas. |

controls to produce a neutral flame; methods of starting the cut and controlling the cutting speed, direction and angle of cut; the procedure for extinguishing the flame and the importance of following the procedure)

- 2.17 describe the procedures to be followed for cutting specific materials, and why these procedures must always be adhered to
- 2.18 describe the problems that can occur with thermal cutting (including causes of distortion during thermal cutting and methods of controlling distortion), and how they can be avoided
- 2.19 describe the effects of oil, grease, scale or dirt on the cutting process
- 2.20 describe the causes of cutting defects, how to recognise them, and methods of correction and prevention
- 2.21 explain when to act on their own initiative and when to seek help and advice from others
- 2.22 describe the importance of leaving the work area and equipment in a safe and clean condition on completion of the thermal cutting activities (such as safely storing gas cylinders and cutting equipment, removing and disposing of waste).

Unit 203 Cutting and shaping materials using thermal cutting equipment

Supporting information

Evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the RQF' which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's PEO NVQ unit assessment strategy which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Unit 204

Finishing surfaces by applying coatings or coverings

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| UAN: | M/504/6443 |
| Level: | 2 |
| Credit value: | 9 |
| GLH: | 41 |
| Relationship to NOS: | SEMPEO2-52 |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA |

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| Learning outcome |
| The learner will: 1. finish surfaces by applying coatings or coverings |
| Assessment criteria |
| The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 carry out all of the following during the surface finishing activities: a. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations b. follow job instructions and finishing specifications and procedures c. check that the tools and finishing equipment that they need (such as brushes, rollers spray equipment, hoses, hand tools) are in a safe and usable condition d. where appropriate, ensure that dust extraction and air filtering equipment is functioning correctly e. provide a suitable means for curing the coating (such as heating, or air supply to assist curing) 1.3 plan the surface finishing activities before they start them 1.4 prepare the work surfaces in readiness to receive the appropriate coating or covering 1.5 prepare the surface to be finished, to include carrying out six of the following: a. stripping old finishes b. cleaning/degreasing c. mechanical surface preparation d. flattening down e. masking up f. filling g. sealing |

- h. pre-surface treatments
- i. re-activating treatments
- 1.6 prepare the required coating or covering materials for use
- 1.7 prepare the coating or covering materials for application, to include carrying out all of the following:
 - a. obtaining the correct types and quantities of materials
 - b. ensuring that the correct mixing ratios are adhered to
 - c. checking that the prepared coating material is of the correct viscosity/consistency
 - d. ensuring that the prepared material has been left for the required induction period (if applicable)
 - e. ensuring that the prepared material is at the temperature recommended for applicationPlus one of the following:
 - f. mixing base materials (such as primers, sealers)
 - g. mixing finishing materials (such as final colour, stain, polish)
 - h. preparing adhesives
 - i. preparing cleaning materials (such as degreasing)
- 1.8 apply the coatings or coverings to the surfaces, using appropriate techniques and procedures
- 1.9 apply coatings or coverings to two of the following materials:
 - a. wood based
 - b. ferrous material
 - c. non-ferrous material
 - d. composite (such as glass fibre, Kevlar)
 - e. pre-painted surfaces
 - f. ceramic
 - g. plaster/brick/concrete
- 1.10 apply liquid coatings such as primer/undercoat and finishing coats, using four of the following finishing materials:
 - a. sanding sealer
 - b. water based paints
 - c. oil/alkyd based paints
 - d. synthetic paints
 - e. two component polyurethane paint
 - f. petroleum based
 - g. polyurethane varnish
 - h. lacquer
 - i. stain
 - j. wax
 - k. French polish
 - l. temporary protective coatings
 - m. mastics
 - n. bituminous or rubber paints
 - o. other special finishes (specify)OR apply coverings which are decorative, insulative or protective, to include three of the following:
 - p. paper based
 - q. polymer based
 - r. composite
 - s. metallic

- t. wood
- u. ceramic
- 1.11 apply finishes to a range of surfaces, to include four of the following:
 - a. flat
 - b. horizontal
 - c. vertical
 - d. overhead
 - e. curved or cylindrical
 - f. corners (such as outside corners, edges, 'obscured' corners)
- 1.12 check that the finished surface achieves the required characteristics and meets the finishing specification
- 1.13 check that the completed surface finishes or coverings comply with all of the following:
 - a. the final finish or covering is in line with the specification or job requirements
 - b. the final finish achieves acceptable colour match and, where applicable, gloss levels
 - c. the finished surface is free from defects (such as runs, drips, bubbles, unevenness)
 - d. the finished surface meets customer/company requirements
- 1.14 deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve
- 1.15 tidy up the work area on completion of the coating or covering activities, to include carrying out all of the following:
 - a. disposing of excess or unused materials, in accordance with approved procedures
 - b. cleaning containers to be reused
 - c. disposing of non-reusable containers, in accordance with approved procedures
 - d. cleaning and returning all tools and excess materials to their designated location
 - e. disposing of waste materials and used solvents, in accordance with approved procedures
- 1.16 dispose of waste material safely and correctly, in line with organisational procedures
- 1.17 leave the work area in a safe condition on completion of the finishing activities.

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| Learning outcome |
| The learner will: 2. know how to finish surfaces by applying coatings or coverings |
| Assessment criteria |
| The learner can: 2.1 describe the specific health and safety precautions which must be taken when preparing surfaces and applying surface coatings and coverings (such as wearing protective clothing and protective equipment, using fume and dust extraction equipment) 2.2 describe the hazards associated with preparing surfaces and applying surface coatings and coverings (such as using chemicals for |

- cleaning activities, dust and fume inhalation, use of power tools and abrasive discs; including the hazard information to be found in manufacturers' data sheets), and how they can be minimised
- 2.3 describe the personal protective equipment (PPE) to be used; how to obtain it and check that it is in a safe and usable condition (such as eye protection, overalls, face masks, breathing equipment)
 - 2.4 describe the requirements for working in confined spaces, and safe systems of work (including required air quantities (RAQs) and local exhaust ventilation (LEV) to maintain safe conditions; the provision of adequate and safe lighting and avoidance of sources of ignition)
 - 2.5 describe the importance of ensuring that fume extraction equipment is operating effectively, and that good housekeeping and fire prevention procedures are observed
 - 2.6 describe the importance of following job instructions and defined surface finishing procedures
 - 2.7 describe the surface preparation methods and techniques to be undertaken, prior to applying the coatings or coverings (such as carrying out repairs to the surface or making good any damaged or defective surfaces; stripping off old materials; using solvents to remove dirt and grease; masking surfaces to prevent overspill/spray)
 - 2.8 describe the specific coatings or coverings to be used, and the types of surfaces for which they are best suited (such as liquid coatings, coverings in sheet, roll or tile form)
 - 2.9 explain how to determine quantities of finishing materials required and, where applicable, mixing materials to achieve the required colour, viscosity or adhesive strength
 - 2.10 describe the preparation methods and techniques for mixing paints, varnishes, lacquers, stains and polishes
 - 2.11 describe the various methods of applying the required finishes (such as using brushes, rollers, paint pads, cloths, adhesive spreaders and spray equipment)
 - 2.12 describe the safe operation of spray equipment, and the effects of air pressure variance on the spray quality
 - 2.13 describe the time intervals that are required between coats, and why these must be adhered to
 - 2.14 describe the use of lamps and heaters to aid the drying of the coatings or coverings
 - 2.15 describe the cleaning and maintenance procedures for the tools and equipment that are used (such as brushes, rollers, adhesive spreading tools and spray equipment)
 - 2.16 describe the procedures for dealing with used consumables and surplus coatings or coverings safely and correctly
 - 2.17 explain how to check and assess the finished work (such as for appearance, colour, coating thickness, coverage and adhesion)
 - 2.18 explain how to recognise defects (such as bubbles, contamination, runs and other surface defects)
 - 2.19 describe the problems that can occur with the finishing operations, and how these can be overcome
 - 2.20 explain when to act on their own initiative and when to seek help and advice from others
 - 2.21 describe the importance of leaving the work area and equipment in a safe and clean condition on completion of the finishing activities (such as returning tools and equipment to the designated location, cleaning the work, area and removing and disposing of waste).

Unit 204 Finishing surfaces by applying coatings or coverings

Supporting information

Evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the RQF' which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's PEO NVQ unit assessment strategy which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Unit 205

Fabricating thick plate, bar and sections

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| UAN: | J/503/0197 |
| Level: | 2 |
| Credit value: | 7 |
| GLH: | 60 |
| Relationship to NOS: | This unit is linked to the NVQ – Performing Engineering Operations Level 2: 2251 Unit 23: Producing Platework Components and Assemblies |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA. |
| Aim: | This unit is concerned with the underlying process technology associated with the fabrication of thick plate bar and rolled sections, in terms of: cutting, forming, assembly and joining of thick plate bar and rolled sections fabrication. It covers health and safety hazards associated with cutting (including oxy-fuel gas), forming, assembly and joining of thick plate bar and rolled sections fabrication. |

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| Learning outcome |
| The learner will: 1. be able to prepare equipment, tools and materials for cutting of thick plate, bar and rolled sections |
| Assessment criteria |
| The learner can: 1.1 prepare equipment for a cutting operation 1.2 prepare materials for a cutting operation 1.3 operate equipment safely. |

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| Range |
| Equipment: <ul style="list-style-type: none">• drills• rotary shears• guillotines• power punch• cutting-off wheel machines• oxy-fuel gas cutting: process, equipment, safe storage conditions, hazards from hot metal/sparks, types of gasses, cylinders types and |

identification, flashback arrestors, hose types and identification, connector types and identification, hose check valves, cutting torch, flashback arrestors, cutting nozzles guides, portable track cutting machines

- grinders
- lifting equipment, wall and overhead mounted travelling cranes, fork lift trucks, pallets and pallet truck, block and tackle, pull/lift lever hoist, engine hoist, chains, ropes, slings, shackles, lifting eyes, friction clamps, welded lugs, lifting capacity

Materials: methods of marking out, use of datums (line, edge, centre point), avoiding damage to surface coatings, minimal wastage, health and safety considerations

Additional Guidance

Equipment:

- drills (bench, pillar, portable)
- rotary shears (portable, nibblers [shear type, punch type])
- guillotines (mechanical, back stops, front stops, guards)
- power punch
- cutting-off wheel machines
- oxy-fuel gas cutting (process, equipment (recognise the hazards from compressed gas cylinders [safe: storage conditions, handling/moving, use, start-up and shut down procedures, dealing with a backfire/flashback], hazards from hot metal/sparks, types of gasses, cylinders types and identification, flashback arrestors, hose types and identification, connector types and identification, hose check valves [protectors], cutting torch, flashback arrestors, cutting nozzles [types, gouging], guides [bevel, circle, radius bar], portable track cutting machines)
- grinders (portable angle grinders/sanders, bench, pedestal)
- lifting equipment (common forms of injury, use lifting aids [straps, bars, harnesses], wall and overhead mounted travelling cranes, fork lift trucks, pallets and pallet truck, block and tackle, pull/lift lever hoist, engine hoist, chains, ropes, slings, shackles, lifting eyes, friction clamps, welded lugs, lifting capacity [safe working load {SWL}])

Learning outcome

The learner will:

2. be able to use equipment and tools for thick plate, bar and rolled sections

Assessment criteria

The learner can:

- 2.1 use equipment for **forming** thick plate, bar and rolled sections
- 2.2 use equipment for assembling thick plate, bar and rolled sections to the required shape/geometry within ± 3.0 mm
- 2.3 operate equipment safely
- 2.4 produce fabricated assemblies safely.

Range

Forming: hot and cold bending (principles – application of heat, hand methods [clamps, vices, levers], bench mounted machines [types, applications], bench bending around a former, fly press [principles,

tooling], brake press [principles, tooling], springback [principle, allowances], 'split and weld' methods, health and safety considerations
Assembling: work holding (clamps, pins, plate dogs, wedges, tack welding), work alignment (strong backs, clamping dogs, wedges, draw-bolts and cleats, bridge pieces, toggle clamps, alignment jigs), distortion control (tack welding, presetting, weld sequencing).

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| Learning outcome |
| The learner will: 3. be able to produce fabrications using thick plate and rolled bar sections joining techniques |
| Assessment criteria |
| The learner can: 3.1 use thick plate joining techniques to produce fabrications to the required shape/geometry within ± 3.0 mm 3.2 produce fabrications that have secure and firm joints and are free from excessive tooling marks, deformation, cracking, sharp edges, slivers or burrs 3.3 join fabricated assemblies safely 3.4 restore the work area using the correct procedure for the disposal of waste. |

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| Range |
| <p>Joining techniques:</p> <ul style="list-style-type: none"> • solid rivets • bolts and nuts • screwed fastenings types of screwed fastening, cap/cheese head, round head, countersunk, self-tapping, use of hank bushes, use of taps and dies • use of welded joints • manual metal arc (MMA) welding equipment/consumables, techniques: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving, Personal Protective Equipment (PPE), fume removal • MIG welding equipment/consumables: direct current [d.c.] electrode positive, wire feed unit, arc ignition, gun/torches, electrodes wires shielding gases used for the welding of carbon steels: carbon dioxide [CO₂], argon/CO₂, argon/oxygen/CO₂), Personal Protective Equipment (PPE), fume removal <p>Additional Guidance</p> <p>Joining techniques:</p> <ul style="list-style-type: none"> • solid rivets (single lap, double lap, single strap, double strap; types of rivet head: flat, countersunk, round [or snap], pan, mushroom, applications; riveting defects; causes of joint failure [tearing of metal, crushing of metal, splitting of metal, shearing of rivet; allowances; sources of pressure: hammers, pneumatic, hydraulic) • bolts and nuts (types of bolts: black, turned, high-strength friction-grip, cap/cheese head; types of nuts: hexagonal, split, self-locking, wing, castellated, domed; use of washers: flat, taper, spring; defects in bolted connections; use of podging spanners and drifts; allowances) • screwed fastenings (types of screwed fastening, cap/cheese head, round head, countersunk, self-tapping, use of hank bushes, use of taps and dies |

- use of welded joints (lap, corner, butt, tee)
 - manual metal arc (MMA) welding (equipment/consumables: alternating current [a.c.] direct current [d.c.], welding leads [welding, return, earth], electrode holders, return clamps, chipping hammer, wire brushes, electrode sizes [Ø2.5, 3.2 Ø 4.0 mm] techniques: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving, Personal Protective Equipment (PPE), fume removal)
 - MIG welding (equipment/consumables: direct current [d.c.] electrode positive, wire feed unit, arc ignition, gun/torches, electrodes wires [Ø0.6 mm, Ø0.8 mm], shielding gases used for the welding of carbon steels: carbon dioxide [CO₂], argon/CO₂, argon/oxygen/CO₂), Personal Protective Equipment (PPE), fume removal)
- Restore the work area:** leave the work area free of unused consumables, cleaning the work area, putting tools and equipment into safe storage, identifying and recording finished work

Unit 206

Create 2D designs using a computer aided design system

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| UAN: | D/600/3095 |
| Level: | 2 |
| Credit value: | 7 |
| GLH: | 60 |
| Relationship to NOS: | This unit is linked to the Performing Engineering Operations Level 2, unit 61 Producing CAD models (drawings) using a CAD system |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA. |
| Aim: | This unit aims to equip candidates with the basic understanding and principles of 2D drawing environment, in terms of hardware, software and physical surroundings. It will explore the typical composition of a CAD system and health and safety matters that are associated with safe working practices. |

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| Learning outcome |
| The learner will: 1. be able to confirm project objectives and CAD requirements |
| Assessment criteria |
| The learner can: 1.1 define project objectives 1.2 identify and interpret relevant parameters 1.3 specify CAD requirements and processes based on consideration of project objectives and identified parameters |

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| Learning outcome |
| The learner will: 2. be able to prepare the 2D computer aided design environment |
| Assessment criteria |
| The learner can: 2.1 customise menus, system variables and drawing defaults to suit standard operating procedures 2.2 retrieve, convert and manipulate files of digitised information relevant to the project 2.3 determine and record any measurements of components, sub- |

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| <p>assemblies, products, models, equipment, layouts or facilities needed for the preparation of the required drawings</p> <p>2.4 calculate the required dimensions and other drafting details based on measurements</p> <p>2.5 identify critical information relevant to the CAD project</p> <p>2.6 establish critical dimensions and data for the required drawings</p> |
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| <p>Learning outcome</p> <p>The learner will:</p> <p>3. be able to create drawings using the full capability of the available software system</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>3.1 link drawing entities to database attributes to meet job requirements, using the correct procedures</p> <p>3.2 prepare preliminary sketches/artwork, as required and review these with design, engineering, production and/or appropriate personnel</p> <p>3.3 create detailed views using various scales to meet the job requirements</p> <p>3.4 save files in various formats to standard operating procedures</p> <p>3.5 extract supplementary data from the drawings to meet job requirements, including area, lengths, angles and perimeters</p> <p>3.6 identify and take appropriate action to resolve problems during the process.</p> |

Unit 207

Preparing and using manual metal arc welding equipment

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| UAN: | K/504/6408 |
| Level: | 2 |
| Credit value: | 15 |
| GLH: | 68 |
| Relationship to NOS: | SEMPEO2-27 |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA |

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| Learning outcome |
| The learner will: 1. prepare and use manual metal arc welding equipment |
| Assessment criteria |
| The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 prepare for the manual metal arc welding process by carrying out all of the following: a. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations b. check the condition of, and correctly connect, welding leads, earthing arrangements and electrode holder c. set and adjust the welding conditions/parameters, in accordance with the welding procedure specification d. prepare the work area for the welding activities (such as positioning welding screens and fume extraction) e. prepare the materials and joint in readiness for welding (such as cleaning of joint faces, grinding weld preparations, setting up the joint, supporting the joint) f. make sure that the work area is maintained and left in a safe and tidy condition 1.3 plan the welding activities before they start them 1.4 obtain and prepare the appropriate welding equipment and welding consumables 1.5 use manual metal-arc welding and related equipment to include either of the following: a. alternating current (AC) equipment b. direct current (DC) equipment 1.6 use two types of electrode from the following: a. rutile |

- b. basic
 - c. cellulosic
 - d. other suitable electrodes
- 1.7 prepare and support the joint, using the appropriate methods
 - 1.8 tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding
 - 1.9 weld the joint to the specified quality, dimensions and profile
 - 1.10 produce three of the following welded joints, of at least 150mm long, using single or multi-run welds (as appropriate), with at least one stop and start included:
 - a. fillet lap joints
 - b. tee fillet joints
 - c. corner joints
 - d. butt joints
 - 1.11 produce joints as follows:
 - one type of material from the following:
 - a. carbon steel
 - b. stainless steel
 - and one form of material from the following:
 - a. sheet (less than 3mm)
 - b. plate
 - c. section
 - d. pipe/tube
 - e. other forms
 - 1.12 weld joints in good access situations, in two of the following BS EN ISO 6947 positions:
 - a. Flat (PA)
 - b. Horizontal vertical (PB)
 - c. Horizontal (PC)
 - d. Vertical upwards (PF)
 - e. Vertical downwards (PG)
 - 1.13 use appropriate methods and equipment to check the quality, and check that all dimensional and geometrical aspects of the weld are to the specification
 - 1.14 check that the welded joint conforms to the specification by checking all of the following:
 - a. dimensional accuracy
 - b. alignment/squareness
 - c. size and profile of weld
 - d. number of runs
 - 1.15 carry out non destructive testing of the welds, using one of the following:
 - a. dye penetrant
 - b. fluorescent penetrant
 - c. magnetic particle
 - 1.16 carry out destructive tests on weld specimens, using one of the following:
 - a. macroscopic examination
 - b. nick break test
 - c. bend tests (such as face, root or side, as appropriate)
 - 1.17 identify all of the following weld defects:

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| <ul style="list-style-type: none"> a. • lack of continuity of the weld b. • uneven and irregular ripple formation c. • incorrect weld size or profile <p>Plus four more of the following:</p> <ul style="list-style-type: none"> a. • undercutting b. • overlap c. • inclusions d. • porosity e. • surface cracks f. • internal cracks g. • lack of fusion h. • lack of penetration <p>1.18 produce welded joints which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements):</p> <ul style="list-style-type: none"> a. welds meet the required dimensional accuracy b. fillet welds are equal in leg length and slightly convex in profile, with the size of the fillet equivalent to the thickness of the material welded c. the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple formation d. the welds are adequately fused, and with minimal undercut, overlap and surface inclusions e. weld finishes are built up to the full section of the weld f. joints at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface g. tack welds are blended in to form part of the finished weld, without excessive hump h. corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint i. the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag j. the weld surface and adjacent parent metal is substantially free from arcing or chipping marks <p>1.19 deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve</p> <p>1.20 shut down and make safe the welding equipment on completion of the welding activities</p> |
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| Learning outcome |
| The learner will: |
| 2. know how to prepare and use manual metal arc welding equipment |
| Assessment criteria |
| The learner can: |
| 2.1 describe the safe working practices and procedures to be followed when preparing and using MMA welding equipment (such as general workshop safety; appropriate personal protective equipment (PPE); fire prevention; protecting other workers from the effects of the welding arc; safety in enclosed/confined spaces; fume extraction/control) |
| 2.2 describe the hazards associated with MMA welding (such as live |

- electrical components; poor earthing; the electric arc; fumes and gases; spatter; hot slag and metal; grinding and mechanical metal/slag removal; elevated working; welding in enclosed spaces; slips, trips and falls), and how they can be minimised
- 2.3 describe the personal protective equipment to be worn for the welding activities (such as correctly fitting overalls; leather aprons, welding gloves/gauntlets; safety boots; head/eye shield with correct shade of filter)
 - 2.4 describe the manual metal arc welding process (such as basic principles of fusion welding, AC and DC power sources, power ranges)
 - 2.5 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken
 - 2.6 describe the types of electrodes used, and the correct control, storage and drying of electrodes
 - 2.7 the types of welded joints to be produced (such as lap joints, corner joints, tee joints, butt welds, single and multi-run welds)
 - 2.8 describe the terminology used for the appropriate welding positions
 - 2.9 explain how to prepare the materials in readiness for the welding activity (such as ensuring that the material is free from excessive surface contamination such as rust, scale, paint, oil/grease and moisture); ensuring that edges to be welded are correctly prepared (such as made flat, square or bevelled)
 - 2.10 explain how to set up and restrain the joint, and the tools and techniques to be used (such as the use of jigs and fixtures, restraining devices - such as clamps and weights/blocks; setting up the joint in the correct position and alignment)
 - 2.11 describe the tack welding size and spacing in relationship to material thickness
 - 2.12 describe the checks to be made prior to welding (such as confirming the correct set-up of the joint; condition of electrical connections, welding return and earthing arrangements; checking operating parameters)
 - 2.13 describe the techniques of operating the welding equipment to produce a range of joints in the various joint positions (such as striking and initiating the arc; fine adjustment of parameters; correct manipulation and welding speed of electrode; blending in stops/starts and tack welds)
 - 2.14 explain how to close down the welding equipment safely and correctly
 - 2.15 explain how to control distortion (such as welding sequence; deposition technique)
 - 2.16 describe the problems that can occur with the welding activities (such as causes of distortion and methods of control; effects of welding on materials and sources of weld defects), and how these can be overcome
 - 2.17 describe the safe working practices and procedures to be adopted when preparing the welds for examination (such as handling hot materials, using chemicals for cleaning and etching, using equipment to fracture welds)
 - 2.18 explain how to prepare the welds for examination (such as removing slag, spatter and surface irregularities; cleaning the weld, polishing and making saw cuts on welds to be fracture tested)

- 2.19 explain how to check the welded joints for uniformity, alignment, position, weld size and profile
- 2.20 describe the various procedures for visual examination of the welds for cracks, porosity and slag inclusions (such as dye penetrant, fluorescent penetrant; magnetic particle testing)
- 2.21 describe the various procedures for carrying out destructive tests on the welds (such as macroscopic examination, bend tests, nick break tests)
- 2.22 describe the methods of removing a specimen of weld from a suitable position in the joint (such as a stop/start position using a non-thermal process, such as hand saws, power saws, abrasive discs)
- 2.23 explain how to examine the welds after the tests and check for such defects as the degree of penetration and fusion, inclusions, porosity, cracks, undercut and overlap, uneven and irregular ripple formation
- 2.24 explain when to act on their own initiative and when to seek help and advice from others
- 2.25 describe the importance of leaving the work area and equipment in a safe condition on completion of the welding activities (such as isolation of electrical supplies; safely storing welding cables and electrode holders; storing electrodes; removing and disposing of waste).

Unit 207 Preparing and using manual metal arc welding equipment

Supporting information

Evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the RQF' which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's PEO NVQ unit assessment strategy which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Unit 208

Preparing and using manual TIG or plasma-arc welding equipment

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| UAN: | M/504/6409 |
| Level: | 2 |
| Credit value: | 15 |
| GLH: | 68 |
| Relationship to NOS: | SEMPEO2-28 |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA |

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| Learning outcome |
| The learner will: 1. prepare and use manual TIG or plasma-arc welding equipment |
| Assessment criteria |
| The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 prepare for the TIG or plasma-arc welding process by carrying out all of the following: a. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations b. check the condition of and correctly connect welding leads, earthing arrangements, hoses and welding torch c. set and adjust the welding conditions/parameters, in accordance with the welding procedure specification d. prepare the work area for the welding activities (such as positioning welding screens and fume extraction) e. prepare the materials and joint in readiness for welding (such as cleaning of joint faces, grinding weld preparations, setting up the joint, supporting the joint) f. make sure that the work area is maintained and left in a safe and tidy condition 1.3 plan the welding activities before they start them 1.4 obtain and prepare the appropriate welding equipment and welding consumables 1.5 use manual welding and related equipment, to include one of the following welding processes: a. TIG b. Plasma-arc 1.6 Use welding consumables appropriate to the material and |

application, to include one of the following:

- a. AC current types
- b. DC current types

- 1.7 prepare and support the joint, using the appropriate methods
- 1.8 pack weld the joint at appropriate intervals, and check the joint for accuracy before final welding
- 1.9 weld the joint to the specified quality, dimensions and profile
- 1.10 Produce three of the following welded joints of at least 150mm long, by single or multi-run (as appropriate), with at least one stop and start included:
 - a. fillet lap joints
 - b. tee fillet joints
 - c. corner joints
 - d. butt joints

And using one of the following methods:

- a. with filler wire
- b. without filler wire (autogenously)

- 1.11 Produce joints in the following:

One type of material from the following:

- a. carbon steel
- b. stainless steel
- c. aluminium

And two forms of material from the following:

- d. sheet (less than 3mm)
- e. plate
- f. section
- g. pipe/tube
- h. other forms

- 1.12 weld joints in good access situations, in two of the following BS EN ISO 6947 positions:

- a. Flat (PA)
- b. Horizontal vertical (PB)
- c. Horizontal (PC)
- d. Vertical upwards (PF)
- e. Vertical downwards (PG)

- 1.13 use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification

- 1.14 check that the welded joint conforms to the specification, by checking all of the following:

- a. dimensional accuracy
- b. alignment/squareness
- c. size and profile of weld
- d. number of runs

- 1.15 carry out non-destructive testing of the welds, using one of the following:

- a. dye penetrant
- b. fluorescent penetrant
- c. magnetic particle

- 1.16 carry out destructive tests on weld specimens, using one of the following :

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| <ul style="list-style-type: none"> a. macroscopic examination b. nick break test c. bend tests (such as face, root or side, as appropriate) d. identify all of the following weld defects: e. lack of continuity of the weld f. uneven and irregular ripple formation g. incorrect weld size or profile <p>1.17 plus four more of the following:</p> <ul style="list-style-type: none"> a. undercutting b. overlap c. inclusions d. porosity e. internal cracks f. surface cracks g. lack of fusion h. lack of penetration <p>1.18 produce welded joints which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements):</p> <ul style="list-style-type: none"> a. welds meet the required dimensional accuracy b. fillet welds are equal in leg length and slightly convex in profile (where applicable), with the size of the fillet equivalent to the thickness of the material welded c. the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple formation d. the welds are adequately fused, and there is minimal undercut, overlap and surface inclusions e. weld finishes are built up to the full section of the weld f. joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface g. tack welds are blended in to form part of the finished weld, without excessive hump h. corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint i. the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag j. the weld surface and adjacent parent metal is substantially free from arcing or chipping marks <p>1.19 deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve</p> <p>1.20 shut down and make safe the welding equipment on completion of the welding activities.</p> |
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| Learning outcome |
| The learner will: 2. know how to prepare and use manual TIG or plasma-arc welding equipment |
| Assessment criteria |
| The learner can: 2.1 describe the safe working practices and procedures to be followed |

- when preparing and using TIG or plasma-arc welding equipment (such as general workshop safety; appropriate personal protective equipment (PPE); fire prevention; protecting other workers from the effects of the welding arc; safety in enclosed/confined spaces; fume extraction/control)
- 2.2 describe the hazards associated with TIG and plasma-arc welding (such as live electrical components; poor earthing; the electric arc; fumes and gases; hot metal; welding in enclosed spaces; slips, trips and falls), and how they can be minimized
 - 2.3 describe the personal protective equipment to be worn for the welding activities (such as correctly fitting overalls; leather aprons, welding gloves/gauntlets; safety boots; head/eye shield with correct shade of filter)
 - 2.4 describe the correct handling and storage of gas cylinders (such as manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features)
 - 2.5 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken
 - 2.6 describe the manual TIG or plasma-arc welding process (such as basic principles of fusion welding; the major parts of the welding equipment and their function)
 - 2.7 describe the types, selection and application of filler wires and welding electrodes
 - 2.8 describe the reasons for using shielding gases, and the types and application of the various gases
 - 2.9 describe the gas pressures and flow rates (in relationship to the type of material being welded)
 - 2.10 describe the types of welded joints to be produced (such as lap joints, corner joints, tee joints and butt welds)
 - 2.11 describe the terminology used for the appropriate welding positions
 - 2.12 explain how to prepare the materials in readiness for the welding activity (such as ensuring that the material is free from excessive surface contamination - such as rust, scale, paint, oil/grease and moisture; ensuring edges to be welded are correctly prepared - such as made flat, square or bevelled)
 - 2.13 explain how to set up and restrain the joint, and the tools and techniques to be used (such as the use of jigs and fixtures, restraining devices such as clamps and weights/blocks; setting up the joint in the correct position and alignment)
 - 2.14 describe the tack welding size and spacing (in relationship to material thickness)
 - 2.15 describe the checks to be made prior to welding (such as confirming the correct set-up of the joint; the condition of electrical connections, welding return and earthing arrangements; operating parameters)
 - 2.16 describe the techniques of operating the welding equipment to produce a range of joints in the various joint positions (such as fine adjustment of parameters; correct manipulation of the torch; blending in stops/starts and tack welds)
 - 2.17 explain how to control distortion (such as welding sequence; deposition technique)

- 2.18 describe the problems that can occur with the welding activities (such as causes of distortion and methods of control; effects of welding on materials and sources of weld defects), and how these can be overcome
- 2.19 explain how to close down the welding equipment safely and correctly
- 2.20 describe the safe working practices and procedures to be adopted when preparing the welds for examination (such as handling hot materials, using chemicals for cleaning and etching, using equipment to fracture welds)
- 2.21 explain how to prepare the welds for examination (such as removing surface irregularities; cleaning the weld, polishing and making saw cuts on welds to be fracture tested)
- 2.22 explain how to check the welded joints for uniformity, alignment, position, weld size and profile
- 2.23 describe the various procedures for visual examination of the welds for cracks, porosity and slag inclusions (such as dye penetrant, fluorescent penetrant; magnetic particle testing)
- 2.24 describe the various procedures for carrying out destructive tests on the welds (such as macroscopic examination, bend tests, nick break tests)
- 2.25 describe the methods of removing a specimen of weld from a suitable position in the joint (such as a stop/start position) using a non thermal process (such as hand saws, power saws, abrasive discs)
- 2.26 explain how to examine the welds after the tests and how to check for such defects as the degree of penetration and fusion, inclusions, porosity, cracks, undercut and overlap, uneven and irregular ripple formation
- 2.27 explain when to act on their own initiative and when to seek help and advice from others
- 2.28 describe the importance of leaving the work area and equipment in a safe condition on completion of the welding activities (such as isolation of electrical supplies, safely storing equipment and consumables, removing and disposing of waste).

Unit 208 Preparing and using manual TIG or plasma-arc welding equipment

Supporting information

Evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the RQF' which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

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Unit 209

Preparing and using semi-automatic MIG, MAG and flux cored arc welding equipment

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| UAN: | H/504/6410 |
| Level: | 2 |
| Credit value: | 15 |
| GLH: | 68 |
| Relationship to NOS: | SEMPEO2-29 |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA |

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| Learning outcome |
| The learner will: 1. prepare and use manual MIG, MAG and other continuous wire welding equipment |
| Assessment criteria |
| The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 prepare for the MIG, MAG or flux cored-wire arc welding process by carrying out all of the following: a. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations b. check the condition of, and correctly connect, welding leads/cables, hoses, shielding gas supply and wire feed mechanisms c. set and adjust the welding conditions/parameters, in accordance with the welding procedure specification d. prepare the work area for the welding activities (such as positioning welding screens and fume extraction) e. prepare the materials and joint in readiness for welding (such as cleaning of joint faces, grinding weld preparations, setting up the joint, supporting the joint) f. make sure the work area is maintained and left in a safe and tidy condition 1.3 plan the welding activities before they start them 1.4 obtain and prepare the appropriate welding equipment and welding consumables 1.5 use manual welding and related equipment to include one of the following: a. MIG |

- b. MAG
- c. flux cored wire welding equipment
- 1.6 use consumables appropriate to the material and application, to include:
 - one of the following wire types:
 - a. solid wire
 - b. cored wire
 - plus one of the following types of shielding gas:
 - c. inert
 - d. active
- 1.7 prepare and support the joint, using the appropriate methods
- 1.8 tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding
- 1.9 weld the joint to the specified quality, dimensions and profile
- 1.10 produce three of the following welded joints of at least 150mm long, by single or multi-run (as appropriate), with at least one stop and start included:
 - a. fillet lap joints
 - b. tee fillet joints
 - c. corner joints
 - d. butt joints
- 1.11 Produce joints as follows:
 - one type of material from the following:
 - a. carbon steel
 - b. stainless steel
 - c. aluminium
 - and two forms of material from the following:
 - d. plate
 - e. section
 - f. sheet (less than 3mm)
 - g. pipe/tube
 - h. other forms
- 1.12 weld joints in good access situations in two of the following EN ISO 6947 positions:
 - a. Flat (PA)
 - b. Horizontal vertical (PB)
 - c. Horizontal (PC)
 - d. Vertical upwards (PF)
 - e. Vertical downwards (PG)
- 1.13 use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification
- 1.14 check that the welded joint conforms to the specification, by checking all of the following:
 - a. dimensional accuracy
 - b. alignment/squareness
 - c. size and profile of weld
 - d. number of runs
- 1.15 carry out non-destructive testing of the welds, using one of the following:
 - a. dye penetrant

- b. fluorescent penetrant
 - c. magnetic particle
- 1.16 carry out destructive tests on weld specimens using one of the following :
- a. macroscopic examination
 - b. nick break test
 - c. bend tests (such as face, root or side, as appropriate)
- 1.17 identify all of the following weld defects:
- a. lack of continuity of the weld
 - b. uneven and irregular ripple formation
 - c. incorrect weld size or profile
- plus four more of the following:
- d. undercutting
 - e. overlap
 - f. inclusions
 - g. porosity
 - h. internal cracks
 - i. surface cracks
 - j. lack of fusion
 - k. lack of penetration
- 1.18 produce welded joints which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements):
- a. welds meet the required dimensional accuracy
 - b. fillet welds are equal in leg length and slightly convex in profile, with the size of the fillet equivalent to the thickness of the material welded
 - c. the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple formation
 - d. the welds are adequately fused, and there is minimal undercut, overlap and surface inclusions
 - e. weld finishes are built up to the full section of the weld
 - f. joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface
 - g. tack welds are blended in to form part of the finished weld, without excessive hump
 - h. corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint
 - i. the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag
 - j. the weld surface and adjacent parent metal is substantially free from arcing or chipping marks
- 1.19 deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve
- 1.20 shut down and make safe the welding equipment on completion of the welding activities.

Learning outcome

The learner will:

- 2. know how to prepare and use manual MIG, MAG and other

Assessment criteria

The learner can:

- 2.1 describe the safe working practices and procedures to be followed when preparing and using MIG, MAG or cored wire arc welding equipment (such as general workshop safety; appropriate personal protective equipment (PPE); fire prevention; protecting other workers from the effects of the welding arc; safety in enclosed/confined spaces; fume extraction/control)
- 2.2 describe the hazards associated with MIG, MAG or flux cored-wire arc welding (such as live electrical components; poor earthing; the electric arc; fumes and gases; spatter; hot slag and metal; grinding and mechanical metal/slag removal; elevated working; enclosed spaces; slips, trips and falls), and how they can be minimised
- 2.3 describe the personal protective equipment to be worn for the welding activities (such as correctly fitting overalls; leather aprons, welding gloves/gauntlets; safety boots; head/eye shield with correct shade of filter)
- 2.4 describe the correct handling and storage of gas cylinders (such as manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features)
- 2.5 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken
- 2.6 describe the semi-automatic MIG, MAG or flux cored wire arc welding process (such as basic principles of fusion welding, power sources, the major parts of the welding equipment and their function)
- 2.7 describe the types, selection and application of electrode wires (such as solid and cored)
- 2.8 describe the reasons for using shielding gases, and the types and application of the various gases
- 2.9 describe the gas pressures and flow rates (in relation to the type of material being welded)
- 2.10 describe the types of welded joints to be produced (such as lap joints, corner joints, tee joints and butt welds)
- 2.11 describe the terminology used for the appropriate welding positions
- 2.12 explain how to prepare the materials in readiness for the welding activity (such as ensuring that the material is free from excessive surface contamination - such as rust, scale, paint, oil/grease and moisture; ensuring edges to be welded are correctly prepared - such as made flat, square or bevelled)
- 2.13 explain how to set up and restrain the joint, and the tools and techniques to be used (such as the use of jigs and fixtures, restraining devices - such as clamps and weights/blocks; setting up the joint in the correct position and alignment)
- 2.14 describe the tack welding size and spacing (in relation to material thickness)
- 2.15 describe the checks to be made prior to welding (such as confirming the correct set-up of the joint; the condition of electrical connections, welding return and earthing arrangements; wire feed

- mechanisms; gas supply; operating parameters)
- 2.16 describe the techniques of operating the welding equipment to produce a range of joints in the various joint positions (such as fine adjustment of parameters; correct manipulation of the welding gun; blending in stops/starts and tack welds)
 - 2.17 describe the methods/modes of metal transfer and their uses (such as dip, globular, free flight, spray and pulsed)
 - 2.18 explain how to close down the welding equipment safely and correctly
 - 2.19 explain how to control distortion (such as welding sequence; deposition technique)
 - 2.20 describe the problems that can occur with the welding activities (such as causes of distortion and methods of control; effects of welding on materials and sources of weld defects), and how these can be overcome
 - 2.21 describe the safe working practices and procedures to be adopted when preparing the welds for examination (such as handling hot materials, using chemicals for cleaning and etching, using equipment to fracture welds)
 - 2.22 explain how to prepare the welds for examination (such as removing surface irregularities; cleaning the weld, polishing and making saw cuts on welds to be break tested)
 - 2.23 explain how to check the welded joints for uniformity, alignment, position, weld size and profile
 - 2.24 describe the various procedures for visual examination of the welds for cracks, porosity and slag inclusions (such as dye penetrant, fluorescent penetrant; magnetic particle testing)
 - 2.25 describe the various procedures for carrying out destructive tests on the welds (such as macroscopic examination, bend tests, nick break tests)
 - 2.26 describe the methods of removing a specimen of weld from a suitable position in the joint (such as a stop/start position), using a non thermal process (such as hand saws, power saws, abrasive discs)
 - 2.27 explain how to examine the welds after the tests, and how to check for such defects as the degree of penetration and fusion, inclusions, porosity, cracks, undercut and overlap, uneven and irregular ripple formation
 - 2.28 explain when to act on their own initiative and when to seek help and advice from others
 - 2.29 describe the importance of leaving the work area and equipment in a safe condition on completion of the welding activities (such as isolation of electrical supplies; safely storing welding cables and electrode holders; storing electrodes; removing and disposing of waste).

Unit 209 **Preparing and using semi- automatic MIG, MAG and flux cored arc welding equipment**

Supporting information

Evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the RQF' which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's PEO NVQ unit assessment strategy which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Unit 210

Preparing and using manual oxy/fuel gas welding equipment

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| UAN: | Y/504/6419 |
| Level: | 2 |
| Credit value: | 14 |
| GLH: | 64 |
| Relationship to NOS: | SEMPEO2-30 |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA |

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| Learning outcome |
| The learner will: 1. prepare and use manual gas welding equipment |
| Assessment criteria |
| The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 prepare for the gas welding process by carrying out all of the following: a. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations b. check regulators, hoses and check that valves are securely connected and free from leaks and damage c. check/fit the correct gas nozzle to the torch d. check that a flashback arrestor is fitted e. set appropriate gas pressures f. use the correct procedure for lighting, adjusting and extinguishing the welding flame g. use appropriate and safe procedures for handling and storing of gas cylinders h. prepare the work area for the welding activities (such as positioning welding screens and fume extraction) i. prepare the materials and joint in readiness for welding (such as cleaning of joint faces, grinding weld preparations, setting up the joint, supporting the joint) j. make sure the work area is maintained and left in a safe and tidy condition 1.3 plan the welding activities before they start them 1.4 obtain and prepare the appropriate welding equipment and welding consumables |

- 1.5 prepare and support the joint, using the appropriate methods
- 1.6 tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding
- 1.7 weld the joint to the specified quality, dimensions and profile
- 1.8 produce three of the following welded joints of at least 150mm long, by single or multi-run (as appropriate), with at least one stop and start included:
 - a. fillet lap joints
 - b. tee fillet joints
 - c. corner joints
 - d. butt joints
 - e. welds made without filler wire (autogenously)
 Using one of the following methods:
 - f. with filler wire
 - g. without filler wire (autogenously)
 Produce joints in one form of material from the following:
 - h. sheet (less than 3mm)
 - i. plate
 - j. section
 - k. pipe/tube
 - l. other forms
- 1.9 weld joints in good access situations in two of the following BS EN ISO 6947 positions:
 - a. • Flat (PA)
 - b. • Horizontal vertical (PB)
 - c. • Horizontal (PC)
 - d. • Vertical upwards (PF)
 - e. • Vertical downwards (PG)
- 1.10 use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification
- 1.11 check that the welded joint conforms to the specification, by checking all of the following:
 - a. dimensional accuracy
 - b. alignment/squareness
 - c. size and profile of weld
 - d. number of runs
- 1.12 carry out non-destructive testing of the welds, using one of the following:
 - a. dye penetrant
 - b. fluorescent penetrant
 - c. magnetic particle
- 1.13 carry out destructive tests on weld specimens using one of the following:
 - a. macroscopic examination
 - b. nick break test
 - c. bend tests (such as face, root or side, as appropriate)
- 1.14 identify all of the following weld defects:
 - a. lack of continuity of the weld
 - b. uneven and irregular ripple formation
 - c. incorrect weld size or profile

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| <p>Plus four more of the following:</p> <ul style="list-style-type: none"> d. undercutting e. overlap f. inclusions g. porosity h. surface cracks i. internal cracks j. lack of fusion k. lack of penetration <p>1.15 produce welded joints which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements):</p> <ul style="list-style-type: none"> a. welds meet the required dimensional accuracy b. fillet welds are equal in leg length and slightly convex in profile (where appropriate), with the size of the fillet equivalent to the thickness of the material welded c. the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple formation d. the welds are adequately fused, and there is minimal undercut and overlap e. weld finishes are built up to the full section of the weld f. joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface g. tack welds are blended in to form part of the finished weld, without excessive hump h. corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint i. the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag j. the weld surface and adjacent parent metal is substantially free from spatter or chipping marks <p>1.16 deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve</p> <p>1.17 shut down and make safe the welding equipment on completion of the welding activities.</p> |
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| Learning outcome |
| The learner will: |
| 2. know how to prepare and use manual gas welding equipment |
| Assessment criteria |
| The learner can: |
| 2.1 describe the safe working practices and procedures to be followed when preparing and using manual gas welding equipment (such as general workshop safety; appropriate personal protective equipment (PPE); fire and explosion prevention, protecting other workers, safety in enclosed/confined spaces; fume extraction/control) |
| 2.2 describe the hazards associated with manual oxy/fuel gas welding (such as naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal, elevated working, welding in enclosed spaces, slips trips and falls), and how they can be |

minimised

- 2.3 describe the personal protective equipment to be worn for the welding activities (such as correctly fitting overalls; leather aprons, welding gloves/gauntlets; safety boots; head/eye shield with correct grade of filter)
- 2.4 describe the correct handling and storage of gas cylinders (such as manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features)
- 2.5 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken
- 2.6 describe the manual gas welding process (such as basic principles of gas welding and related equipment; care of the equipment)
- 2.7 describe the consumables associated with gas welding (such as types of filler wire, fluxes, the types of gas and its supply and control)
- 2.8 explain how to prepare the welding equipment, and the checks to be made to ensure that it is safe and ready to use (such as connection of hoses, torch, flashback arrestors, hose check valves and regulators)
- 2.9 explain how to check connections for leaks, and the methods that are used
- 2.10 explain how to set gas working pressures; reading the gauges to establish content and pressures
- 2.11 describe the types of welded joints to be produced (such as lap joints, corner joints, tee joints and butt welds)
- 2.12 describe the terminology used for the appropriate welding positions
- 2.13 explain how to prepare the materials in readiness for the welding activity (such as ensuring that the material is free from excessive surface contamination - such as rust, scale, paint, oil/grease and moisture; ensuring edges to be welded are correctly prepared - such as made flat, square or bevelled)
- 2.14 explain how to set up and restrain the joint, and the tools and techniques to be used (such as the use of jigs and fixtures, restraining devices - such as clamps and weights/blocks; setting up the joint in the correct position and alignment)
- 2.15 describe the tack welding size and spacing (in relation to material thickness)
- 2.16 describe the techniques of operating the welding equipment to produce a range of joints in the various joint positions (such as selection of nozzle, lighting and adjusting the flame, correct manipulation of torch and filler rods)
- 2.17 describe the safe and correct sequence for shutting down the equipment (such as sequence of turning off the gases, extinguishing the flame and closing valves on the gas supply/cylinders)
- 2.18 describe the control of heat input to prevent filler material and parent material faults (such as welding sequence; deposition technique)
- 2.19 describe the problems that can occur with the welding activities (such as causes of distortion and methods of control; effects of welding on materials and sources of weld defects), and how these can be overcome

- 2.20 describe the safe working practices and procedures to be adopted when preparing the welds for examination (such as handling hot materials, using chemicals for cleaning and etching, using equipment to fracture welds)
- 2.21 explain how to prepare the welds for examination (such as removing surface irregularities; cleaning the weld, polishing and making saw cuts on welds to be break tested)
- 2.22 explain how to check the welded joints for uniformity, alignment, position, weld size and profile
- 2.23 describe the various procedures for visual examination of the welds for cracks, porosity and inclusions (such as dye penetrant, fluorescent penetrant; magnetic particle testing)
- 2.24 describe the various procedures for carrying out destructive tests on the welds (such as macroscopic examination, bend tests, nick break tests)
- 2.25 describe the methods of removing a specimen of weld from a suitable position in the joint (such as a stop/start position), using a non thermal process (such as hand saws, power saws, abrasive discs)
- 2.26 explain how to examine the welds after the tests, and how to check for such defects as the degree of penetration and fusion, inclusions, porosity, cracks
- 2.27 explain when to act on their own initiative and when to seek help and advice from others
- 2.28 describe the importance of leaving the work area and equipment in a safe condition on completion of the gas welding activities (such as isolation of gas cylinders; safely storing cylinders, hoses and torches; storing filler rods; removing and disposing of waste).

Unit 210 Preparing and using manual oxy/fuel gas welding equipment

Supporting information

Evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the RQF' which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's PEO NVQ unit assessment strategy which can be downloaded from Semta's website or requested via customerservices@semta.org.uk

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| UAN: | F/503/0196 |
| Level: | 2 |
| Credit value: | 7 |
| GLH: | 60 |
| Relationship to NOS: | This unit is linked to the NVQ – Performing Engineering Operations Level 2: 2251 Unit 22: Producing Sheet Metal Components and Assemblies |
| Endorsement by a sector or regulatory body: | This unit is endorsed by SEMTA |
| Aim: | This unit is concerned with the underlying process technology associated with the fabrication of sheet metal products, in terms of cutting, forming, assembly and joining of sheet metal. It covers the health and safety considerations associated with cutting, forming, assembly and joining of sheet metal. |

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| Learning outcome |
| The learner will: |
| 1. be able to prepare equipment and tools for sheet metal cutting |
| Assessment criteria |
| The learner can: |
| 1.1 prepare equipment and tools for a cutting operation |
| 1.2 prepare materials for a cutting operation. |

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| Range |
| Equipment: drills (bench, pillar, portable), rotary shears (portable, nibblers [shear type, punch type], guillotines (treadle, mechanical, back stops, front stops, guards), fly press, power punch, portable angle grinders/sanders, health and safety considerations |
| Tools: hand shears (straight, left hand, right hand, universal), bench shears (hand-lever) tinman's hand-level punch, health and safety considerations |
| Materials: methods of marking out, use of datums (line, edge, centre point), avoiding damage to surface coatings, minimal wastage, health and safety considerations |

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| Learning outcome |
| The learner will: |

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| 2. be able to use equipment, tools and materials for sheet metal forming |
| Assessment criteria |
| The learner can: 2.1 use equipment and tools for a forming operation 2.2 use stiffening techniques to strengthen materials 2.3 operate equipment safely. |

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| Range |
| Equipment: jennys (tooling) rolling machines (pyramid type, pinch type, slip rolls, hand-operated), folding machines (box and pan, universal swing-beam), fly press (tooling: dies, forming tools), health and safety considerations Tools: hammers, planishing hammers, mallets, wooden blocks, range of bench stakes Forming: forms (square, rectangular, cylindrical, cones, boxed), hand forming techniques (hollowing, raising, planishing, flanging, 'split and weld' methods, health and safety considerations Stiffening techniques: swaging, beading, wired edges [including false], folds, flanging, reinforcement, diamond break, health and safety considerations |

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| Learning outcome |
| The learner will: 3. be able to produce fabrications using sheet metalwork assembly techniques. |
| Assessment criteria |
| The learner can: 3.1 use of sheet metalwork assembly and joining techniques to produce fabrications to the required shape/geometry within ± 3.0 mm 3.2 produce fabrications that have secure and firm joints and are free from excessive tooling marks, deformation, cracking, sharp edges, slivers or burrs 3.3 produce fabricated assemblies safely 3.4 restore the work area using the correct procedures for the disposal of waste. |

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| Range |
| Assembly: holding methods, clamping, distortion control methods Joining techniques: Non self-secured joints Self-secured joints, mechanical joining methods Soldering techniques, cleaning the soldered joint Brazing techniques, cleaning the joint, types of brazing alloys, types of flux, heat sources Resistance welding MIG welding equipment/consumables: direct current [d.c.] electrode positive, wire feed unit, arc ignition, gun/torches, electrodes wires, shielding gases used for the welding of carbon steels, PERSONAL PROTECTIVE EQUIPMENT (PPE), fume removal |

TIG welding equipment/consumables: direct current [d.c.] electrode negative, methods of arc ignition, welding torches, tungsten electrodes for the welding of steels, electrode sizes, filler wire sizes, shielding gas used for the welding of carbon steels: argon, Personal Protective Equipment (PPE)

Additional Guidance

Joining techniques:

Non self-secured joints (lap, corner, butt, tee, joggled lap, flanged butt, lock seam, bottom seam [internal lap, external lap])

Self-secured joints (grooved seam, panned down, slip joint, allowances); mechanical joining methods (solid riveting, hollow riveting, threaded fastenings)

Soldering techniques (preparing the joint, cleaning the joint, types of soft solder, types of flux, types of soldered iron, heat sources [electrical, flame], cleaning the soldered joint)

Brazing techniques (preparing the joint, cleaning the joint, types of brazing alloys, types of flux, heat sources [flame, gas mixtures], cleaning the brazed joint)

Resistance welding (spot, seam, the electrodes available for spot welding, electrode functions (gripping, exertion of force, passage of high current) electrode material, electrode tip geometry (domed end, truncated cone)

MIG welding (equipment/consumables: direct current [d.c.] electrode positive, wire feed unit, arc ignition, gun/torches, electrodes wires [Ø0.6 mm, Ø0.8 mm], shielding gases used for the welding of carbon steels: carbon dioxide [CO₂], argon / CO₂, argon/oxygen/ CO₂), Personal Protective Equipment (PPE), fume removal)

TIG welding (equipment/consumables: direct current [d.c.] electrode negative, methods of arc ignition, welding torches, tungsten electrodes for the welding of steels: [thoriated, ceriated, lanthanated], electrode sizes [Ø1.6 mm, Ø2.4 mm], filler wire sizes [Ø1.6 mm, Ø2.4 mm], shielding gas used for the welding of carbon steels: argon, Personal Protective Equipment (PPE))

Restore the work area: leave the work area free of unused consumables, cleaning the work area, putting tools and equipment into safe storage, identifying and recording finished work

Unit 309

Communicate effectively in craft

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| UAN: | T/505/8092 |
| Level: | 3 |
| Credit value: | 9 |
| GLH: | 60 |
| Relationship to NOS: | Creative and Cultural Skills, Craft NOS, CCSCR10 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | This unit enables learners to understand the importance of clear communication, be able to communicate and respond to different audiences and assess the appropriateness of their own communication. |

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| Learning outcome |
| The learner will: 1. understand the importance of clear communication in craft |
| Assessment criteria |
| The learner can: 1.1 explain why effective communication is important in all areas of design and making ideas. 1.2 explain the importance of selecting appropriate methods of communication to suit different audiences. 1.3 explain the importance of presenting a positive image of oneself and own organisation. |

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| Learning outcome |
| The learner will: 2. be able to communicate effectively with different audiences |
| Assessment criteria |
| The learner can: 2.1 determine the scale and needs of audience for the information being communicated. 2.2 select the most appropriate method of communication for the audience. 2.3 determine the appropriate language and references to be used when communicating to an audience 2.4 make constructive contributions to discussions, developing points and ideas. |

Learning outcome

The learner will:

3. be able to respond effectively to an audience

Assessment criteria

The learner can:

- 3.1 check the understanding of the audience.
- 3.2 give people the opportunity to ask questions.
- 3.3 focus on information that other people are communicating.
- 3.4 clarify points that may be unclear.

Learning outcome

The learner will:

4. be able to respond effectively to an audience

Assessment criteria

The learner can:

- 4.1 ensure communication has met its purpose.
- 4.2 deal with situations where communication purpose has not been achieved
- 4.3 present a positive image of oneself and own organisation.
- 4.4 safeguard confidential information.

Unit 313

Blacksmithing forge practices using small forge assemblies

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| UAN: | R/505/9976 |
| Level: | 3 |
| Credit value: | 80 |
| GLH: | 145 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCBS2 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to develop the learner's ability to work alone or as a member of a team when applying the core skills of the blacksmith to select and combine techniques and processes in order to efficiently and competently create small assemblies that are commercially sustainable and fit for purpose. Small assemblies can include e.g. hanging basket brackets, trivets, candlesticks, fire irons, lighting, door furniture, hand tooling. |

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| Learning outcome |
| The learner will: 1. understand the processes and tooling used to set up for forge production |
| Assessment criteria |
| The learner can: 1.1 explain methods of materials estimation from samples, drawings and specifications 1.2 explain the effects of heating and cooling for blacksmithing processes on metals 1.3 explain the uses of set up tooling 1.4 explain methods and equipment used when setting out work. |

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| Range |
| Materials estimation mean line/neutral axis, volume, weight, area, compound error, section dimensions, stretch, shrinkage, wastage, bend allowances, compaction, coefficient of expansion |
| Effects |

temperatures, visible colours, effects of ambient light, effects of heat on the grain structure of metal, speed of cooling, quenching media

Blacksmithing processes

forge welding, forging, bending, finishing, heat treating

Metals

iron, plain carbon steel (at least 4 samples range 0.04% to 1.4% Carbon), non ferrous, alloys

Set up tooling

jigs, formers, templates, vices (engineers/leg vice), stands, wedges/shims, clamps,

Methods

datums, squaring, levels, angles, working drawings, drawing transfer. specifications

Equipment

chalk, soft wire/string, dividers, trammels, rulers, tape, level, gauges, compass, angle finders, squares. laser. Traveller, centre finders, dot punches, scribes, engineers blue, surface table, 'v' blocks

Learning outcome

The learner will:

2. understand constructional techniques for small assemblies

Assessment criteria

The learner can:

- 2.1 explain the **process of construction** for small assemblies
- 2.2 explain considerations when selecting **joining techniques** for small assemblies
- 2.3 explain considerations when selecting **forging, forming and cutting processes** for small assemblies.

Range

Process of construction

Project planning/method statement, materials estimation, time estimation, tooling requirements

Joining techniques

rivets (dome head, pan head, faceted, decorative), fire welded joints (faggot, lap, straight scarf, branch, box, split core e.g. cage, pocket / socket, cleft, corner, 'T', glut, gusset, collar, butt), fixed and moveable joints, pegs and wedges, halving joints, pass throughs, mortice and tenons (straight tenon, upset tenon, offset tenon), bolts and screws (decorative, functional, visible, hidden), collars and wraps, dovetails, self securing, fire brazed

Forging processes

upsetting, drawing down, spreading by hand, sets, transitions, swaging,

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| fullering |
| <p>Forming processes bending, twisting, dishing, controlled heat techniques, repoussé, pressing using hand-operated tooling</p> |
| <p>Cutting processes punching (taper punching, parallel punching, slitter punching, slot punching), drifting (parallel drifting, taper drifting), chiselling (splitting/slitting, surface chiselling/incising, cropping, profiling)</p> |

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| Learning outcome |
| The learner will: 3. be able to carry out constructional techniques for small assemblies |
| Assessment criteria |
| The learner can: 3.1 Select and combine forging, forming, cutting and joining processes by hand and/or machine processes 3.2 construct small assemblies to specification |

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| Range |
| <p>Forging processes upsetting, drawing down, spreading, sets, transitions, swaging, fullering</p> |
| <p>Forming processes bending, twisting, dishing, controlled heat techniques, repoussé, pressing</p> |
| <p>Cutting processes punching (taper punching, parallel punching, slitter punching, slot punching), drifting (parallel drifting, taper drifting), chiselling (cropping off, splitting/slitting, surface chiselling/incising, profiled edges)</p> |
| <p>Joining processes riveting (hidden, dome head, pan head, faceted, decorative), fire welding (faggot, lap, straight scarf, branch, box, split core (e.g . cage, pocket / socket, cleft, corner, 'T', glut, gusset, collar, butt), fixed and moveable joints, pegging and/or wedging, halving joints, piercing and passing through, morticing and tenoning (straight tenon, upset tenon, offset tenon), bolting and screwing (decorative and/or functional) (visible and/or hidden), collaring (forged, composite, profiled), wrapping, dovetailing, self securing, fire brazing</p> |
| <p>Hand and/or machine processes hand, smith and striker, power hammer, press, rolls</p> |
| <p>Specification method statement, timely completion, accuracy to tolerance, working drawings and/or samples</p> |

Unit 313 Blacksmithing forge practices using small forge assemblies

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 1.2 Candidates must understand the effects for at least **two** of the ranged metals.

AC 3.1 Candidates must be able to carry out at least **four** of the ranged forming processes and at least **three** of the ranged cutting processes. In total at least **nine** joining processes must be covered; including at least **two** of the ranged riveting techniques and **two** of the ranged collaring techniques. At least **three** of the ranged hand or machine processes must be covered

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Assessment

This unit will be assessed by portfolio of evidence including staged practical/theoretical trade tests

Unit 314

Blacksmithing forge practices using large forge machinery

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| UAN: | D/505/9978 |
| Level: | 3 |
| Credit value: | 11 |
| GLH: | 29 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCBS2 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to develop the learner's ability to work alone or as a member of a team when using large forge machinery. |

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| Learning outcome |
| The learner will: 1. understand the use and maintenance of large forge tooling |
| Assessment criteria |
| The learner can: 1.1 explain the use and maintenance of large forge machinery 1.2 explain the installation and mode of operation of large forge machinery 1.3 explain the use and maintenance of large forge machinery tooling 1.4 explain the design of large forge machinery tooling 1.5 explain the setting up of large forge machinery tooling |

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| Range |
| Large forge machinery hammers, presses, rolls, |
| Mode of operation electrical, mechanical, hydraulic, pneumatic |
| Large forge machinery tooling pallets, pallet shoes, top and bottom swages, top and bottom fullers, spreading tools, set tools, die/stamping blocks, punch tools, cutting tools, bending/dishing tools, joggling tools, lifting gear – pulley blocks, snatch blocks, cranes/gantries. |

Learning outcome

The learner will:

2. be able to make and maintain large forge tooling

Assessment criteria

The learner can:

- 2.1 carry out visual inspections and report findings for forge **fixed plant**
- 2.2 change tooling for forge **fixed plant**
- 2.3 produce **large forge machinery tooling** to specification

Range**Fixed plant**

anvil, fly press, power hammer, hydraulic press

Large forge machinery tooling

pallet shoes, top and bottom swages, top and bottom fullers, spreading tools, set tools, die/stamping blocks, punch tools, cutting tools, bending/dishing tools, joggling tools, split/combination blocks

Unit 314 Blacksmithing forge practices using large forge machinery

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

C 1.1 Candidates must be able to explain the use and maintenance of at least **two** of the ranged large forge machinery.

AC 1.2 Candidates must be able to explain installation and mode of operation of at least **two** of the ranged types of large forge machinery.

AC 2.1 Candidates must report on at least **two** of the following - Anvil, fly press, power hammer, hydraulic press.

AC 2.2 Candidates must Change tooling on at least **two** of the following - Fly press, power hammer, hydraulic press.

AC 2.3 Candidates must produce at least **three** of the ranged large forge machinery tooling

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Assessment

This unit will be assessed by portfolio of evidence.

Unit 315

Blacksmithing processes

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| UAN: | H/505/9979 |
| Level: | 3 |
| Credit value: | 44 |
| GLH: | 131 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCBS3 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to introduce the skills and understanding that comprise the principles and practice for high quality production of traditional forgework motifs that are common throughout the history of the blacksmith's craft. |

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| Learning outcome |
| The learner will: 1. understand how to control quality in general forgework and toolmaking |
| Assessment criteria |
| The learner can: 1.1 describe general forgework production faults 1.2 explain methods for correcting or avoiding defects 1.3 explain hand and anvil tooling production methods including equipment required and materials used. |

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| Range |
| Forgework production faults galls, internal/external cracking, surface defects, coldshuts, over/underforging, bends/kinks, incomplete/opening joints, red/hot short overheating, cold short, flashing, oversize, undersize, out of true distortion |
| Hand tooling hammers punches, chisels, bending irons |
| Anvil tooling top and bottom tools, spring tools, stakes, horns, dies, hold fasts |

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| Learning outcome |
| The learner will: 2. understand the artistic and architectural periods of forged metalwork |
| Assessment criteria |
| The learner can: 2.1 describe the historical styles of forged metalwork 2.2 describe influences on styles of European artistic and architectural forged metal work |

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| Range |
| Historical styles (Art Movements) prehistory, Egyptian, Greek, roman, medieval , byzantine renaissance, mannerism, baroque, rococo, neoclassicism/romanticism, modernism, arts and crafts, art nouveau, Bauhaus, art deco |
| Influences blacksmith/ironworker (eg Robert Bakewell, Davies Brothers , Jean Tijou, Fritz Kuhn, Alfred Habberman, Frances Skidmore, Edgar Brandt, Paul Zimmerman, Tom Joyce, Albert Paley), architects/artists (eg Antonio Gaudi, Victor Horta, Frank Lloyd Wright, Charles Rennie Mackintosh, Edwin Lutyens, John Ruskin, William Morris), vernacular (domestic regional), art movements |

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| Learning outcome |
| The learner will: 3. be able to produce hand tooling |
| Assessment criteria |
| The learner can: 3.1 make hand and anvil tools used in forgework 3.2 check produced tools are fit for purpose. |

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| Range |
| Hand and anvil tools hammers, punches, chisels, hot sets, tongs, flatters, set tools, top and bottom swages, top and bottom fullers, formers, horns, wrenches, (twisting/bending), helpers, holdfasts, bolsters, headers/monkey, stakes, dishing blocks, butcher, hardies (straight, offset and curved), measuring/marking out tools |

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| Learning outcome |
| The learner will: 4. be able to use production processes for making decorative elements |
| Assessment criteria |
| The learner can: 4.1 produce decorative ironwork elements to specification including; a. Scroll types b. Scroll ends c. Forged corners d. Decorative twists e. Finials and terminations. |

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| Range |
| Specification working drawings, written tolerances |
| Decorative ironwork elements scroll types (oval, volute, blown back, Greek key, 'S' scroll, 'C' scroll, branched scrolls), scroll ends (ribbon, fishtail, rat tail, split fishtail, snub [solid & rolled], bolt, halfpenny, bevel, bevel leaf, leaf), forged corners (square, obtuse, acute), decorative twists (straight, forward/reverse, composite, decorated), finials and terminations (railing ends, handles, forged, box welded leaf, cage, ball, composite) |

Unit 315 Blacksmithing processes

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 1.2 Candidates must be able to explain methods of correcting or avoiding at least **five** of the ranged forge work production faults.

AC 1.3 Candidates must be able to explain hammer production methods **plus** at least **one** other of the ranged hand tooling. Also, candidates must be able to explain top and bottom tools **plus** at least **one** other of the ranged anvil tooling.

AC 2.1 Candidates must be able to describe in detail at least three of the ranged historical styles of forged metal work.

AC 2.2 Candidates must be able to describe at least **one** Pre 1900 **and one** post 1900 influence from those ranged.

AC 3.1 Candidates must make at least **eight** examples of the ranged hand and anvil tools.

AC 4.1 Candidates must produce decorative elements including at least

- **four** of the ranged scroll types
- **six** of the ranged scroll ends
- **one** of the ranged forged corners
- **two** of the ranged decorative twists.

Finials and terminations to include railing ends and handles using at least **two** of the following - forged, box welded leaf, cage, ball and composite.

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Assessment

This unit will be assessed by portfolio of evidence.

Unit 316

Blacksmithing construction skills

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| UAN: | K/505/9983 |
| Level: | 3 |
| Credit value: | 104 |
| GLH: | 253 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCBS4 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to provide the learner with the skills and knowledge to develop workshop specifications and the ability to work accurately allied to the selection and control of production processes within historical and contemporary aspects of the craft, demonstrating analytical ability in the production of complex forged constructions. |

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| Learning outcome |
| The learner will: 1. understand historical and contemporary methods of metal production |
| Assessment criteria |
| The learner can: 1.1 explain the physical properties , and effects of working on different metals in the forge 1.2 describe methods of production and supply of metals |

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| Range |
| Physical properties malleability, ductility, elasticity, strength, brittleness/hardness |
| Effects of working compaction, work hardening, grain distortion, recrystallization, |
| Metals iron, steel, cast iron, copper, brass, bronze, alloy steels, aluminium, titanium |
| Methods |

production (history of iron and steel production, reduction furnace, blast furnace, puddling furnace, Bessemer process, alloying), **supply** (bar, plate, sheet, pre cut profiles, tubing, rolled profile sections)

Learning outcome

The learner will:

2. understand historical and contemporary construction details

Assessment criteria

The learner can:

- 2.1 explain historical and contemporary **methods** of forging and joining dissimilar metals in a forge
- 2.2 compare and contrast **visual characteristics** and **physical attributes** of historical and contemporary dissimilar metal joints

Range

Methods

forging - hot and cold working, punching, splitting and chasing raising, dishing and bending/twisting, drawing down, setting down, fullering, upsetting and swaging

joining - mechanical (threading, wedging), welding (forge), brazing (forge), self securing, (interference, shrink, friction, compression), riveting (rivets-solid, hollow, pop, head types), mortice & tenons, soldering (lead, silver), glueing, pins/pegs, stitching

Metals

iron, steel, copper, brass, bronze, alloy steels, aluminium, titanium

Visual characteristics

surface appearance (light responsiveness, texture), coatings/patination, material base colour, overall shape/form

Physical attributes

structural integrity, corrosion resistance, complexity of production, suitability of material/process

Learning outcome

The learner will:

3. understand the production and use of specialised tooling for historical and contemporary methods of construction

Assessment criteria

The learner can:

- 3.1 explain the use of **specialised tooling** for different methods of construction

Range

Specialised tooling

tongs, stakes, punches, drifts, chisels, hammers, top and bottom anvil tools, spring tools, mandrels, jigs/formers, snaps, dies, monkeys, bolsters

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| Learning outcome |
| The learner will: 4. understand the use of common finishing techniques in forged metalwork |
| Assessment criteria |
| The learner can: 4.1 explain common finishing techniques for metals and reasons for using them 4.2 explain aesthetic and physical attributes of historical and contemporary finishing techniques 4.3 explain methods of corrosion control for metalwork 4.4 explain methods to control distortion of the structure. |

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| Range |
| Finishing techniques brushing, grinding, sanding and finishing, filing, etching, waxing, oiling patinating, metal coating (hot-dip galvanising, metal spraying, electroplating), painting and/or lacquering, polishing, burnishing, electro-polishing, gilding, anodising, powder coating, enamelling |
| Metals iron, steel, cast iron, copper, brass, bronze, alloy steels, aluminium, titanium |
| Methods of corrosion control electro-chemical series, metal coating (hot-dip galvanising, metal spraying, electroplating), paints/laquers, powder coating, sacrificial anodes, design considerations, electrolytic barriers, environmental factors, corrosion resistant metals and alloys |
| Methods to control distortion bracing, triangulation, stiffening, material weight and section selection, joining methods and fixing points, assembly procedure. heat treatment. |

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| Learning outcome |
| The learner will: 5. be able to produce drawings and specifications |
| Assessment criteria |
| The learner can: 5.1 estimate materials required to produce specifications considering relevant factors 5.2 use methods for producing workshop drawings and specifications |

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| Range |
| Relevant factors mean line, volume, area, weight, wastage, compaction, shrinkage, stretch, coefficient of expansion, bend and stretch allowances |
| Methods method statements to include time frames, workshop drawings (by computer aided design (CAD) or by hand), relevant drawing conventions, basic geometry, marking out (use of datums, measuring tools, drawing tools), samples, models/maquettes, templates |

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| Learning outcome |
| The learner will: 6. be able to produce complex blacksmith constructions and motifs using a combination of metals |
| Assessment criteria |
| The learner can: 6.1 use blacksmith construction joint types and methods 6.2 make decorative forged elements and motifs as part of complex forged constructions 6.3 make decorative forged elements and motifs in dissimilar metals . |

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| Range |
| Joint types and methods tenons (cut, forged, upset, offset, straight tenon), collars (welded, forged, composite, profiled, decorated), pass through, wrap, rivets - headed, blind, decorative, halving joints, forge welds - box, corner, branch, 'T', split core (e.g.cage, cleft, pocket / socket, faggot, straight scarf, gusset, glut, collar, butt, lap), mechanical fixings - bolts, pegs & wedges, screws, pins |
| Decorative forged elements and motifs simple and non standard sections, transitions, terminations (forged, composite, forge welded), bends, branched, twists, applied sheet work (forge welded, riveted, screwed), decorative chiselling/chasing, texturing, applique, relevant specialised tooling |
| Dissimilar metals steel, iron, alloy steel, copper, bronze, brass, aluminium, titanium |

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| Learning outcome |
| The learner will: 7. be able to specify and apply finishes to metalwork |
| Assessment criteria |
| The learner can: 7.1 prepare the work and apply appropriate workshop finishes to metalwork 7.2 specify non forge workshop based finishes . |

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| Range |
| Workshop finishes brushing, grinding, sanding and finishing, filing, etching, waxing, oiling, patinating, painting and/or lacquering, polishing, burnishing, gilding, enamelling (cold) |
| Non forge workshop based finishes hot-dip galvanising, metal spraying, electro-plating, electro-polishing, anodising, enamelling (hot), powder coating |

Unit 316 Blacksmithing construction skills

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 1.1 Candidates must be able to explain the effects of working on at least **three** of the ranged types of metals.

AC 2.1 Candidates must cover at least **three** of the ranged types of metals.

AC 4.1 Candidates must be able to explain at least **nine** of the ranged finishing techniques across at least **three** of the ranged types of metal.

AC 6.1 Candidates must be able to blacksmith construction joint types and methods including at least;

- **three** of the ranged types of tenons
- **three** of the ranged types of collars
- **seven** of the ranged types of forge welds
- **two** of the ranged types of mechanical fixings.

AC 6.2 Candidates must make at least **seven** of the ranged decorative forged elements and motifs.

AC 6.3 Candidates must make forged elements and motifs across at least **three** of the ranged types of dissimilar metals.

AC 7.1 Candidates must prepare for and apply at least **six** of the ranged workshop finishes.

AC 7.2 Candidates must specify at least **three** of the ranged non-forge based finishes.

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Assessment

This unit will be assessed by portfolio of evidence.

Unit 317

Working safely in blacksmithing

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| UAN: | M/505/9984 |
| Level: | 3 |
| Credit value: | 8 |
| GLH: | 45 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to embed safe working practice within the craft of blacksmithing by ensuring that the learner is fully aware of the of the requirements and their responsibilities for safe working in the blacksmithing workplace. |

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| Learning outcome |
| The learner will: 1. understand roles and responsibilities when working safely in blacksmithing |
| Assessment criteria |
| The learner can: 1.1 explain roles and responsibilities for safe working in blacksmithing 1.2 describe current safety legislation affecting blacksmithing work. |

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| Range |
| Roles employer, self-employed, employee, visitors and general public, sub contract, designers, manufactures and suppliers of goods and materials, health and Safety executive |
| Responsibilities relevant personal protective equipment (PPE), reporting (safety issues, accident and dangerous occurrences), safe working, communication, recognising risk, identifying hazards, managing risk, working safely, environment (flora, fauna), legal |
| Legislation Health and Safety at Work Act 1974, Provision and use of work equipment regulations 1998 (PUWER), Workplace safety and welfare 1992, Control of substances hazardous to health 2002 (COSHH), Fire precautions 1971, First aid at work 1981, Reporting of injuries, diseases and dangerous occurrences regulations 1995 (RIDDOR), Noise at work 1989, Manual handling operations 1992, Personal protective equipment |

Learning outcome

The learner will:

2. understand risks associated with blacksmithing work

Assessment criteria

The learner can:

- 2.1 identify potential sources of **hazards** in the workshop and on site
- 2.2 describe potential **consequences** of accidents occurring
- 2.3 explain **methods** of assessing and evaluating risks
- 2.4 identify types of safety **information**, labels and equipment.

Range

Hazards

equipment, materials/substances, work procedures or methods, environment (Noise, Heat/cold, fume, lighting, weather), disabilities/allergy/sickness, lack of training/induction, working at height, vibration, fire, hot work or substances, electricity, slippery/ uneven/ cluttered surfaces and work areas, work and welfare facilities, transportation, lifting gear, access and egress, explosions,

Consequences

injury (e.g. Impact, vibration, abrasion, laceration, crushing, burns, scalds, puncture wounds), asphyxiation (e.g. fume, dust, vapour, gas), shock, electrocution, strangulation, poisoning, disease, death/disability, cost, litigation

Methods

risk assessment, method statement, control methods, COSH data sheets

Information

warning signs (hazardous substances, dangerous areas and processes, emergency exits), mandatory notices, emergency notices, statutory notices, fire extinguishers, COSH data sheets, risk assessments

Learning outcome

The learner will:

3. Be able to work safely when carrying out blacksmithing activities

Assessment criteria

The learner can:

- 3.1 use appropriate PPE when working
- 3.2 follow blacksmithing **safe working procedures**
- 3.3 use blacksmithing equipment, machinery and tools **safely**
- 3.4 dispose of waste safely, following legislative requirements
- 3.5 store materials and substances in line with safe working practices
- 3.6 secure work area, tools and materials from public and unauthorized access
- 3.7 protect the **environment** from damage from blacksmithing practices

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| Range |
| Safe working procedures first aid, site work access, reporting procedures, emergency procedures (practice drills - fire, evacuation), procedure for changing grinding wheels, clean/tidy & efficient work area, following current legislation, perform risk assessment |
| Safely checking, maintaining, following operational procedures |
| Environment built environment, flora, fauna, structures, fixtures/fittings |

Unit 317 Working safely in blacksmithing

Supporting information

Evidence Requirements

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Guidance

AC 1.2 All health and safety legislation ranged must be covered unless superseded by others/updated.

Assessment

This unit will be assessed by portfolio of evidence.

Unit 318

Use hand tools to shape components by material removal in blacksmithing

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| UAN: | T/505/9985 |
| Level: | 3 |
| Credit value: | 44 |
| GLH: | 167 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCBS9 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to develop the learner's ability to manually form and shape materials using appropriate tools, equipment, techniques and processes to meet specifications in blacksmithing. |

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| Learning outcome |
| The learner will: 1. understand how to interpret technical drawings, instructions and specifications |
| Assessment criteria |
| The learner can: 1.1 explain types of technical drawings conventions . |

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| Range |
| Types engineering, fabrication, blacksmithing |
| Conventions projection (third angle projection, first angle projection, isometric projection, oblique projection), instructions, abbreviations and pictorials used on drawings, line types, types of dimension (linear, angle, curves, radii, size dimension/location dimension, scaling), tolerances, limits and fits, British standards of drawing conventions |

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| Learning outcome |
| The learner will: 2. understand the use and maintenance of hand cutting tools. |
| Assessment criteria |
| The learner can: 2.1 identify thread forms for taps and dies and their application. 2.2 explain types of tap and die for hand and machine thread cutting and their maintenance. 2.3 explain cut types of hand files their use and maintenance 2.4 explain types of cold chisels their use and maintenance 2.5 explain the use of hand scrapers 2.6 explain types of hacksaw their use and maintenance. |

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| Range |
| Thread forms ISO Metric coarse and fine thread forms, British standard pipe BSP, National pipe thread NPT, Unified fine UNF, Unified fine UNC, British standard Brass, British standard Whitworth, British standard fine BSF, British standard coarse BSC, British Association screw thread, Acme/square/buttress |
| Types of tap and die straight flute taps (taper tap/second tap/plug tap), spiral flute taps, spiral point taps, circular split die, two piece die, die nut, |
| Cut type rasp/rough cut, bastard file, second cut, smooth, dead smooth, double cut, single cut |
| Hand files flat file, hand file, half round file, triangular file, knife file, round file, square file, rat tail file, needle files, thread files |
| Cold chisels Flat, round nose, diamond point, non sparking, chasing chisels, cross cut |
| Hand Scrapers 3 cornered, flat, curved |
| Types of hacksaw straight handle, pistol grip, blade teeth per inch (TPI), blade tension, blade type – bi-metal/fully hard |

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| Learning outcome |
| The learner will: 3. understand the use and maintenance of powered tools |
| Assessment criteria |
| The learner can: 3.1 explain types of powered metal removal tools 3.2 explain set up and maintenance of bench/pedestal grinders 3.3 explain the use of different materials in grinding wheel composition |

- 3.4 explain the use of die grinder **tool tips**
- 3.5 explain the correct fitting and selection of **abrasive discs and brushes** for angle grinders
- 3.6 explain types of powered metal **drilling tools, drilling cutters, cutting lubricants** and **cutter maintenance**
- 3.7 explain the use of **cutting speeds** for drilling, grinding and reaming machines
- 3.8 explain the use of **reamers**
- 3.9 explain types of powered **metal cutting saws**
- 3.10 explain **features** of powered metal cutting saw blades
- 3.11 compare and contrast the **features** of electrical and pneumatic power tools.

Range

Powered metal removal tools

bench/pedestal grinders, belt grinders, linishers, power file, angle grinder, die grinders, nibblers (pneumatic/hydraulic/electric), cropper (mechanical/hydraulic), punch (mechanical/hydraulic)

Set up

fitting grinding wheels, setting up grinding wheels, wheel dressing

Grinders

straight wheel, tapered wheel, recessed wheel, diamond wheel

Materials

silicon carbide, aluminium oxide, diamond

Tool tips

burrs, flap wheels, mounted stones

Abrasive discs and brushes

sanding discs, flap discs, grinding discs, metal cutting discs, stone cutting discs, cup brushes, flat brushes

Drilling tools

bench/Pedestal drill, pistol drill, magnetic base drill

Drilling cutters

high speed steel twist drills, carbon steel twist drills, annular cutters hole saws, long reach twist drills, tungsten tipped, diamond core

Cutting lubricants

soluble cutting oil, non soluble cutting oil, cutting paste, paraffin

Cutter maintenance

drill geometry (ferrous and non ferrous materials, non metallics, varying thickness of material), cutting lip angle, lip clearance angle, chisel edge angle, land, flutes

Cutting speeds

data sheets, material types, cutter type

Reamers

size selection, parallel reamers, spiral reamers, hand reamers, machine

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| reamers, cutting/ feed speeds |
| Metal cutting saws chop/cut off saw, vertical bandsaw, horizontal bandsaw, power hacksaw |
| Features powered metal cutting saw blades - tooth pitch, teeth per inch (TPI), cutting blade width, cutting speeds (mild steel, carbon steel, stainless steel, aluminium, copper/brass) electrical and pneumatic power tools - portability, flexibility, noise, power consumption, cost to purchase |

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| Learning outcome |
| The learner will: 4. understand the use of engineering measuring tools and marking out equipment |
| Assessment criteria |
| The learner can: 4.1 explain how to read micrometres, Vernier callipers and clock gauges 4.2 explain the maintenance and care of micrometres and Vernier callipers 4.3 explain the use of marking out and measuring tools |

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| Range |
| Maintenance use of slips/gauge plates, effect of heat, effect of dirt |
| Marking out and measuring tools Out side callipers, inside callipers, odd leg callipers, wing compasses, spring dividers, centre punch, engineers steel square, protractor, centre finder, angle plate, bevel gauge, ruler, scribing block, scribes, surface plate, marking blue, trammels, vee blocks, engineer's chalk, plumb bob, chalk line |

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| Learning outcome |
| The learner will: 5. understand methods of material removal and shaping using hand tools |
| Assessment criteria |
| The learner can: 5.1 explain the methods of material removal and shaping. |

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| Range |
| Methods sawing, grinding, filing, chiselling, punching, scraping, reaming, drilling, shearing, nibbling |

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| Learning outcome |
| The learner will: 6. be able to use hand tools to perform blacksmithing cutting and |

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| shaping operations |
| Assessment criteria |
| <p>The learner can:</p> <p>6.1 use engineers data tables to identify cutting and shaping requirements</p> <p>6.2 check, maintain and change tooling</p> <p>6.3 sharpen and dress tooling</p> <p>6.4 cut and shape materials to specification using different methods</p> <p>6.5 use measuring equipment to mark and set out work to specification</p> <p>6.6 use measuring equipment to check outcomes against specification</p> <p>6.7 produce technical drawings to required conventions.</p> |

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| Range |
| <p>Requirements correct drill size for selective tap cutting speeds thread types fits (interference and clearance)</p> <p>Check, maintain and change tooling grinding regulations, cutting speeds, faults (chips, cracks, wear and tear, mushrooming), clean tooling – files, centre and balancing (drills and grinding wheels), chuck changing (drills), use of soft hammers to avoid damage (copper or brass)</p> <p>Sharpen drills, chisels, scrapers, scribes, centre punches</p> <p>Specification working drawings, data tables, written instructions</p> <p>Methods sawing, abrasive finishing, scraping, filing, grinding, chiselling, thread cutting, drilling/reaming, punching, shearing, nibbling</p> <p>Measuring equipment out side callipers, inside callipers, odd leg callipers, wing compasses, spring dividers, centre punch, engineers steel square, protractor, centre finder, angle plate, bevel gauge, ruler, scribing block, scribes, surface plate, marking blue, trammels, vee blocks, engineer's chalk, plumb bob, chalk line, micrometer/clock gauge, vernier,</p> <p>Technical drawings blacksmithing, engineering, fabrication</p> |

Unit 318

Use hand tools to shape components by material removal in blacksmithing

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 2.1 Candidates must be able to identify at least **five** of the ranged thread forms.

AC 2.2 Candidates must be able to explain at least **four** of the ranged types of tap and die.

AC 2.3 Candidates must be able to explain at least **four** of the ranged cut types and four of the ranged hand files.

AC 2.4 Candidates must be able to explain at least **four** of the ranged types of cold chisel.

AC 2.5 Candidates must be able to explain the use of at least **one** of the ranged types of hand scrapers.

AC 3.1 Candidates must be able to explain at least **five** of the ranged powered metal removal tools.

AC 3.2 Candidates must be able to explain at least **one** of the ranged types of grinding wheel.

AC 3.4 Candidates must be able to explain the use of at least **two** of the ranged grinder tool tips.

AC 3.6 Candidates must be able to explain the use of least **two** of the ranged drilling cutters and **two** of the ranged cutting lubricants plus **all** the ranged drilling tool types and cutter maintenance methods.

AC 3.8 Candidates must be able to explain the use of at least **three** of the ranged types of reamer.

AC 3.9 Candidates must be able to explain the use of at least **two** of the ranged metal cutting saws.

AC4.3 Candidates must be able to explain the use of at least **twelve** of the ranged marking out and measuring tools.

AC 6.1 Candidates must use data tables to identify at least **two** of the ranged tool attributes.

AC 6.3 Candidates must sharpen drills plus any **two** of the other ranged tools.

AC 6.4 Candidate must use at least **six** of the ranged methods

AC 6.6 Candidate must use at least **twelve** of the ranged measuring equipment.

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Guidance

AC 6.7 Blacksmithing drawing can be a mixture of both freehand and technical drawing that is commonly scaled to full size and contains drawn sectional details, joint details and is often supported by separate engineering and/or fabrication technical drawings.

Assessment

This unit will be assessed by portfolio of evidence.

Unit 319

Historical, decorative and sheet metal blacksmithing techniques

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| UAN: | A/505/9986 |
| Level: | 3 |
| Credit value: | 40 |
| GLH: | 214 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCSBS6 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to provide the learner with the skills and knowledge that introduces and addresses the core elements of specialist blacksmithing conservation skills and decorative techniques such as repoussé that are an integral part of the preservation and reproduction of historical decorative ironwork. |

Learning outcome

The learner will:

1. understand the techniques of blacksmithing conservation

Assessment criteria

The learner can:

- 1.1 explain the **methods** used in blacksmithing conservation
- 1.2 describe the **materials** used in blacksmithing conservation
- 1.3 explain historical and modern **finishes**.

Range

Methods

record keeping, corrosion control (materials [metals - ferrous, non ferrous], electrochemical series, coatings [sacrificial materials, paints, waxes/oils, historical, electro and hot dip plating]
researching (guidelines, process, heritage organisations, sources),
conservation principles

Materials

ferrous metals – iron (wrought, pure), cast iron, plain carbon steel, stainless steel.
non ferrous – zinc, copper, brass, bronze, aluminium, lead, tin, nickel,

chromium, titanium
non metallic - stone, wood, Ceramics, plastics, plaster, cement/concrete

Finishes

oils, waxes, paints, metallic finishes, gilding, patinas

Learning outcome

The learner will:

2. understand the techniques used in decorative sheet work

Assessment criteria

The learner can:

2.1 describe the history of repoussé and sheet work **forms**

2.2 describe the **materials** used in repoussé and sheet work

2.3 describe **tools and methods** used in the process of forming decorative sheet work.

Range

Forms

leaves, water, blown back, bevel, rosettes, acanthus faced, acanthus cupped, heavy incised, figurative, animals, birds, human/mythical forms, masks

Materials

iron, steel, copper, brass, zinc, aluminium

Tools

punches, chasing tools, specialist hammers, stakes/horns, lead blocks, pitch blocks, wood blocks, lead blocks, sand bags, spring veining tools

Methods

appliqué, piercing, chasing, chiselling, profiling, surface-texturing, etching, raising, dishing, repoussé

Learning outcome

The learner will:

3. understand the techniques of traditional forgework decorative elements

Assessment criteria

The learner can:

3.1 explain the **types** of traditional forged decorative elements

3.2 explain the types of traditional forged decorative **constructions** used with repoussé and decorative elements.

Range

Types

twists, scroll forms, Finials, complex sections (forged composites)

Constructions

panels, overthrows, pilasters, balusters and balustrades, locks, gates, weather vanes, signs, grave markers, furniture (interior/exterior), containers, sculpture, garden constructions, door/window furniture and frames, domestic objects (e.g. cook ware/dining ware), fire side furniture, lighting

Learning outcome

The learner will:

4. be able to perform the techniques of decorative blacksmithing work

Assessment criteria

The learner can:

4.1 use **sheet metal techniques** to produce **decorative blacksmithing work**

4.2 use **tools** and **materials** for decorative sheet metal work

4.3 use construction **methods** to produce and combine **decorative elements** and blacksmithing **structures**.

Range

Sheet metal techniques

stake, pitch block, lead block, annealing, wood block

Decorative blacksmithing work

motifs, masks, shelled forms, light relief, figurative, coat of arms

Tools

punches, chasing tools, stakes/horns, sand bags, specialist hammers, spring veining tools, blocks (lead, pitch, wood), **dishing**

Materials

iron (pure or wrought), steel, copper, brass, aluminium, titanium

Methods

appliqué, repoussé, chasing, chiseling, profiling, surface texturing, jointing

Decorative elements

complex scroll forms, rosettes, twists, leaves, water, blown back, bevel, rosettes, acanthus faced, acanthus cupped, heavy incised, figurative (animals, birds, human/mythical forms, masks)

Structures

panels, overthrows, pilasters, balusters and balustrades, locks, gates, weather vanes, signs, grave markers, furniture (interior/exterior), containers, sculpture, garden structures

Domestic ware

door/ window furniture and frames, domestic objects eg, cook ware / dinning ware, fire side furniture, lighting

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| Learning outcome |
| The learner will: 5. be able to produce decorative tooling |
| Assessment criteria |
| The learner can: 5.1 produce tools for decorative sheet metal activities. |

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| Range |
| Tools punches, chasing tools, specialist hammers, stakes/horns, lead blocks, pitch blocks, dishing blocks, spring veining tools |

Unit 319 Historical, decorative and sheet metal blacksmithing techniques

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 4.1 Candidates must use at least **two** of the ranged techniques to produce at least **two** of the ranged types of decorative blacksmithing work.

AC 4.2 Candidates must use at least **four** of the ranged tools and at least **two** of the ranged materials.

AC 4.3 Candidates must use at least **three** of the ranged methods, produce and combine at least **four** of the ranged decorative elements on at least **two** of the ranged blacksmithing structures.

AC 5.1 Candidates must produce at least **three** of the ranged tools.

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Assessment

This unit will be assessed by portfolio of evidence.

Unit 320

Large scale blacksmithing construction and installation

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| UAN: | F/505/9987 |
| Level: | 3 |
| Credit value: | 81 |
| GLH: | 230 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCBS5 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to provide the learner with the skills and knowledge to install the products he or she makes covering the skills involved in the production and installation of complex forged constructions. This will often require working independently to the exacting standards of customers and other professionals. This links to the need for a rigorous and professional approach when managing the production costs when working to specification. |

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| Learning outcome |
| The learner will: 1. understand site evaluation and mapping |
| Assessment criteria |
| The learner can: 1.1 explain site survey methods and procedures 1.2 explain roles and responsibilities of self and others. |

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| Range |
| methods and procedures use of equipment: levels, laser, camera, tapes site surveying methods: mapping & plotting, setting datum's, drawings and conventions, building regulations access, relevant current legislation (to include CSCS requirements),, ensure services located and checked, permissions required |
| Roles and responsibilities lines of communication, areas of responsibility, legal, employee, employer, fellow professionals, customer/commissioner |

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| Learning outcome |
| The learner will: 2. understand costings and record keeping for workshop construction and site work |
| Assessment criteria |
| The learner can: 2.1 explain standard business models for a blacksmithing business 2.2 describe relevant legislation that can affect a blacksmithing business 2.3 explain how to produce costings for workshop and site 2.4 explain how and why you need to keep site records . |

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| Range |
| Business models business types, sole proprietor, Partnership, Limited company |
| Relevant legislation VAT, tax, NI, PAYE, employment, self employment, health and safety legislation, insurances |
| Costings workshop - methods of calculating job costs - (job cards, hour sheets, work program planning), direct and indirect costs, materials, wastage, rent, rates, utilities, clerical, insurances, depreciation, equipment, consumables , labour costs (man hours to plan, hourly rate) site - planning/consultations, evaluation of site, transport, security, site work , sub contract, travel/accommodation, environmental and health and safety considerations |
| Records job work sheets , materials stock records, plans, working drawings, hour sheets, method statements, risk assessments |

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| Learning outcome |
| The learner will: 3. understand the reasons for using site fixing operations |
| Assessment criteria |
| The learner can: 3.1 explain Site assembly methods and procedures 3.2 explain Site installation methods and procedures . |

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| Range |
| Site assembly temporary and permanent fixings (bolts, studs, screws, pegs, wedges, pins, adhesives/fillers, thread cutting, rivets, welding, lead caulking) joints (lap joints, halving joints, welded and brazed, fish plate, |

fixed/movable, pierced and passed through)

Site installation

types - lead, chemical, cement/grout. concrete, mechanical anchors
temporary fixings and bracing, supporting structures, work positioning
methods, lifting operations and manual handling, securing and
transporting, **risk assessment and method statements**

Learning outcome

The learner will:

4. be able to survey a given site to meet objectives

Assessment criteria

The learner can:

4.1 use **equipment** and **surveying methods** to survey blacksmithing sites

4.2 consider relevant issues when carrying out site work

4.3 consider own **roles and responsibilities** when communicating effectively at work

4.4 produce **site records** needed to meet defined specifications.

Range

Equipment

levels (spirit, laser, theodolite, water) line lasers, cameras, tapes, templates, distance finders, angle finders, datum pegs and string lines

Surveying methods

mapping & plotting, setting datum's, drawings and conventions

Roles and responsibilities

lines of communication, areas of responsibility, legal requirements/implications, employee, employer, fellow professionals, customer/commissioner

Site records

drawings, notes, film and/or photographs, timesheets, permissions, communications

Learning outcome

The learner will:

5. be able to perform site installation operations

Assessment criteria

The learner can:

5.1 select and use **site assembly** methods and procedures

5.2 perform specified **site installation** operations

5.3 **transport** work and materials to and from site safely.

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| <p>Range</p> <p>Site assembly temporary and permanent fixings (bolts, studs, screws, pegs, wedges, pins, adhesives/fillers, thread cutting, rivets, welding, lead caulking), joints (lap joints, halving joints, welded and brazed fish plate, fixed/movable, pierced and passed through)</p> <p>Site installation types - lead, chemical, cement/grout. Concrete, mechanical anchors. tools, equipment (handling and lifting equipment, setting out equipment site security and protection equipment, equipment for working at height, ground works and site fixing equipment, temporary fixings and bracing, supporting structures) site processes, preparation and maintenance (groundwork, making good, housekeeping, security/protection, confirm permissions and restrictions, work positioning methods, lifting operations and manual handling, securing and transporting, confirming and working to risk assessment and method, statements)</p> <p>Transport in appropriate packing, ensuring is secured, maintaining security, confirming insurances</p> |
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| <p>Learning outcome</p> <p>The learner will: 6. be able to perform workshop construction methods</p> |
| <p>Assessment criteria</p> <p>The learner can: 6.1 produce structural infills and elements 6.2 use assembly methods for constructing structural infills and elements 6.3 produce logical order of assembly for workshop constructions using assembly methods 6.4 produce large scale fixed and/or movable blacksmithing structures for different situations 6.5 produce decorative elements for large scale structures.</p> |

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| <p>Range</p> <p>Structural infills and elements elements - hinges and pivots, locks, heel bars, joints, rails, palings, braces, front and back stiles, Frames infills - balusters, transoms, posts, pillars and pilasters, treads, stringers, handrails and newels, wreaths</p> <p>Assembly methods setting out, use assembly jigs and templates, check to industry tolerances, use clamping and restraining methods, lifting and manual handling techniques, assembly/disassembly to ensure fitting</p> |
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Situations

domestic, architectural, sculptural, interior, exterior, industrial

Decorative elements

traditional - scrolls, rosettes, twists, appliqué, piercing, chiseling/incising, repoussé, motif, masks, figurative, leaves (acanthus faced, acanthus cupped), water leaves (crimped, plain, blown back, bevel)

contemporary - forgings, sections, transitions, terminations, bends
branch welds, twists, applied sheet work (forge welded, riveted, screwed), decorative chiselling/chasing, textures, appliqué

Unit 320 Large scale blacksmithing construction and installation

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 4.1 Candidates must be able to use at least five of the ranged types of equipment.

AC 5.1 Candidates must select and use at least **five** of the ranged fixings and at least **three** types of joints when performing site installation operations.

AC 5.2 Candidates must perform at least **four** of the ranged site installation operations using at least

- **three** of the ranged tools/equipment **including** ground works and site fixing equipment
- **five** of the ranged site processes.

AC 6.1 Candidates must produce at least **four** of the ranged structural infills **and** at least **four** of the ranged structural elements.

AC 6.2 & 3 Candidates must use at least **five** of the ranged assembly methods.

AC 6.4 Candidates must produce blacksmithing structures for at least **four** of the ranged situations.

AC 6.5 Candidates must produce contemporary complex decorative elements in response to at least **one** of the following; a client brief, an employer brief or a personal brief. At least **eight** traditional or **eight** contemporary elements must be covered.

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Guidance

AC 4.2 Examples of issues to be applied as appropriate – might include; building regulations, access to site, relevant current legislation, ensure services located and checked, permissions, health and safety, environmental, heritage, health and welfare

AC 6.5 Guidance – either a combination of contemporary and traditional or one or the other can be covered for assessment. Assessors should ensure that within the contemporary decorative element requirement that the appropriate level of craft skill and complexity is demonstrated as would be required for the historical elements.

Assessment

This unit will be assessed by portfolio of evidence.

Unit 321

Design processes for blacksmithing work

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| UAN: | J/505/9988 |
| Level: | 3 |
| Credit value: | 53 |
| GLH: | 195 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCSBS6 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to provide the learner with the skills and knowledge to undertake research, develop ideas, design proposals and specifications for the production of forged metalwork. |

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| Learning outcome |
| The learner will: 1. understand the design cycle |
| Assessment criteria |
| The learner can: 1.1 describe the stages of the design process 1.2 explain the requirements of a design brief. |

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| Range |
| Stages requirements of a design brief, research/sources, ideas generation, analysis, evaluation, selection, development, testing, realisation, |
| Requirements client and/or employer requirements, defining concept (ie broad notion, category or idea), design approach, aesthetic requirements, functional requirements, timelines, contractual issues, budgets, relevant regulatory requirements, design ethics and copyright |

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| Learning outcome |
| The learner will: 2. understand the importance and use of research in the design process |
| Assessment criteria |
| The learner can: 2.1 identify design considerations when researching blacksmithing |

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| <p>work</p> <p>2.2 compare primary and secondary sources of information when researching designs</p> <p>2.3 explain how to analyse, evaluate and select research information for designing.</p> |
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| <p>Range</p> <p>Design considerations context (e.g. Location, social, historical/modern, narrative, utility, Client requirements), design approach (e.g. literal/abstract, form/function, aesthetic), aesthetic/visual qualities (e.g. natural world, man made objects, materials, process, function, representational or expressive qualities, connection/construction details, composition and relationships, shape/form, surface, colour/tone), tactile qualities (e.g. textures, edges, profiles), function (e.g. existing examples, experiments, mechanical operation, ergonomics and biomechanics), process (e.g. working methods, experimental samples), materials (e.g. working characteristics, colour, modes of supply, structure/physical properties), regulatory/legal/safety, budget/costs</p> <p>Primary sources location, observed drawings, photographs, actual objects, paintings, prints, collages, written commentary</p> <p>Secondary sources paintings, postcards, photographs, computer generated imagery (downloads), photography</p> <p>Analyse, evaluate and select research information written annotations, recognising relationships, comparing and contrasting information, pertinence to the brief requirements, sketchbooks</p> |
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| <p>Learning outcome</p> <p>The learner will:</p> <p>3. be able to generate and develop design ideas to brief from research information</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>3.1 evaluate research information for designing</p> <p>3.2 use design tools to generate and capture innovative design ideas</p> <p>3.3 analyse and evaluate design ideas to identify that which best responds to brief requirements</p> <p>3.4 use a range of methods to develop blacksmithing designs from design ideas</p> <p>3.5 produce realised designs in accordance with the requirements of client briefs and design specifications.</p> |

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| <p>Range</p> <p>Research information written annotations, recognising relationships, comparing and contrasting information, pertinence to the brief requirements,</p> |
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| <p>sketchbooks</p> <p>Design tools sketchbooks, annotations, drawing developments of ideas, samples, models, maquettes, collages, computer generated visuals and drawings, tracing/copying/scanning, pertinence to the brief requirements</p> <p>Methods presentational drawings, samples, models/maquettes, technical/working specifications (e.g. materials, process, construction, finish, site fixing), technical/working drawings, designs to the brief requirements, method statement/timeline</p> <p>Requirements costing/budget, design brief, regulatory/legal/safety as appropriate, design ethics and copyright</p> |
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| Learning outcome |
| The learner will: 4. be able to produce technical and freehand drawings |
| Assessment criteria |
| The learner can: 4.1 produce technical drawings following blacksmithing design conventions 4.2 produce free hand drawings using a variety of methods and media . |

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| Range |
| Technical drawings engineering, fabrication, blacksmithing |
| Conventions Orthographic Projections (third angle projection or first angle projection, isometric projection or Oblique projection), instructions, abbreviations and pictorials used on drawings, line types, types of dimension (linear, angle, curves, radii, size), dimension location, dimension scaling, tolerances, limits and fits, British standards of drawing conventions |
| Free hand drawings directly observed small scale objects, directly observed large scale (architectural) objects, directly observed geometric objects, directly observed amorphous objects, presentational design drawing |
| Methods line, tone, perspective (1,2 & 3 point), sight sizing, scaling |
| Media pencil, charcoal, pastel, paint, graphite stick, pen, crayon |

Unit 321 Design processes for blacksmithing work

Supporting information

Evidence requirements

You must provide your assessor with evidence for all the learning outcomes and assessment criteria. The evidence must be provided in the following ways taking into account any of the special considerations below.

AC 2.2 candidates must use at least **four** ranged primary sources and **two** of the ranged secondary sources.

AC 3.2 Candidates must cover sketch books, annotations, drawing developments plus at least **one** other ranged design tool.

AC3.4 Candidates must cover presentational drawings, technical/working drawings plus at least **two** others from the range.

AC4.1 Candidates must produce at least **one** of the types of technical drawings ranged.

AC4.2 Candidates must produce at least **one** of the ranged types of free hand drawing. **All** of the ranged methods must be covered and at least **two** of the ranged media types.

NB – Where evidence requirements are not specified for ranged criteria elements, all must be completed.

Guidance

AC 3.2 Design ideas must satisfy the brief requirements.

AC 4.1 In the case of fabrication drawings candidates must produce both radial and parallel line projections. Drawings can be made by hand or with Computer Aided Design (CAD).

Assessment

This unit will be assessed by portfolio of evidence.

Unit 322

Blacksmithing work combining other materials and processes

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| UAN: | L/505/9989 |
| Level: | 3 |
| Credit value: | 38 |
| GLH: | 168 |
| Relationship to NOS: | Creative and Cultural Skills Blacksmithing NOS CCSBS7 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim: | The aim of this unit is to provide the learner with the under pinning knowledge and skills to select and join dissimilar materials that are associated in designing and creating mixed media forged metalwork. |

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| Learning outcome |
| The learner will: 1. understand properties of metallic and non- metallic materials used in blacksmithing |
| Assessment criteria |
| The learner can: 1.1 Explain the physical properties of metallic materials 1.2 Explain the physical properties of non metallic materials . |

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| Range |
| Physical Properties Malleability, ductility, elasticity, strength, plasticity, expansion and/or contraction, brittleness/hardness, electrical conductivity, texture, colour, surface, weight, internal structure |
| Metallic materials Ferrous metals – plain carbon steels, alloy steels, cast iron, cast steel, stainless steels, weathering steels, wrought iron, pure Iron Non ferrous metals – copper, bronzes, brasses, zinc, tin, aluminium, titanium, lead, gold, platinum, silver |
| Non metallic materials Natural materials/non metallic – stone, leather, hard and soft woods, natural fibres, natural rubber |

Synthetic or man made materials/non metallic - nylon, synthetic fibre, synthetic rubber plastics, bricks, glass, ceramics, concrete, composite materials

Learning outcome

The learner will:

2. understand the potential effects of combining different materials in blacksmithing work

Assessment criteria

The learner can:

- 2.1 differentiate effects of combining different **materials**
- 2.2 explain the galvanic corrosion table/series
- 2.3 explain the properties of fluxes
- 2.4 explain the properties of adhesives
- 2.5 explain types of material **degradation** with relation to the mixing of materials in different **environmental conditions**
- 2.6 describe the different rates of material degradation
- 2.7 explain jointing methods for combining different materials
- 2.8 explain the causes of material corrosion
- 2.9 explain **methods** of controlling corrosion when combining materials.

Range

Materials

Leather, wood, textiles, natural fibres, nylon, synthetic fibres, rubber, ferrous metals (Stainless steels, weathering steels) , non ferrous metals, precious metals, stone, concrete, glass, ceramics, composites, plastics, bricks

Degradation

Rots, bacterial / fungal attack, wet and dry corrosion, insect attack, light degradation (e.g. colour loss), electrolytic corrosion, differential aeration effect, internal stress, abrasion / wear, spalling, rust expansion (jacking), chemical/physical breakdown (e.g. recrystallization)

Environmental conditions

Temperatures , dry environment, wet environment, hot gas , salt water environment , light eg intensity / type, relative humidity, precipitation, pollution, rate of flow of liquid and air/gas, acidity and alkalinity, relative surface area, external stresses, weathering /freezing and thawing , plant/animal attack

Methods

Insulation of combined materials, location of combined materials, surface coatings of combined materials, coating strength, adherence and elasticity, maintenance of combined materials, joining methods and processes when combining materials (e.g. expansion bolts, resin anchors, leading in, cement grouts, glueing, welding, brazing, soldering, using screws, mechanical fixings etc.), avoiding water traps, avoiding capillary action, stress control methods/bracing/ strengthening/ normalising, surface quality/removal of surface contaminants, use of sacrificial materials, relative surface areas

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| Learning outcome |
| The learner will: 3. be able to produce products using a combination of different materials with forged metalwork |
| Assessment criteria |
| The learner can: 3.1 combine forgeable and non-forgeable materials to produce interior forged metalwork products 3.2 combine forgeable and non-forgeable materials to produce exterior forged metalwork products. |

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| Range |
| Materials Forgeable (plain carbon steels, alloy steels, stainless steel, weathering steels eg, corten, wrought iron, pure iron, copper, bronzes, brasses , aluminium, cast steel, titanium) Non forgeable (stone, concrete , glass, ceramics, composites, plastics, rubber natural/synthetic, bricks, leather, wood, textiles, nylon, natural fibres, synthetic fibres, cast Iron, zinc, tin, lead, gold, platinum, silver) |

Unit 322 Blacksmithing work combining other materials and processes

Supporting information

Evidence requirements

This unit will be assessed by portfolio of evidence including staged practical/theoretical trade tests.

AC 1.1 Candidates must understand how to combine at least **six** of the ranged materials with a ferrous metal including at least **one** ferrous to non-ferrous mix.

AC2.1 Candidates must differentiate effects of at least **six** of the ranged materials with metals, including **one** example of ferrous and non-ferrous metal.

AC2.5 Candidates must cover at least **five** of the ranged types of degradation and at least **five** of the ranged environmental conditions

AC2.9 Candidates must be able to explain at least **five** of the ranged methods of controlling corrosion when combining methods.

AC 3.1 & 3.2 Candidates must produce at least **one** interior product and **one** exterior product using forgeable metals in conjunction with at least **one** non-forgeable material.

NB – Where evidence requirements are not specified for ranged criteria all elements

Assessment

This unit will be assessed by portfolio of evidence.

Unit 323

Introduction to ethics and professional judgement for cultural heritage conservation

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| UAN: | H/601/6852 |
| Level: | 3 |
| Credit value: | 5 |
| GLH: | 30 |
| Relationship to NOS: | CCCSC63 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |

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| Learning outcome |
| The learner will: 1. be able to understand ethical and legal obligations in relation to cultural heritage conservation |
| Assessment criteria |
| The learner can: 1.1 explain the key principles of cultural heritage conservation 1.2 describe legal obligations that apply to their work under health and safety, contract and employment law. |

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| Learning outcome |
| The learner will: 2. know how to apply ethical principles in their work |
| Assessment criteria |
| The learner can: 2.1 explain ethical standards as set down by their relevant professional bodies' code of ethics and practice 2.2 explain how relevant ethical principles apply to their own work 2.3 explain how to balance conservation requirements with the need for cost-effectiveness and access to cultural heritage 2.4 evaluate the extent to which organisational practices conform with conservation ethics 2.5 describe how the cultural, historic and spiritual context of cultural heritage can influence how it needs to be treated. |

Unit 324

Working on conservation and restoration projects in the workplace

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| UAN: | F/504/7080 |
| Level: | 3 |
| Credit value: | 30 |
| GLH: | 100 |
| Relationship to NOS: | COSVR546 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |

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| Learning outcome |
| The learner will: 1. interpret the given information relating to the work and resources when working on conservation and restoration projects. |
| Assessment criteria |
| The learner can: 1.1 interpret and extract information from drawings, specifications, method statements, schedules and manufacturers' information. 1.2 comply with information and/or instructions derived from risk assessments and/or method statement. 1.3 state the organisational procedures developed to report and rectify inappropriate information and unsuitable resources and how they are implemented. 1.4 describe different types of information, their source and how they are interpreted in relation to: – drawings, specifications, method statements, schedules, manufacturers' information, archaeological watching brief, historical conservation plans and charters, legislations and regulations governing buildings. |

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| Learning outcome |
| The learner will: 2. know how to comply with relevant legislation and official guidance when working on conservation and restoration projects. |
| Assessment criteria |
| The learner can: 2.1 describe their responsibilities under current legislation and official guidance whilst working: in the workplace, below ground level, in confined spaces, at height, with tools and equipment, with materials and substances, with |

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| <p>movement/storage of materials and by manual handling and mechanical lifting.</p> <p>2.2 describe the organisational security procedures for tools, equipment and personal belongings in relation to site, workplace, company and operative.</p> <p>2.3 state what the accident reporting procedures are and who is responsible for making reports.</p> |
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| <p>Learning outcome</p> <p>The learner will:</p> <p>3. maintain safe and healthy working practices when working on conservation and restoration projects</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>3.1 use health and safety control equipment and access equipment safely to carry out the activity in accordance with current legislation and organisational requirements when working on conservation and restoration projects.</p> <p>3.2 comply with information relating to specific risks to health when working on conservation and restoration projects</p> <p>3.3 explain why and when health and safety control equipment, identified by the principles of protection, should be used, relating to working on conservation and restoration projects, and the types, purpose and limitations of each type, the work situation and general work environment, in relation to:</p> <ul style="list-style-type: none"> – collective protective measures – personal protective equipment (PPE) – respiratory protective equipment (RPE) – local exhaust ventilation (LEV). <p>3.4 describe how the relevant health and safety control equipment should be used in accordance with the given instructions.</p> <p>3.5 describe how emergencies should be responded to in accordance with organisational authorisation and personal skills when involved with fires, spillages, injuries and other task-related hazards.</p> |

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| <p>Learning outcome</p> <p>The learner will:</p> <p>4. select the required quantity and quality of resources for the methods of work to work on conservation and restoration projects</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>4.1 select resources associated with own work in relation to materials, components, fixings, tools and equipment</p> <p>4.2 describe the characteristics, quality, uses, sustainability limitations and defects associated with the resources in relation to:</p> <ul style="list-style-type: none"> – conservation and restoration materials or structural components – hand and/or powered tools and equipment. <p>4.3 describe how the resources should be used correctly and how problems associated with the resources are reported.</p> <p>4.4 explain why the organisational procedures have been developed and how they are used for the selection of required resources.</p> |

- 4.5 describe any potential hazards associated with the resources and methods of work
- 4.6 describe how to calculate quantity, length, area and wastage associated with the method/procedure to work on conservation and restoration projects.

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| Learning outcome |
| The learner will: |
| 5. minimise the risk of damage to the work and surrounding area when working on conservation and restoration projects |
| Assessment criteria |
| The learner can: |
| 5.1 protect the work and its surrounding area from damage in accordance with safe working practices and organisational procedures |
| 5.2 minimise damage and maintain a clean work space |
| 5.3 dispose of waste in accordance with current legislation |
| 5.4 describe how to protect work from damage and the purpose of protection in relation to general workplace activities, other occupations and adverse weather conditions |
| 5.5 explain why the disposal of waste should be carried out safely in accordance with environmental responsibilities, organisational procedures, manufacturers' information, statutory regulations and official guidance. |

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| Learning outcome |
| The learner will: |
| 6. Complete the work within the allocated time when working on conservation and restoration projects |
| Assessment criteria |
| The learner can: |
| 6.1 demonstrate completion of the work within the allocated time |
| 6.2 state the purpose of the work programme and explain why deadlines should be kept in relation to: |
| a. types of progress charts, timetables and estimated times |
| b. organisational procedures for reporting circumstances which will affect the work programme |

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| Learning outcome |
| The learner will: |
| 7. comply with the given contract information to work on conservation and restoration projects to the required specification |
| Assessment criteria |
| The learner can: |
| 7.1 demonstrate the following work skills when working on conservation and restoration projects: |
| – measuring, marking out, adapting, aligning, applying, making good, maintaining, conserving, restoring or reinstating, finishing, positioning and securing. |
| 7.2 use specialist heritage and historical conservation/restoration skills |

to sample, select, prepare, match, maintain or repair in at least one of the following occupational areas, to given working instructions:

- roofing
- lead work
- brickwork
- earthen structure
- stonemasonry
- decoration
- plastering
- wall and floor tiling
- carpentry and joinery.

- 7.3 safely use materials, hand tools, portable power tools and ancillary equipment
- 7.4 safely store the materials, tools and equipment used when working on conservation and restoration projects
- 7.5 describe how to apply safe and healthy work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- validate appropriate ways in which the work should be carried out
 - recognise sensitive areas
 - maintain heritage and archaeological integrity
 - maintain the principles of minimum intervention and reversible alterations
 - remove deteriorated and/or inappropriate materials
 - remove and restore fabric, materials or structural components
 - repair removed fabric, materials or structural components
 - replace fabric, materials or structural components
 - repair fabric, materials or structural components in-situ
 - maintain existing structure
 - integrate existing and new constructional components or finishes
 - store salvageable fabric, materials and structural components
- 7.6 describe how to apply safe and healthy work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- stop work at the point when conjecture begins and report findings
 - record work carried out (written, photographic or digital)
 - recognise and/or report endangered/protected flora and fauna
 - use hand tools, power tools and equipment
 - work at height
 - use access equipment.
- 7.7 describe the needs of other occupations and how to effectively communicate within a team when working on conservation and restoration projects
- 7.8 describe how to maintain the tools and equipment used when working on conservation and restoration projects.

Unit 324 Working on conservation and restoration projects in the workplace

Supporting information

Guidance

This unit must be assessed in a work environment, in accordance with:

- the Additional Requirements for Qualifications using the title NVQ in RQF
- the Construction Skills' Consolidated Assessment Strategy for Construction and the Built Environment.

Assessors for this unit must have verifiable, current industry experience and a sufficient depth of relevant occupational expertise and knowledge, and must use a combination of assessment methods as defined in the Consolidated Assessment Strategy.

Workplace evidence of skills cannot be simulated.

This unit must be assessed against **one** of the following endorsements:

- Roofing/Lead work/Brickwork/Earthen structure/Stonemasonry/Decoration/Plastering/Wall and floor tiling/Carpentry and joinery/Iron/metal work/Thatching

Unit 325

Repairing, restoring, conserving, replacing or maintaining forged heritage metalwork in the workplace

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| UAN: | F/502/9968 |
| Level: | 3 |
| Credit value: | 52 |
| GLH: | 173 |
| Relationship to NOS: | COSVR621 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |

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| Learning outcome |
| The learner will: 1. interpret the given information relating to the work and resources when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork |
| Assessment criteria |
| The learner can: 1.1 interpret and extract relevant information from plans, drawings, specifications, permits, schedules, method statements and manufacturers' information 1.2 comply with information and/or instructions derived from risk assessments and method statements 1.3 state the organisational procedures developed to report and rectify inappropriate information and unsuitable resources and how they are implemented 1.4 describe different types of information, their source and how they are interpreted in relation to: plans, drawings, specifications, permits, schedules, method statements, manufacturers' information, archaeological watching brief, historical conservation plans and charters, legislation and regulations governing buildings. |

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| Learning outcome |
| The learner will: 2. know how to comply with relevant legislation and official guidance when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork. |
| Assessment criteria |

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| <p>The learner can:</p> <p>2.1 describe their responsibilities under current legislation and official guidance whilst working: in the workplace, below ground level, in confined spaces, at height, with tools and equipment, with materials and substances, with movement/storage of materials and by manual handling and mechanical lifting</p> <p>2.2 describe the organisational security procedures for tools, equipment and personal belongings in relation to site, workplace, company and operative</p> <p>2.3 explain what the accident reporting procedures are and who is responsible for making reports</p> <p>2.4 state the types of fire extinguishers available when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork and describe how and when they are used.</p> |
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| <p>Learning outcome</p> <p>The learner will:</p> <p>3. maintain safe working practices when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>3.1 use personal protective equipment (PPE), access equipment (if applicable) and perform hot works safely to carry out the activity in accordance with legislation and organisational requirements when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork</p> <p>3.2 explain why, when and how personal protective equipment (PPE) should be used, relating to repairing, restoring, conserving, replacing or maintaining forged heritage metalwork, and the types, purpose and limitations of each type</p> <p>3.3 state how emergencies should be responded to in accordance with organisational authorisation and personal skills when involved with fires, spillages, injuries and other task-related hazards.</p> |

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| <p>Learning outcome</p> <p>The learner will:</p> <p>4. select the required quantity and quality of resources for the methods of work to repair, restore, conserve, replace or maintain forged heritage metalwork</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>4.1 select resources associated with own work in relation to materials, components, consumables and fixings.</p> <p>4.2 describe the characteristics, quality, uses, sustainability, limitations and defects associated with the resources in relation to:</p> <ol style="list-style-type: none"> a. metals b. components, fixings, consumables c. protective coatings d. hand and/or powered tools and blacksmith's equipment <p>4.3 describe how the resources should be used correctly and how</p> |

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| <p>problems associated with the resources are reported</p> <p>4.4 explain why the organisational procedures have been developed and how they are used for the selection of required resources</p> <p>4.5 describe any potential hazards associated with the resources and method of work</p> <p>4.6 describe how to calculate quantity, length, area and wastage associated with the method/procedure to repair, restore, conserve, replace or maintain forged heritage metalwork.</p> |
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| Learning outcome |
| <p>The learner will:</p> <p>5. minimise the risk of damage to the work and surrounding area when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork</p> |
| Assessment criteria |
| <p>The learner can:</p> <p>5.1 protect the work and its surrounding area from damage in accordance with safe working practices and organisational procedures</p> <p>5.2 minimise damage and maintain a clean work space.</p> <p>5.3 dispose of waste in accordance with legislation</p> <p>5.4 describe how to protect work from damage and the purpose of protection in relation to general workplace activities, other occupations and adverse weather conditions</p> <p>5.5 explain why the disposal of waste should be carried out safely in accordance with environmental responsibilities, organisational procedures, manufacturers' information, statutory regulations and official guidance.</p> |

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| Learning outcome |
| <p>The learner will:</p> <p>6. complete the work within the allocated time when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork</p> |
| Assessment criteria |
| <p>The learner can:</p> <p>6.1 demonstrate completion of the work within the allocated time</p> <p>6.2 state the purpose of the work programme and explain why deadlines should be kept in relation to:</p> <ol style="list-style-type: none"> a. types of progress charts, timetables and estimated times b. organisational procedures for reporting circumstances which will affect the work programme. |

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| Learning outcome |
| <p>The learner will:</p> <p>7. comply with the given contract information to repair, restore, conserve, replace or maintain forged heritage metalwork to the required specification</p> |
| Assessment criteria |
| <p>The learner can:</p> |

- 7.1 demonstrate the following work skills when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork:
- measuring, marking out, disassembling, cutting, shaping, joining, fitting, positioning, assembling, securing and protecting
- 7.2 repair, restore, conserve, replace or maintain forged heritage metalwork to given working instructions by applying the following techniques:
- a. hot forge: drawdown, spread, upset, swage, fuller
 - b. hot form: bend, twist, dish, raise
 - c. hot cut: punch, split
 - d. join: forge weld, fasten mechanically (fixed and moveable)
 - e. fill
 - f. cold form
- 7.3 safely use and store substances, materials, hand tools, portable power tools and blacksmith's equipment.
- 7.4 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- a. assess requirements for repair, restoration, conservation, replacement or maintenance of forged heritage metalwork
 - b. validate appropriate ways in which the work should be carried out
 - c. sensitive areas
 - d. maintain heritage and archaeological integrity
 - e. maintain the principles of minimum intervention and reversible alterations
 - f. survey, label and record components
 - g. stop work at the point when conjecture begins and report findings
 - h. identify types of deterioration
 - i. identify the effects of reduced loads, changed stress regimes, strengthening and reinforcement techniques to forged heritage metalwork
- 7.5 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- a. relate equilibrium diagrams to metal types and properties
 - b. identify metal properties
 - c. heat treat
 - d. make tools
 - e. fix and fit components
 - f. hot forge: drawdown, spread, upset, swage, fuller
 - g. hot form: bend, twist, dish, raise
 - h. hot cut: punch, split
 - i. join: forge weld, fasten mechanically (fixed and moveable)
 - j. fill
 - k. cold form
 - l. clean and prepare metal
- 7.6 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- a. record the work carried out (written, photographic or digital)
 - b. recognise and/or report endangered/ protected flora and fauna

- c. pack and transport heritage metalwork
 - d. use hand tools, power tools and blacksmith's equipment
 - e. work at height
 - f. use access equipment
- 7.7 describe the needs of other occupations and how to effectively communicate within a team when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork
- 7.8 describe how to maintain the tools and equipment used when repairing, restoring, conserving, replacing or maintaining forged heritage metalwork.

Unit 326

Cleaning, preparing and protecting heritage metalwork in the workplace

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| UAN: | A/503/0049 |
| Level: | 3 |
| Credit value: | 23 |
| GLH: | 77 |
| Relationship to NOS: | COSVR622 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |

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| Learning outcome |
| The learner will: 1. interpret the given information relating to the work and resources when cleaning, preparing and protecting heritage metalwork |
| Assessment criteria |
| The learner can: 1.1 interpret and extract relevant information from plans, drawings, specifications, permits, schedules, method statements and manufacturers' information. 1.2 comply with information and/or instructions derived from risk assessments and method statements 1.3 state the organisational procedures developed to report and rectify inappropriate information and unsuitable resources and how they are implemented 1.4 describe different types of information, their source and how they are interpreted in relation to: plans, drawings, specifications, permits, schedules, method statements, manufacturers' information, archaeological watching brief, historical conservation plans and charters, legislation and regulations governing buildings. |

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| Learning outcome |
| The learner will: 2. know how to comply with relevant legislation and official guidance when cleaning, preparing and protecting heritage metalwork |
| Assessment criteria |
| The learner can: 2.1 describe their responsibilities under current legislation and official guidance whilst working: in the workplace, below ground level, in confined spaces, at height, with tools and equipment, with materials and substances, with movement/storage of materials and by manual |

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| <p>handling and mechanical lifting.</p> <p>2.2 describe the organisational security procedures for tools, equipment and personal belongings in relation to site, workplace, company and operative.</p> <p>2.3 explain what the accident reporting procedures are and who is responsible for making reports.</p> <p>2.4 state the types of fire extinguishers available when cleaning, preparing and protecting heritage metalwork in the workplace and describe how and when they are use.</p> |
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| <p>Learning outcome</p> <p>The learner will:</p> <p>3. Maintain safe working practices when cleaning, preparing and protecting heritage metalwork</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>3.1 use personal protective equipment (PPE) and access equipment (if applicable) safely to carry out the activity in accordance with legislation and organisational requirements when cleaning, preparing and protecting heritage metalwork</p> <p>3.2 explain why, when and how personal protective equipment (PPE) should be used, relating to cleaning, preparing and protecting heritage metalwork and the types, purpose and limitations of each type</p> <p>3.3 state how emergencies should be responded to in accordance with organisational authorisation and personal skills when involved with fires, spillages, injuries and other task-related hazards</p> |

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| <p>Learning outcome</p> <p>The learner will:</p> <p>4. Select the required quantity and quality of resources for the methods of work to clean, prepare and protect heritage metalwork</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>4.1 select resources associated with own work in relation to materials, components, consumables, fixings, tools and equipment.</p> <p>4.2 describe the characteristics, quality, uses, sustainability, limitations and defects associated with the resources in relation to:</p> <ol style="list-style-type: none"> a. – cleaning agents b. – fillers c. – protective coatings d. – traditional/historical primers and finishing systems e. – hand and/or powered tools and cleaning and finishing equipment. <p>4.3 describe how the resources should be used correctly and how problems associated with the resources are reported.</p> <p>4.4 explain why the organisational procedures have been developed and how they are used for the selection of required resources.</p> <p>4.5 describe any potential hazards associated with the resources and method of work.</p> <p>4.6 describe how to calculate quantity, length, area and wastage</p> |

associated with the method/procedure to clean, prepare and protect heritage metalwork.

Learning outcome

The learner will:

5. minimise the risk of damage to the work and surrounding area when cleaning, preparing and protecting heritage metalwork

Assessment criteria

The learner can:

- 5.1 protect the work and its surrounding area from damage in accordance with safe working practices and organisational procedures.
- 5.2 minimise damage and maintain a clean work space.
- 5.3 dispose of waste in accordance with legislation
- 5.4 describe how to protect work from damage and the purpose of protection in relation to general workplace activities, other occupations and adverse weather conditions.
- 5.5 explain why the disposal of waste should be carried out safely in accordance with environmental responsibilities, organisational procedures, manufacturers' information, statutory regulations and official guidance.

Learning outcome

The learner will:

6. complete the work within the allocated time when cleaning, preparing and protecting heritage metalwork

Assessment criteria

The learner can:

- 6.1 demonstrate completion of the work within the allocated time
- 6.2 state the purpose of the work programme and explain why deadlines should be kept in relation to:
 - a. types of progress charts, timetables and estimated times
 - b. organisational procedures for reporting circumstances which will affect the work programme.

Learning outcome

The learner will:

7. comply with the given contract information to clean, prepare and protect heritage metalwork to the required specification

Assessment criteria

The learner can:

- 7.1 demonstrate the following work skills when cleaning, preparing and protecting heritage metalwork:
 - a. cleaning, filling, protecting, disassembling, assembling and finishing.
- 7.2 clean, prepare and apply filling agents to heritage metalwork to given working instructions by three of the following methods:
 - a. flame clean
 - b. wire brush by hand or machine

- c. abrade by hand or machine
 - d. blast system
 - e. chemical cleaning system
 - f. fettling
 - g. degreasing
- 7.3 protect heritage metalwork to given working instructions by demonstrating two of the following techniques:
- a. – coatings by hand
 - b. – coatings by machine
 - c. – polishing
 - d. – gilding
- 7.4 safely use and store materials, substances, access equipment, hand tools, portable power tools and cleaning and finishing equipment.
- 7.5 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- a. assess the metalwork condition to identify suitable cleaning and protection processes
 - b. assess requirements for repair, restoration or maintenance of metalwork finishes and coatings
 - c. validate appropriate ways in which the work should be carried out
 - d. recognise sensitive areas
 - e. maintain heritage and archaeological integrity
 - f. maintain the principles of minimum intervention and reversible alterations
 - g. survey, label and record components
 - h. stop work at the point when conjecture begins and report findings
 - i. identify types of deterioration
- 7.6 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- a. identify metal properties
 - b. apply the principles and methods of corrosion control in ferrous and non-ferrous metals
 - c. promote sacrificial protection
 - d. prevent electrolytic and chemical corrosion
 - e. clean, prepare and apply filler to metal (flame clean, wire brush, abrade, blast, fettling and degreasing)
 - f. control contamination (the work and environment)
 - g. identify effects of atmospheric conditions on coatings and work
 - h. remove, protect and apply traditional/ historical finishes
 - i. evaluate appropriate finishing techniques and materials
 - j. apply protective coatings (by hand, machine, polish and gilding)
 - k. recognise the effects of dissimilar materials and substances
- 7.7 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
- a. recognise and/or report endangered/ protected flora and fauna
 - b. record the work carried out (written, photographic or digital)
 - c. pack and transport metalwork

- d. use hand tools, power tools and equipment
 - e. work at height
 - f. use access equipment
- 7.8 describe the needs of other occupations and how to effectively communicate within a team when cleaning, preparing and protecting heritage metalwork.
- 7.9 describe how to maintain the tools and equipment used when cleaning, preparing and protecting heritage metalwork.

Unit 326 Cleaning, preparing and protecting heritage metalwork in the workplace

Supporting information

Guidance

This unit must be assessed in a work environment, in accordance with:
-the Additional Requirements for Qualifications using the title NVQ in RQF
-the Construction Skills' Consolidated Assessment Strategy for Construction and the Built Environment.

Assessors for this unit must have verifiable, current industry experience and a sufficient depth of relevant occupational expertise and knowledge, and must use a combination of assessment methods as defined in the Consolidated Assessment Strategy.

Workplace evidence of skills cannot be simulated.

This unit must be assessed against **three** of the following endorsements:

- flame clean
- wire brush by hand or machine
- abrade by hand or machine
- blast system
- chemical cleaning system
- fettling
- degreasing.
- Plus against two of the following endorsements:
- coatings by hand
- coatings by machine
- polishing
- gilding

Unit 327

Heating, welding or soldering heritage metalwork in the workplace

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| UAN: | A/503/0102 |
| Level: | 3 |
| Credit value: | 27 |
| GLH: | 90 |
| Relationship to NOS: | COSVR623 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |

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| Learning outcome |
| The learner will: 1. interpret the given information relating to the work and resources when heating, welding or soldering heritage metalwork |
| Assessment criteria |
| The learner can: 1.1 interpret and extract relevant information from plans, drawings, specifications, permits, schedules, method statements and manufacturers' information related to the work to be carried out. 1.2 comply with information and/or instructions derived from risk assessments and method statements. 1.3 state the organisational procedures developed to report and rectify inappropriate information and unsuitable resources and how they are implemented 1.4 describe different types of information, their source and how they are interpreted in relation to: plans, drawings, specifications, permits, schedules, method statements, manufacturers' information, archaeological watching brief, historical conservation plans and charters, legislation and regulations governing buildings |

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| Learning outcome |
| The learner will: 2. know how to comply with relevant legislation and official guidance when heating, welding or soldering heritage metalwork |
| Assessment criteria |
| The learner can: 2.1 describe their responsibilities under current legislation and official guidance whilst working: in the workplace, below ground level, in confined spaces, at height, |

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| <p>with tools and equipment, with materials and substances, with movement/storage of materials and by manual handling and mechanical lifting.</p> <p>2.2 describe the organisational security procedures for tools, equipment and personal belongings in relation to site, workplace, company and operative.</p> <p>2.3 explain what the accident reporting procedures are and who is responsible for making reports.</p> <p>2.4 state the types of fire extinguishers available when heating, welding or soldering heritage metalwork and describe how and when they are used.</p> |
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| <p>Learning outcome</p> <p>The learner will:</p> <p>3. Maintain safe working practices when heating, welding or soldering heritage metalwork.</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>3.1 use personal protective equipment (PPE) and access equipment (if applicable) safely to carry out the activity in accordance with legislation and organisational requirements when heating, welding or soldering heritage metalwork.</p> <p>3.2 explain why, when and how personal protective equipment (PPE) should be used, relating to heating, welding or soldering heritage metalwork, and the types, purpose and limitations of each type.</p> <p>3.3 state how emergencies should be responded to in accordance with organisational authorisation and personal skills when involved with fires, spillages, injuries and other task-related hazards</p> |

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| <p>Learning outcome</p> <p>The learner will:</p> <p>4. Select the required quantity and quality of resources for the methods of work to heat</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>4.1 select resources associated with own work in relation to materials, components, consumables, fixings, tools and equipment</p> <p>4.2 Describe the characteristics, quality, uses, sustainability, limitations and defects associated with the resources in relation to:</p> <ol style="list-style-type: none"> a. metals b. consumables (gases, filling rods/wires) c. welding machines equipment and ancillaries d. hand and/or powered tools and heating equipment <p>4.3 describe how the resources should be used correctly and how problems associated with the resources are reported</p> <p>4.4 explain why the organisational procedures have been developed and how they are used for the selection of required resources</p> <p>4.5 describe any potential hazards associated with the resources and method of work</p> <p>4.6 describe how to calculate quantity, length, area and wastage associated with the method/procedure to heat, weld or solder</p> |

heritage metalwork.

Learning outcome

The learner will:

5. minimise the risk of damage to the work and surrounding area when heating, welding or soldering heritage metalwork

Assessment criteria

The learner can:

- 5.1 protect the work and its surrounding area from damage in accordance with safe working practices and organisational procedures.
- 5.2 minimise damage and maintain a clean work space.
- 5.3 dispose of waste in accordance with legislation.
- 5.4 describe how to protect work from damage and the purpose of protection in relation to general workplace activities, other occupations and adverse weather conditions.
- 5.5 explain why the disposal of waste should be carried out safely in accordance with environmental responsibilities, organisational procedures, manufacturers' information, statutory regulations and official guidance

Learning outcome

The learner will:

6. complete the work within the allocated time when heating welding or soldering heritage metalwork

Assessment criteria

The learner can:

- 6.1 demonstrate completion of the work within the allocated time
- 6.2 state the purpose of the work programme and explain why deadlines should be kept in relation to:
 - a. types of progress charts, timetables and estimated times
 - b. organisational procedures for reporting circumstances which will affect the work programme.

Learning outcome

The learner will:

7. comply with the given contract information to heat, weld or solder heritage metalwork to the required specification

Assessment criteria

The learner can:

- 7.1 demonstrate the following work skills when heating, welding or soldering heritage metalwork:
 - a. measuring, marking out, fitting, heating, welding, soldering, preparing, positioning securing and finishing
- 7.2 heat metalwork to given working instructions to achieve two of the following:
 - a. free components (thermal shock)
 - b. heat treat
 - c. reduce or remove rust

- d. adjust (localised/spot)
- 7.3 join wrought iron, cast iron, other ferrous metals and non-ferrous metals to given working instructions using two of the following welding and/or brazing and/or soldering techniques:
 - a. oxygen and fuel gas
 - b. manual metal arc
 - c. metal inert gas shielded or metal active gas shielded
 - d. tungsten inert gas shielded
- 7.4 carry out the work in three of the following positions:
 - a. flat
 - b. vertical/horizontal
 - c. vertical
 - d. overhead
- 7.5 safely use and store substances, materials, hand tools, portable power tools, welding and heating equipment and ancillary equipment
- 7.6 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
 - a. assess requirements for repair, restoration or the maintenance of metalwork by joining and heating
 - b. validate appropriate ways in which the work should be carried out
 - c. recognise sensitive areas
 - d. maintain heritage and archaeological integrity
 - e. maintain the principles of minimum intervention and reversible alterations
 - f. survey, label and record components
 - g. stop work at the point when conjecture begins and report findings
- 7.7 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
 - a. relate equilibrium diagrams to metal types/properties
 - b. identify metal properties
 - c. apply the principles and methods of joining and heating ferrous and non-ferrous metals
 - d. join metals by welding, soldering and brazing in all positions (flat, vertical/horizontal, vertical and overhead)
 - e. recognise join types (butt, lap, fillet, corner)
 - f. inspect joins by non-destructive testing (visual, x-ray and dye penetrates) and destructive testing (bend test, tensile, nick break and weld etch)
 - g. finish and dress joints
 - h. recognise the effects of applying heat to metals (distortion, heat affected zone)
- 7.8 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:
 - a. record the work carried out (written, photographic or digital)
 - b. recognise and/or report endangered/ protected flora and fauna
 - c. use and store fuel gases
 - d. use hand tools, power tools and equipment
 - e. work at height

f. use access equipment

7.9 describe the needs of other occupations and how to effectively communicate within a team when heating, welding or soldering heritage metalwork

7.10 describe how to maintain the tools and equipment used when heating, welding or soldering heritage metalwork.

Unit 327 Heating, welding or soldering heritage metalwork in the workplace

Supporting information

Guidance

This unit must be assessed in a work environment, in accordance with:
-the Additional Requirements for Qualifications using the title NVQ in RQF
-the Construction Skills' Consolidated Assessment Strategy for Construction and the Built Environment.

Assessors for this unit must have verifiable, current industry experience and a sufficient depth of relevant occupational expertise and knowledge, and must use a combination of assessment methods as defined in the Consolidated Assessment Strategy. Workplace evidence of skills cannot be simulated.

This unit must be assessed against **two** of the following endorsements:
Free components (thermal shock), Heat treat, Reduce or remove rust or Adjust (localised/spot)

Plus **two** of the following:
Oxygen and fuel gas, Manual metal arc, Metal inert gas shielded or metal active gas shielded or Tungsten inert gas shielded

Plus **three** of the following:
Flat, Vertical/horizontal, Vertical or Overhead.

Unit 328

Thermal cutting metal for heritage work in the workplace

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| UAN: | D/503/0089 |
| Level: | 3 |
| Credit value: | 14 |
| GLH: | 47 |
| Relationship to NOS: | COSVR624 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |

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| Learning outcome |
| The learner will: 1. interpret the given information relating to the work and resources when thermal cutting metal for heritage work |
| Assessment criteria |
| The learner can: 1.1 interpret and extract relevant information from plans, drawings, specifications, permits, schedules, method statements and manufacturers' information. 1.2 comply with information and/or instructions derived from risk assessments and method statements. 1.3 state the organisational procedures developed to report and rectify inappropriate information and unsuitable resources and how they are implemented. 1.4 describe different types of information, their source and how they are interpreted in relation to: plans, drawings, specifications, permits, schedules, method statements, manufacturers' information, archaeological watching brief, historical conservation plans and charters, legislation and regulations governing buildings. |

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| Learning outcome |
| The learner will: 2. know how to comply with relevant legislation and official guidance when thermal cutting metal for heritage work |
| Assessment criteria |
| The learner can: 2.1 describe their responsibilities under current legislation and official guidance whilst working: |

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| <p>in the workplace, below ground level, in confined spaces, at height, with tools and equipment, with materials and substances, with movement/storage of materials and by manual handling and mechanical lifting.</p> <p>2.2 describe the organisational security procedures for tools, equipment and personal belongings in relation to site, workplace, company and operative.</p> <p>2.3 explain what the accident reporting procedures are and who is responsible for making reports.</p> <p>2.4 state the types of fire extinguishers available when thermal cutting metal for heritage work and describe how and when they are used.</p> |
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| <p>Learning outcome</p> <p>The learner will:</p> <p>3. maintain safe working practices when thermal cutting metal for heritage work</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>3.1 use personal protective equipment (PPE) and access equipment (if applicable) safely to carry out the activity in accordance with legislation and organisational requirements when thermal cutting metal for heritage work.</p> <p>3.2 explain why, when and how personal protective equipment (PPE) should be used, relating to thermal cutting metal for heritage work, and the types, purpose and limitations of each type.</p> <p>3.3 state how emergencies should be responded to in accordance with organisational authorisation and personal skills when involved with fires, spillages, injuries and other task-related hazards.</p> |

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| <p>Learning outcome</p> <p>The learner will:</p> <p>4. select the required quantity and quality of resources for the methods of work to thermal cut metal for heritage work.</p> |
| <p>Assessment criteria</p> <p>The learner can:</p> <p>4.1 select resources associated with own work in relation to materials, components, consumables, fixings, tools and equipment.</p> <p>4.2 describe the characteristics, quality, uses, sustainability, limitations and defects associated with the resources in relation to:</p> <ol style="list-style-type: none"> a. thermal cutting equipment b. thermal cutting consumables c. hand and/or powered tools and equipment <p>4.3 describe how the resources should be used correctly and how problems associated with the resources are reported</p> <p>4.4 explain why the organisational procedures have been developed and how they are used for the selection of required resources</p> <p>4.5 describe any potential hazards associated with the resources and method of work</p> <p>4.6 describe how to calculate quantity, length, area and wastage associated with the method/procedure to thermal cut metal for heritage work.</p> |

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| Learning outcome |
| The learner will: 5. minimise the risk of damage to the work and surrounding area when thermal cutting metal for heritage work |
| Assessment criteria |
| The learner can: 5.1 protect the work and its surrounding area from damage in accordance with safe working practices and organisational procedures. 5.2 minimise damage and maintain a clean work space. 5.3 dispose of waste in accordance with legislation. 5.4 describe how to protect work from damage and the purpose of protection in relation to general workplace activities, other occupations and adverse weather conditions. 5.5 explain why the disposal of waste should be carried out safely in accordance with environmental responsibilities, organisational procedures, manufacturers' information, statutory regulations and official guidance. |

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| Learning outcome |
| The learner will: 6. complete the work within the allocated time when thermal cutting metal for heritage work |
| Assessment criteria |
| The learner can: 6.1 demonstrate completion of the work within the allocated time. 6.2 state the purpose of the work programme and explain why deadlines should be kept in relation to: a. types of progress charts, timetables and estimated times b. organisational procedures for reporting circumstances which will affect the work programme. |

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| Learning outcome |
| The learner will: 7. complete the work within the allocated time when thermal cutting metal for heritage work |
| Assessment criteria |
| The learner can: 7.1 demonstrate the following work skills when thermal cutting metal for heritage work: a. measuring, marking out, positioning, cutting, securing and finishing 7.2 cut metals by thermal means to given working instructions, using one of the following techniques: a. oxygen and fuel gas b. – plasma arc 7.3 safely use and store substances, materials, hand tools, portable power tools, thermal cutting equipment and ancillaries 7.4 describe how to apply safe work practices, follow procedures, report |

problems and establish the authority needed to rectify them, to:

- a. validate appropriate ways in which the work should be carried out
- b. recognise sensitive areas
- c. maintain heritage and archaeological integrity
- d. maintain the principles of minimum intervention and reversible alterations
- e. survey, label and record components
- f. stop work at the point when conjecture begins and report findings
- g. relate equilibrium diagrams to metal types and properties
- h. identify metal properties
- i. pre-heat in order to cut metals
- j. recognise the effects of applying heat to metals (distortion, heat effected zone)
- k. clean and prepare cut metal (remove dross)

7.5 describe how to apply safe work practices, follow procedures, report problems and establish the authority needed to rectify them, to:

- a. record the work carried out (written, photographic or digital)
- b. recognise and/or report endangered/ protected flora and fauna
- c. use gases and thermal cutting equipment to cut metals (oxygen and fuel gases and plasma arc methods)
- d. use hand tools, power tools and equipment
- e. work at height
- f. use access equipment

7.6 describe the needs of other occupations and how to effectively communicate within a team when thermal cutting metal for heritage work

7.7 describe how to maintain the tools and equipment used when thermal cutting metal for heritage work.

Unit 328 Thermal cutting metal for heritage work in the workplace

Supporting information

Guidance

This unit must be assessed in a work environment, in accordance with:
-the Additional Requirements for Qualifications using the title NVQ in RQF
-the Construction Skills' Consolidated Assessment Strategy for
Construction and the Built Environment.

Assessors for this unit must have verifiable, current industry experience
and a sufficient depth of relevant occupational expertise and knowledge,
and must use a combination of assessment methods as defined in the
Consolidated Assessment Strategy.

Workplace evidence of skills cannot be simulated.

This unit must be assessed against one of the following endorsements:

- Oxygen and fuel gas
- Plasma arc.

Unit 329

Using machine tools to shape components by material removal in blacksmithing

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| UAN: | L/505/9975 |
| Level: | 3 |
| Credit value: | 32 |
| GLH: | 111 |
| Endorsement by a sector or regulatory body: | Creative and Cultural Skills (CCSkills) |
| Aim | The aim of this unit is to give the student a practical and theoretical understanding of milling and lathe work for blacksmithing. |

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| Learning outcome |
| The learner will: 1. understand roles and responsibilities when operating machine tools |
| Assessment criteria |
| The learner can: 1.1 Explain the roles and responsibilities when operating blacksmithing machine tools |

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| Range |
| Responsibilities The specifications to which you will be expected to work, ensuring the care and security of tools and equipment, measuring and recording pro forma, reporting lines and procedures in your working environment. |

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| Learning outcome |
| The learner will: 2. be able to carry out blacksmithing machining operations |
| Assessment criteria |
| The learner can: 2.1 Set up and carry out blacksmithing machining operations 2.2 Carry out blacksmithing machining operations accurately to quality standards and specification 2.3 Carry out quality check operations 2.4 Machine a range of materials |

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| <p>Range</p> |
| <p>Set up</p> <ul style="list-style-type: none"> • Machine • Cutting tools (to include sharpening as appropriate) • Materials <p>Operations</p> <p>Lathing</p> <ul style="list-style-type: none"> • Facing • Parting • Turning • Drilling • Boring • Thread cutting • Taper turning • Knurling <p>Milling</p> <ul style="list-style-type: none"> • Slotting • Surfacing • Face milling • Drilling/boring • Chamfering <p>Specification</p> <ul style="list-style-type: none"> • Correct to customer's request (or specification) • Finished to drawing tolerances <p>Quality check</p> <ul style="list-style-type: none"> • Measurement and recording in pro formas • Use of quarantine area • Checks against drawings and/or specification • Checks against samples and/or templates • Tracking materials <p>Materials</p> <ul style="list-style-type: none"> • Ferrous • Non ferrous metals • Composites • Plastics • Natural |

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| <p>Learning outcome</p> |
| <p>The learner will:</p> <p>3. understand the set up and operation of blacksmithing machine tools</p> |
| <p>Assessment criteria</p> |
| <p>The learner can:</p> <p>3.1 Explain types of blacksmithing machine tools used to shape components by material removal</p> <p>3.2 Explain types and set up of lathe and mill cutting tools</p> |

- 3.3 describe **materials** used for lathe and mill cutting tools
3.4 explain **material set up methods**
3.5 explain lathing and milling **machining operations**.

Range

Machine tool

- Lathe (Centre)
- Mill (Vertical and/or Horizontal)

Types

Lathe

- Parting
- Finishing
- Roughing
- Boring bars
- Knife tools
- Point tools
- Profile
- Centre drill

Mill

- End mills
- Slot mills
- Face mills
- Radius mills
- Dove tail cutter
- Profile

Set up

- Tool Holders
- Set up of the correct tools required for the job
- Cutting speeds plus feed
- Cutting angles
- Assess the condition of tools
- Tool replacement and sharpening
- Cutting fluids

Materials

- Tungsten Carbide tipped
- High speed steel (HSS)
- Ceramic
- Tool steel

Material set up methods

- Securing work (mechanical. magnetic)
- Measuring methods
- Centering, leveling, aligning.
- Lathe (face plate, 3&4 Jaw chuck, centers, steady's)
- Mill (indexing units and rotary tables, angle plates, 'V' blocks, machine vice)
- Safety guards in place

- Machinist guidance tables
- Cooling/lubrication systems
- Machine operated shaping methods and techniques

Machining operations

Lathing

- Facing
- Parting
- Turning
- Drilling
- Boring
- Thread cutting
- Taper turning
- Offset
- Knurling

Milling

- Slotting
- Surfacing
- Face milling
- Drilling/boring
- Dove tailing
- Chamfering.

Unit 329 Using machine tools to shape components by material removal in blacksmithing

Supporting information

Guidance

Guidance point 2.1 – Candidates must demonstrate machining operations on at least one type of machining operation; **either** Lathe (centre) **or** Miller (Horizontal and/or vertical). For lathing at least **five** of the ranged operation types must be carried out and or milling at least **four** of the ranged operation types must be carried out.

Guidance point 2.3 – Candidates must carry out at least **two** of the ranged quality checks

Guidance point 2.4 – Candidate must machine at least **three** of the ranged materials



Appendix 1 Relationships to other qualifications

Links to other qualifications

Mapping is provided as guidance and suggests areas of commonality between the qualifications. It does not imply that candidates completing units in one qualification have automatically covered all of the content of another.

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications.

These qualifications have connections to the:

- 7168 Level 3 Diploma in Craft Skills for Creative Industries
- 2850 Level 2 Certificate/Diploma in Engineering
- 1788 Level 3 Extended Diplomas in Engineering

Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see www.cityandguilds.com/functionalskills
- Essential Skills (Northern Ireland) – see www.cityandguilds.com/essentialskillsni
- Essential Skills Wales – see www.cityandguilds.com/esw



Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on www.cityandguilds.com.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information on such things as:

- **Walled Garden:** how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment:** how to register for e-assessments.

City & Guilds
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www.cityandguilds.com

Useful contacts

| | |
|---|---|
| UK learners General qualification information | T: +44 (0)844 543 0033 E: learnersupport@cityandguilds.com |
| International learners General qualification information | T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: intcg@cityandguilds.com |
| Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results | T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: centresupport@cityandguilds.com |
| Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change | T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: singlesubjects@cityandguilds.com |
| International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports | T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: intops@cityandguilds.com |
| Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems | T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: walledgarden@cityandguilds.com |
| Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy | T: +44 (0)121 503 8993 E: business@cityandguilds.com |
| Publications Logbooks, Centre documents, Forms, Free literature | T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 |

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About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Licence to Practice (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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