QUALIFICATION HANDBOOK

Level 2 NVQ Diploma in Fabrication and Welding (1781-20-28)

September 2011 Version 1.0

City & Guilds

Qualification at a glance

Subject area	Fabrication and welding engineering
City & Guilds number	1781
Age group approved	16+
Entry requirements	None
Assessment	Portfolio of evidence
Automatic Approval	Available
Support materials	Centre handbook
Registration/ certification dates	See City & Guilds website for details

Title and level	City & Guilds number	Accreditation number
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Manual Welding	1781-20	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Welding Machine Operating	1781-21	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Brazing and Soldering	1781-22	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Sheet Metalwork (3mm or less)	1781-23	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Plateworker (3mm upwards)	1781-24	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Structural Steelwork	1781-25	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Pipework Fabrication	1781-26	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Composite Fabrication	1781-27	600/2095/7
Level 2 NVQ Diploma in Fabrication and Welding Engineering – Thermal Cutting	1781-28	600/2095/7

Contents

1 Introduction

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

Area	Description
Who are the qualifications for?	For candidates who work or want to work as fabrication and welding engineering in the engineering sector
What do the qualifications cover?	Allow candidates to learn, develop and practise the skills required for employment and/or career progression in the fabrications and welding engineering sector.
Are the qualifications part of a framework or initiative?	Serve as competence qualifications, in the Engineering Apprenticeship framework.
What opportunities for progression are there?	Allow candidates to progress into employment or to the following City & Guilds qualifications: • Level 3 NVQ Diploma in Fabrication and Welding Engineering • Level 3 NVQ Extended Diploma in Fabrication and Welding Engineering

Structure

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Manual Welding

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Manual Welding, learners must achieve 15 credits from the mandatory units and a minimum of 44 credits from the optional units available.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Manual Welding

Unit accreditation number	City & Guilds unit number	Unit title	Credit value
Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5

Optional			
F/601/1447	204	Joining materials by the manual metal arc welding process	54
J/601/1451	205	Joining materials by the manual MIG/MAG and other continuous wire processes	54
K/601/1457	206	Joining materials by the manual TIG and plasma-arc welding processes	54
T/601/1459	207	Joining materials by the manual gas welding process	50
L/601/1466	208	Producing fillet welded joints using a manual welding process	44

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Welding Machine Operating

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Welding Machine Operating, learners must achieve 15 credits from the mandatory units and a minimum of 35 credits from the optional units available.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Welding Machine Operating

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
Optional			
Y/601/1471	209	Welding materials with mechanised arc welding equipment	37
Y/601/1485	210	Welding materials using resistance spot, seam and projection welding machines	35
H/601/1490	211	Welding materials using laser welding machines	37
T/601/1493	212	Welding materials using electron beam welding machines	37
R/601/1498	213	Welding materials using friction welding machines	35

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Brazing and Soldering

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Brazing and Soldering, learners must achieve 50 credits from the mandatory units.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Brazing and Soldering

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
H/601/1912	217	Joining materials by manual torch brazing and soldering	35

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Sheet Metalwork (3mm or less)

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Sheet Metalwork (3mm or less), learners must achieve 15 credits from the mandatory units and a minimum of 25 credits from at least 2 units from optional group A and a minimum of 7 credits from optional group B.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Sheet Metalwork (3mm or less)

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
Optional Group A			
J/601/1921	221	Marking out components for fabrication	15
Y/601/1924	222	Cutting sheet metal to shape using hand and machine tools	28
D/601/1925	223	Forming sheet metal using hand and machine tools	28
M/601/1931	224	Producing sheet metal assemblies	35
F/601/1934	225	Heat treating materials for fabrication activities	10
R/601/1937	226	Cutting and shaping materials using NC/CNC laser profiling machines	37
J/601/1949	227	Cutting and shaping using NC/CNC plasma or gas cutting machines	37
Optional Group B			
J/601/1451	205	Joining materials by the manual MIG/MAG and other continuous wire processes	54
K/601/1457	206	Joining materials by the manual TIG and plasma-arc welding processes	54
T/601/1459	207	Joining materials by the manual gas welding process	50
F/601/1951	228	Assembling components using mechanical fasteners	18
H/601/1960	229	Bonding engineering materials using adhesives	14
J/601/1966	230	Joining materials by resistance spot welding	7
Y/601/1969	231	Slinging, lifting and moving materials and components	14

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Plateworker (3mm upwards)

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Plateworker (3mm upwards), learners must achieve 30 credits from the mandatory units and a minimum of 13 credits from optional group A, a minimum of 10 credits from optional group B and a minimum of 14 credits from optional group C.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Plateworker (3mm upwards)

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
J/601/1921	221	Marking out components for fabrication	15
Optional Group A			
R/601/1937	226	Cutting and shaping materials using NC/CNC laser profiling machines	37
J/601/1949	227	Cutting and shaping using NC/CNC plasma or gas cutting machines	37
D/601/1973	232	Cutting plate and sections using shearing machines	21
A/601/1978	233	Cutting materials using hand operated thermal cutting equipment	28
K/601/1992	234	Cutting and shaping materials using gas cutting machines	28
M/601/1993	235	Cutting materials using saws and abrasive discs	13
Optional Group B			
F/601/1996	236	Bending and forming plate using power operated machines	28
J/601/1997	237	Forming platework using power rolling machines	28
L/601/1998	238	Producing platework assemblies	30
R/601/1999	239	Producing holes using drilling machines	10
Optional Group C			
L/601/1466	208	Producing fillet welded joints using a manual welding process	44
Y/601/1471	209	Welding materials with mechanised arc welding equipment	37
F/601/1951	228	Assembling components using mechanical fasteners	18
Y/601/1969	231	Slinging, lifting and moving materials and components	14

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Structural Steelwork

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Structural Steelwork, learners must achieve 30 credits from the mandatory units and a minimum of 13 credits from optional group A and a minimum of 24 credits from at least 2 units from optional group B.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Structural Steelwork

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
J/601/1921	221	Marking out components for fabrication	15
Optional Group A			
D/601/1973	232	Cutting plate and sections using shearing machines	21
A/601/1978	233	Cutting materials using hand operated thermal cutting equipment	28
K/601/1992	234	Cutting and shaping materials using gas cutting machines	28
M/601/1993	235	Cutting materials using saws and abrasive discs	13
Optional Group B			
L/601/1466	208	Producing fillet welded joints using a manual welding process	44
Y/601/1471	209	Welding materials with mechanised arc welding equipment	37
F/601/1951	228	Assembling components using mechanical fasteners	18
Y/601/1969	231	Slinging, lifting and moving materials and components	14
R/601/1999	239	Producing holes using drilling machines	10
F/601/2002	240	Forming structural sections using machines	35
R/601/2005	241	Producing structural steel ancillary components	24
D/601/2007	242	Assembling structural steelwork	35

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Pipework Fabrication

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Pipework Fabrication, learners must achieve 30 credits from the mandatory units and a minimum of 13 credits from optional group A and a minimum of 24 credits from at least 2 units from optional group B.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Pipework Fabrication

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
J/601/1921	221	Marking out components for fabrication	15
Optional Group A			
A/601/1978	233	Cutting materials using hand operated thermal cutting equipment	28
K/601/1992	234	Cutting and shaping materials using gas cutting machines	28
M/601/1993	235	Cutting materials using saws and abrasive discs	13
Optional Group B			
F/601/1951	228	Assembling components using mechanical fasteners	18
H/601/1960	229	Bonding engineering materials using adhesives	14
R/601/1999	239	Producing holes using drilling machines	10
D/601/2010	243	Forming pipework by machine bending	35

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Composite Fabrication

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Composite Fabrication, learners must achieve 15 credits from the mandatory units and a minimum of 46 credits from at least 2 units from the optional units available.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Composite Fabrication

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5

Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
Optional			
A/601/2015	245	Producing composite mouldings using wet lay-up techniques	42
D/601/2038	246	Producing composite mouldings using pre-preg laminating techniques	42
D/601/2041	247	Produce components by acrylic moulding	32
F/601/2047	248	Vacuum forming composite materials	32
D/601/2055	249	Trimming composite mouldings using hand tools	32
A/601/2063	250	Identifying defects in composite mouldings	23
Y/601/2068	251	Applying surface finishes to composite mouldings	32
R/601/2070	252	Bonding composite mouldings	23
H/601/2073	253	Producing composite assemblies	42

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Thermal Cutting

To achieve the Level 2 NVQ Diploma in Fabrication and Welding Engineering – Thermal Cutting, learners must achieve 15 credits from the mandatory units and a minimum of 56 credits from at least 2 units from the optional units available.

Level 2 NVQ Diploma in Fabrication and Welding Engineering – Thermal Cutting

Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
Y/601/5052	203	Working efficiently and effectively in engineering	5
Optional			
R/601/1937	226	Cutting and shaping materials using NC/CNC laser profiling machines	37
J/601/1949	227	Cutting and shaping using NC/CNC plasma or gas cutting machines	37
A/601/1978	233	Cutting materials using hand operated thermal cutting equipment	28
K/601/1992	234	Cutting and shaping materials using gas cutting machines	28

2 Centre requirements

Approval

If your Centre is approved to offer the qualification Level 2 NVQ Diploma in Fabrication and Welding Engineering (1681-21-31) you will receive automatic approval for the new Level 2 NVQ Diploma in Fabrication and Welding Engineering (1781-20-28).

To offer these 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 qualifications before designing a course programme.

Resource requirements

Centre staffing

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

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

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but must never internally verify their own assessments.

Assessors and internal verifiers

Assessor Requirements to Demonstrate Effective Assessment Practice

Assessment must be carried out by competent Assessors that as a minimum must hold the QCF Level 3 Award in Assessing Competence in the Work Environment**.** Current and operational

Assessors that hold units D32 and/or D33 or A1 and/or A2 as appropriate to the assessment being carried out, will not be required to achieve the QCF Level 3 Award as they are still appropriate for the assessment requirements set out in this Unit Assessment Strategy. However, they will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace assessment to the most up to date National Occupational Standards (NOS).

Assessor Technical Requirements

Assessors must be able to demonstrate that they have verifiable, relevant and sufficient technical competence to evaluate and judge performance and knowledge evidence requirements as set out in the relevant QCF unit learning outcomes and associated assessment criteria.

This will be demonstrated either by holding a relevant technical qualification or by proven industrial experience of the technical areas to be assessed. The assessor's competence must, at the very least, be at the same level as that required of the learner(s) in the units being assessed.

Assessors must also be:

Fully conversant with the City & Guilds assessment recording documentation used for the QCF NVQ units against which the assessments and verification are to be carried out, other relevant documentation and system and procedures to support the QA process.

Verifier Requirements (internal and external)

Internal quality assurance (Internal Verification) must be carried out by competent Verifiers that as a minimum must hold the QCF Level 4 Award in the Internal Quality Assurance of Assessment Processes and Practices. Current and operational Internal Verifiers that hold internal verification units V1 or D34 will not be required to achieve the QCF Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the QCF Level 3 Award in Assessing Competence in the Work Environment

External quality assurance **(External Verification)** must be carried out by competent External Verifiers that as a minimum must hold the QCF Level 4 Award in the External Quality Assurance of Assessment Processes and Practices**.** Current and operational External Verifiers that hold external verification units V2 or D35 will not be required to achieve the QCF Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy.

Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the QCF Level 3 Award in Assessing Competence in the Work Environment External and Internal Verifiers will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace Quality Assurance (verification) of Assessment Processes and Practices to the most up to date National Occupational Standards (NOS)

Verifiers, both Internal and External, will also be expected to be fully conversant with the terminology used in the QCF NVQ units against which the assessments and verification are to be carried out, the City & Guilds systems and procedures and the relevant City & Guilds documentation, systems and procedures within which the assessment and verification is taking place.

Continuing professional development (CPD)
Centres are expected to support their staff in ensuring that their knowledge remains current of the occupational area and of best practice in delivery, mentoring, training, assessment and verification, and that it takes account of any national or legislative developments.

2.1 Candidate entry requirements

Candidates should not be entered for a qualification of the same type, content and level as that of a qualification they already hold.

There are no formal entry requirements for candidates undertaking these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.

The SEMTA Engineering Manufacture apprenticeship framework suggests that:

Employers would be interested in candidates that:

- Are keen and motivated to work in an engineering environment
- Are willing to undertake a course of training both on-the-job and off-the-job and apply this learning in the workplace
- Have previous work experience or employment in the sector
- Have completed a 14 to 19 Diploma in Engineering or Manufacturing
- Have completed a Young Apprenticeship in Engineering or other related area
- Have GCSEs in English, Maths and Science
- Have completed tests in basic numeracy, literacy and communication skills and have spatial awareness.

As a guide, the Engineering Manufacturing framework is suitable for applicants who have five GCSEs grades D to E in English, Maths and Science. The selection process on behalf of employers may include initial assessment where applicants will be asked if they have any qualifications or experience that can be accredited against the requirements of the apprenticeship. They may also be required to take tests in basic numeracy and literacy, communications skills and spatial awareness. There may also be an interview to ensure applicants have selected the right occupational sector and are motivated to become an apprentice, as undertaking an apprenticeship is a major commitment for both the individual and the employer.'

Assessment Environment (extract from SEMTA QCF Unit Assessment Strategy 1 January 2011)

The evidence put forward for this qualification can only be regarded valid, reliable, sufficient and authentic if achieved and obtained in the working environment and be clearly attributable to the learner. However, in certain circumstances, simulation/replication of work activities may be acceptable.

- The use of high quality, realistic simulations/replication, which impose pressures which are consistent with workplace expectations, should only be used in relation to the assessment of the following:-

- rare or dangerous occurrences, such as those associated with health, safety and the environment issues, emergency scenarios and rare operations at work;
- the response to faults and problems for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence;
- aspects of working relationships and communications for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence.

Simulations/replications will require prior approval from centres City & Guilds external verifier/qualification consultant and should be designed in relation to the following parameters: -

- the environment in which simulations take place must be designed to match the characteristics of the working environment;
- competencies achieved via simulation/replication must be transferable to the working environment
- simulations which are designed to assess competence in dealing with emergencies, accidents and incidents must be verified as complying with relevant health, safety and environmental legislation by a competent health and safety/environmental control officer before being used;
- simulated activities should place learners under the same pressures of time, access to resources and access to information as would be expected if the activity was real;
- simulated activities should require learners to demonstrate their competence using plant and/or equipment used in the working environment;
- simulated activities which require interaction with colleagues and contacts should require the learner to use the communication media that would be expected at the workplace;
- for health and safety reason simulations need not involve the use of genuine substances/materials. Any simulations which require the learner to handle or otherwise deal with materials substances/should ensure that the substitute take the same form as in the workplace.

Age restrictions

City & Guilds cannot accept any registrations for candidates under 16 as these qualifications are not approved for under 16s.

Legal restrictions apply to candidates under the age of 18 working unsupervised with children. Centres and candidates should be fully aware of minimum age requirements in their home nation and any implications for completing assessments.

3 Delivering the qualification

Initial assessment and induction

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

- if the candidate 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 candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Recommended delivery strategies

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

Centres may design course programmes of study in any way which:

- best meets the needs and capabilities of their candidates
- satisfies the requirements of the qualifications.

When designing and delivering the course programme, centres might wish to incorporate other teaching and learning that is not assessed as part of the qualifications. This might include the following:

- literacy, language and/or numeracy
- personal learning and thinking
- personal and social development
- employability

Where applicable, this could involve enabling the candidate to access relevant qualifications covering these skills.

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems. Further details are available at: **www.cityandguilds.com/eportfolios**.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate.

Recording forms are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre.

Amendable (MS Word) versions of the forms are available on the City & Guilds website.

4 Assessment

Assessment of the qualification

Candidates must:

- have a completed portfolio of evidence for each unit chosen

Time constraints

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

- Candidates must finish their assessment within the period of registration

Evidence requirements

Carrying Out Assessment

The NVQ units were specifically developed to cover a wide range of activities. The evidence produced for the units will, therefore, depend on the learners choice of “bulleted items” listed in the unit assessment criteria.

Where the assessment criteria gives a choice of bulleted items (for example ‘any three from five’), assessors should note that learners do not need to provide evidence of the other items to complete the unit (in this example, two) items, particularly where these additional items may relate to other activities or methods that are not part of the learners normal workplace activity or area of expertise.

Minimum Performance Evidence Requirements

Performance evidence must be the main form of evidence gathered. In order to demonstrate consistent, competent performance for a unit, a minimum of 3 different examples of performance must be provided, and must be sufficient to show that the assessment criteria have been achieved to the prescribed standards. It is possible that some of the bulleted items in the assessment criteria may be covered more than once. The assessor and learner need to devise an assessment plan to ensure that performance evidence is sufficient to cover all the specified assessment criteria and which maximises the opportunities to gather evidence. Where applicable, performance evidence maybe used for more than one unit.

The most effective way of assessing competence, is through direct observation of the learner.

Assessors must make sure that the evidence provided reflects the learner’s competence and not just the achievement of a training programme.

Evidence that has been produced from team activities, for example, maintenance or installation activities is only valid when it clearly relates to the learners specific and individual contribution to the activity, and not to the general outcome(s).

Each example of performance evidence will often contain features that apply to more than one unit, and can be used as evidence in any unit where appropriate.

Performance evidence must be a combination of:

- outputs of the learner's work, such as items that have been manufactured, installed, maintained, designed, planned or quality assured, and documents produced as part of a work activity together with:
- evidence of the way the learner carried out the activities such as witness testimonies, assessor observations or authenticated learner reports, records or photographs of the work/activity carried out, etc.

Competent performance is more than just carrying out a series of individual set tasks. Many of the units contain statements that require the learner to provide evidence that proves they are capable of combining the various features and techniques. Where this is the case, separate fragments of evidence would not provide this combination of features and techniques and will not, therefore, be acceptable as demonstrating competent performance.

If there is any doubt as to what constitutes valid, authentic and reliable evidence, the internal and/or external verifier should be consulted.

Assessing knowledge and understanding

Knowledge and understanding are key components of competent performance, but it is unlikely that performance evidence alone will provide enough evidence in this area. Where the learners knowledge and understanding (and the handling of contingency situations) is not apparent from performance evidence, it must be assessed by other means and be supported by suitable evidence.

Knowledge and understanding can be demonstrated in a number of different ways. Semta expects oral questioning and practical demonstrations to be used, as these are considered the most appropriate for these units. Assessors should ask enough questions to make sure that the learner has an appropriate level of knowledge and understanding, as required by the unit.

Evidence of knowledge and understanding will **not** be required for those bulleted items in the assessment criteria that have not been selected by the learner.

The achievement of the specific knowledge and understanding requirements of the units cannot simply be inferred by the results of tests or assignments from other units, qualifications or training programmes. Where evidence is submitted from these sources, the assessor must, as with any assessment, make sure the evidence is valid, reliable, authentic, directly attributable to the learner, and meets the full knowledge and understanding requirements of the unit.

Where oral questioning is used the assessor must retain a record of the questions asked, together with the learner's answers.

Witness testimony

Where observation is used to obtain performance evidence, this must be carried out against the unit assessment criteria. Best practice would require that such observation is carried out by a qualified Assessor. If this is not practicable, then alternative sources of evidence may be used.

For example, the observation may be carried out against the assessment criteria by someone else that is in close contact with the learner. This could be a team leader, supervisor, mentor or line manager who may be regarded as a suitable witness to the learner's competency. However, the witness must be technically competent in the process or skills that they are providing testimony for, to at least the same level of expertise as that required of the learner. It will be the responsibility of the assessor to make sure that any witness testimonies accepted as evidence of the learner's competency are reliable, auditable and technically valid.

Recognition of Prior Learning

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 and is also sector specific.

5 Units

Availability of units

The following units can also be obtained from The Register of Regulated Qualifications: **http://register.ofqual.gov.uk/Unit**

Structure of units

These units each have the following:

- City & Guilds reference number
- unit accreditation number
- title
- level
- credit value
- unit aim
- relationship to NOS, other qualifications and frameworks
- endorsement by a sector or other appropriate body
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria.

Summary of units

Unit Number	Unit title	Credits	QCF unit number (UAN)
201	Complying with statutory regulations and organisational safety requirements	5	A/601/5013
202	Using and interpreting engineering data and documentation	5	Y/601/5102
203	Working efficiently and effectively in engineering	5	Y/601/5052
204	Joining materials by the manual metal arc welding process	54	F/601/1447
205	Joining materials by the manual MIG/MAG and other continuous wire processes	54	J/601/1451
206	Joining materials by the manual TIG and plasma-arc welding processes	54	K/601/1457
207	Joining materials by the manual gas welding process	50	T/601/1457

208	Producing fillet welded joints using a manual welding process	44	L/601/1466
209	Welding materials with mechanised arc welding equipment	37	Y/601/1471
210	Welding materials using resistance spot, seam and projection welding machines	35	Y/601/1485
211	Welding materials using laser welding machines	37	H/601/1490
212	Welding materials using electron beam welding machines	37	T/601/1493
213	Welding materials using friction welding machines	35	R/601/1498
217	Joining materials by manual torch brazing and soldering	35	H/601/1912
221	Marking out components for fabrication	15	J/601/1921
222	Cutting sheet metal to shape using hand and machine tools	28	Y/601/1924
223	Forming sheet metal using hand and machine tools	28	D/601/1925
224	Producing sheet metal assemblies	35	M/601/1931
225	Heat treating materials for fabrication activities	10	F/601/1934
226	Cutting and shaping materials using NC/CNC laser profiling machines	37	R/601/1937
227	Cutting and shaping using NC/CNC plasma or gas cutting machines	37	J/601/1949
228	Assembling components using mechanical fasteners	18	F/601/1951
229	Bonding engineering materials using adhesives	14	H/601/1960
230	Joining materials by resistance spot welding	7	J/601/1966
231	Slinging, lifting and moving materials and components	14	Y/601/1969
232	Cutting plate and sections using shearing machines	21	D/601/1973
233	Cutting materials using hand operated thermal cutting equipment	28	A/601/1978
234	Cutting and shaping materials using gas cutting machines	28	K/601/1992
235	Cutting materials using saws and abrasive discs	13	M/601/1993
236	Bending and forming plate using power operated machines	28	F/601/1996

237	Forming platework using power rolling machines	28	J/601/1997
238	Producing platework assemblies	30	L/601/1998
239	Producing holes using drilling machines	10	R/601/1999
240	Forming structural sections using machines	35	F/601/2002
241	Producing structural steel ancillary components	24	R/601/2005
242	Assembling structural steelwork	35	D/601/2007
243	Forming pipework by machine bending	35	D/601/2010
245	Producing composite mouldings using wet lay-up techniques	42	A/601/2015
246	Producing composite mouldings using pre-preg laminating techniques	42	D/601/2038
247	Produce components by acrylic moulding	32	D/601/2041
248	Vacuum forming composite materials	32	F/601/2047
249	Trimming composite mouldings using hand tools	32	D/601/2055
250	Identifying defects in composite mouldings	23	A/601/2063
251	Applying surface finishes to composite mouldings	32	Y/601/2068
252	Bonding composite mouldings	23	R/601/2070
253	Producing composite assemblies	42	H/601/2073

Unit 201 Complying with statutory regulations and organisational safety requirements

UAN:	A/601/5013
Level:	Level 2
Credit value:	5
GLH:	35
Relationship to NOS:	This unit has been derived from Semta national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment. The learner will be expected to comply with all relevant regulations that apply to their area of work, as well as their general responsibilities as defined in the Health and Safety at Work Act. The learner will need to be able to identify the relevant qualified first aiders and know the location of the first aid facilities. The learner will have a knowledge and understanding of the procedures to be adopted in the case of accidents involving injury and in situations where there are dangerous occurrences or hazardous malfunctions of equipment, processes or machinery. The learner will also need to be fully conversant with their organisation's procedures for fire alerts and the evacuation of premises. The learner will also be required to identify the hazards and risks that are associated with their job. Typically, these will focus on their working environment, the tools and equipment that they use, the materials and substances that they use, any working practices that do not follow laid-down procedures, and manual lifting and carrying techniques. The learner's responsibilities will require them to comply with all relevant statutory and

organisational policy and procedures for health and safety in the workplace. The learner must act in a responsible and safe manner at all times, and present themselves in the workplace suitably prepared for the activities to be undertaken. The learner will be expected to report any problems with health and safety issues, to the relevant authority.

The learner's knowledge will provide a good understanding of the relevant statutory regulations and organisational requirements associated with their work, and will provide an informed approach to the procedures used. The learner will need to understand their organisation's health and safety requirements and their application, in adequate depth to provide a sound basis for carrying out their activities in a safe and competent manner.

Learning outcome	The learner will:
1. comply with statutory regulations and organisational safety requirements	
Assessment criteria	
The learner can: 1.1 comply with their duties and obligations as defined in the Health and Safety at Work Act 1.2 demonstrate their understanding of their duties and obligations to health and safety by: • applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act • identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as: o eye protection and personal protective equipment (PPE) o COSHH regulations o risk assessments • identifying the warning signs and labels of the main groups of hazardous or dangerous substances • complying with the appropriate statutory regulations at all times 1.3 present themselves in the workplace suitably prepared for the activities to be undertaken 1.4 follow organisational accident and emergency procedures 1.5 comply with emergency requirements, to include: • identifying the appropriate qualified first aiders and the location of first aid facilities • identifying the procedures to be followed in the event of injury to themselves or others • following organisational procedures in the event of fire and the evacuation of premises • identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment	

1.6 recognise and control hazards in the workplace

1.7 identify the hazards and risks that are associated with the following:

- their working environment
- the equipment that they use
- materials and substances (where appropriate) that they use
- working practices that do not follow laid-down procedures

1.8 use correct manual lifting and carrying techniques

1.9 demonstrate one of the following methods of manual lifting and carrying:

- lifting alone
- with assistance of others
- with mechanical assistance

1.10 apply safe working practices and procedures to include:

- maintaining a tidy workplace, with exits and gangways free from obstruction
- using equipment safely and only for the purpose intended
- observing organisational safety rules, signs and hazard warnings
- taking measures to protect others from any harm resulting from the work that they are carrying out.

Learning outcome	The learner will:
2. know how to comply with statutory regulations and organisational safety requirements	
Assessment criteria	

The learner can:

2.1 describe the roles and responsibilities of themselves and others under the Health and Safety at Work Act, and other current legislation (such as The Management of Health and Safety at Work Regulations, Workplace Health and Safety and Welfare Regulations, Personal Protective Equipment at Work Regulations, Manual Handling Operations Regulations, Provision and Use of Work Equipment Regulations, Display Screen at Work Regulations, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations)

2.2 describe the specific regulations and safe working practices and procedures that apply to their work activities

2.3 describe the warning signs for the seven main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations

2.4 explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed

2.5 explain what constitutes a hazard in the workplace (such as moving parts of machinery, electricity, slippery and uneven surfaces, poorly placed equipment, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile, flammable or toxic materials, unshielded processes, working in confined spaces)

2.6 describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace

2.7	describe the risks associated with their working environment (such as the tools, materials and equipment that they use, spillages of oil, chemicals and other substances, not reporting accidental breakages of tools or equipment and not following laid-down working practices and procedures)
2.8	describe the processes and procedures that are used to identify and rate the level of risk (such as safety inspections, the use of hazard checklists, carrying out risk assessments, COSHH assessments)
2.9	describe the first aid facilities that exist within their work area and within the organisation in general; the procedures to be followed in the case of accidents involving injury
2.10	explain what constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if no-one is injured
2.11	describe the procedures for sounding the emergency alarms, evacuation procedures and escape routes to be used, and the need to report their presence at the appropriate assembly point
2.12	describe the organisational policy with regard to fire fighting procedures; the common causes of fire and what they can do to help prevent them
2.13	describe the protective clothing and equipment that is available for their areas of activity
2.14	explain how to safely lift and carry loads, and the manual and mechanical aids available
2.15	explain how to prepare and maintain safe working areas; the standards and procedures to ensure good housekeeping
2.16	describe the importance of safe storage of tools, equipment, materials and products
2.17	describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve.

Unit 202 Using and interpreting engineering data and documentation

UAN:	Y/601/5102
Level:	Level 2
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from Semta national occupational standard: Using and interpreting engineering data and documentation (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to make effective use of text, numeric and graphical information, by interpreting and using technical information extracted from documents such as engineering drawings, technical manuals, reference tables, specifications, technical sales/marketing documentation, charts or electronic displays, in accordance with approved procedures. The learner will be required to extract the necessary information from the various documents, in order to establish and carry out the work requirements, and to make valid decisions about the work activities based on the information extracted. The learner's responsibilities will require them to comply with organisational policy and procedures for obtaining and using the documentation applicable to the activity. They will be expected to report any problems with the use and interpretation of the documents that they cannot personally resolve, or are outside their permitted authority, to the relevant people. They will be expected to work to instructions if necessary, with an appropriate level of supervision or as a member of a team, and take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide a good understanding of the types of documentation used, and will provide an informed approach to applying instructions and procedures. They will be able to read and interpret the documentation used and will know about the conventions, symbols and abbreviations, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

Learning outcome	The learner will:
1. use and interpret engineering data and documentation	
Assessment criteria	

The learner can:

1.1 use the approved source to obtain the required data and documentation

1.2 use the data and documentation and carry out all of the following:

- check the currency and validity of the data and documentation used
- exercise care and control over the documents at all times
- correctly extract all necessary data in order to carry out the required tasks
- seek out additional information where there are gaps or deficiencies in the information obtained
- deal with or report any problems found with the data and documentation
- make valid decisions based on the evaluation of the engineering information extracted from the documents
- return all documents to the approved location on completion of the work
- complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation

1.3 correctly identify, interpret and extract the required information

1.4 extract information that includes three of the following:

- materials or components required
- dimensions
- tolerances
- build quality
- installation requirements
- customer requirements
- time scales
- financial information
- operating parameters
- surface texture requirements
- location/orientation of parts
- process or treatments required
- dismantling/assembly sequence
- inspection/testing requirements
- number/volumes required

- repair/service methods
- method of manufacture
- weld type and size
- operations required
- connections to be made
- surface finish required
- shape or profiles
- fault finding procedures
- safety/risk factors
- environmental controls
- specific data (such as component data, maintenance data, electrical data, fluid data)
- resources (such as tools, equipment, personnel)
- utility supply details (such as electricity, water, gas, air)
- location of services, including standby and emergency backup systems
- circuit characteristics (such as pressure, flow, current, voltage, speed)
- protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)
- other specific related information

1.5 use the information obtained to ensure that work output meets the specification

1.6 use information extracted from documents to include one from the following:

- drawings (such as component drawings, assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings)
- diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit diagrams)
- manufacturers manuals/drawings
- approved sketches
- technical illustrations
- photographic representations
- visual display screen information
- technical sales/marketing documentation
- contractual documentation
- other specific drawings/documents

1.7 use information extracted from related documentation, to include two from the following:

- instructions (such as job instructions, drawing instructions, manufacturers instructions)
- specifications (such as material, finish, process, contractual, calibration)
- reference materials (such as manuals, tables, charts, guides, notes)
- schedules
- operation sheets

- service/test information
- planning documentation
- quality control documents
- company specific technical instructions
- national, international and organisational standards
- health and safety standards relating to the activity (such as COSHH)
- other specific related documentation

1.8 deal promptly and effectively with any problems within their control and report those which cannot be solved

1.9 report any inaccuracies or discrepancies in documentation and specifications.

Learning outcome	The learner will:
2. know how to use and interpret engineering data and documentation	
Assessment criteria	

The learner can:

2.1 explain what information sources are used for the data and documentation that they use in their work activities

2.2 explain how documents are obtained, and how to check that they are current and valid

2.3 explain the basic principles of confidentiality (including what information should be available and to whom)

2.4 describe the different ways/formats that data and documentation can be presented (such as such as drawings, job instructions product data sheets, manufacturers' manuals, financial spreadsheets, production schedules, inspection and calibration requirements, customer information)

2.5 explain how to use other sources of information to support the data (such as electronic component pin configuration specifications, reference charts, standards, bend allowances required for material thickness, electrical conditions required for specific welding rods, mixing ratios for bonding and finishing materials, metal specifications and inspection requirements, health and safety documentation)

2.6 describe the importance of differentiating fact from opinion when reviewing data and documentation

2.7 describe the importance of analysing all available data and documentation before decisions are made

2.8 describe the different ways of storing and organising data and documentation to ensure easy access

2.9 describe the procedures for reporting discrepancies in the data or documentation, and for reporting lost or damaged documents

2.10 describe the importance of keeping all data and documentation up to date during the work activity, and the implications of this not being done

2.11 explain the care and control procedures for the documents, and how damage or graffiti on documents can lead to scrapped work

2.12 explain the importance of returning documents to the designated location on completion of the work activities

2.13 explain what basic drawing conventions are used and why there needs to be different types of drawings (such as isometric and orthographic, first and third angle, assembly drawings, circuit and

2.14	explain what types of documentation are used and how they interrelate (such as production drawings, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)
2.15	explain the imperial and metric systems of measurement; tolerancing and fixed reference points
2.16	describe the meaning of the different symbols and abbreviations found on the documents that they use (such as surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)
2.17	describe the extent of their own responsibility, when to act on their own initiative to find, clarify and evaluate information, and to whom they should report if they have problems that they cannot resolve.

Unit 203 Working efficiently and effectively in engineering

UAN:	Y/601/5052
Level:	Level 2
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from Semta national occupational standard: Working efficiently and effectively in engineering Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the work place, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they have the appropriate job specifications and instructions, and ensuring that any tools, equipment, materials and other resources required are available and in a safe and usable condition. On completion of the engineering activity, the learner will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used. In order to be efficient and effective in the workplace, the learner will also be required to demonstrate that they can create and maintain effective working relationships with colleagues and line management, and to review objectives and targets for their

personal development in the workplace and contribute to, and communicate any opportunities for, improvements that could be made to working practices and procedures.

The learner's responsibilities will require them to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities or the tools and equipment that are used that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, and to take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to working efficiently and effectively in an engineering environment. The learner will understand the need to work efficiently and effectively, and will know about the areas they need to consider when preparing and tidying up the work area, how to deal with problems, maintain effective working relationships and agree their development objectives and targets, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

The learner will understand the safety precautions required when carrying out engineering activities. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. work efficiently and effectively in engineering	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 prepare the work area to carry out the engineering activity 1.3 prepare to carry out the engineering activity, taking into consideration all of the following, as applicable to the work to be undertaken: • the work area is free from hazards and suitably prepared for the activities to be undertaken	

- any required safety procedures are implemented
- any necessary personal protection equipment is obtained and is in a usable condition
- tools and equipment required are obtained and checked that they are in a safe and useable condition
- all necessary drawings, specifications and associated documentation is obtained
- job instructions are obtained and understood
- the correct materials or components are obtained
- storage arrangements for work are appropriate
- appropriate authorisation to carry out the work is obtained

1.4 check that there are sufficient supplies of materials and/or consumables and that they meet work requirements

1.5 ensure completed products or resources are stored in the appropriate location on completion of the activities

1.6 complete work activities, to include all of the following:

- returning tools and equipment
- returning drawings and work instructions
- completing all necessary documentation accurately and legibly
- identifying, where appropriate, any unusable tools, equipment and components
- arranging for the safe disposal of waste materials

1.7 tidy up the work area on completion of the engineering activity

1.8 deal promptly and effectively with problems within their control and report those that cannot be resolved

1.9 deal with problems affecting the engineering process, to include two of the following:

- materials
- tools and equipment
- drawings
- job specification
- quality
- people
- timescales
- safety
- activities or procedures

1.10 contribute to organisational procedures for identifying opportunities for improvement to one of the following:

- working practices
- working methods
- quality
- safety
- tools and equipment
- supplier relationships
- internal communication
- customer service
- training and development
- teamwork

- other

1.11 maintain effective working relationships with colleagues to include two of the following:
- colleagues within their own working group
- people outside their normal working group
- line management
- external contacts

1.12 review personal training and development as appropriate to the job role

1.13 review personal development objectives and targets to include one of the following:
- dual or multi-skilling
- training on new equipment/technology
- increased responsibility
- understanding of company working practices, procedures, plans and policies
- other specific requirements.

Learning outcome	The learner will:

2. know how to work efficiently and effectively in engineering

Assessment criteria

The learner can:

2.1 describe the safe working practices and procedures to be followed whilst preparing and tidying up their work environment

2.2 describe the correct use of any equipment to protect the health and safety of themselves and their colleagues

2.3 describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity

2.4 describe the action that should be taken if documentation received is incomplete and/or incorrect

2.5 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity

2.6 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity

2.7 describe the action that should be taken if tools and equipment are not in full working order

2.8 describe the checks to be carried out to ensure that all required materials are correct and complete, prior to undertaking the activity

2.9 describe the action that should be taken if materials do not meet the requirements of the activity

2.10 explain whom to inform when the work activity has been completed

2.11 describe the information and/or documentation that others will require to confirm that the activity has been completed

2.12 explain what materials, equipment and tools can be re-used

2.13 explain how any waste materials and/or products are transferred, stored and disposed of

2.14 explain where tools and equipment should be stored and located

2.15 describe the importance of maintaining effective working relationships within the workplace

2.16	describe the procedures for dealing with and reporting any problems that can affect working relationships
2.17	describe the importance of making a contribution to improving working practices
2.18	describe the procedure and format for making suggestions for improvements
2.19	describe the benefits for the work area if improvements can be identified
2.20	describe the difficulties that can occur in working relationships
2.21	describe the regulations that affect how they should be treated at work (such as Equal Opportunities Act, Race and Sex Discrimination, Working Time Directive)
2.22	describe the benefits of continuous personal development
2.23	describe the training opportunities that are available in the workplace
2.24	describe the importance of reviewing their training and development
2.25	explain with whom to discuss training and development issues
2.26	describe the extent of their own authority and to whom they should report if they have any problems that they cannot resolve.

Unit 204 Joining materials by the manual metal arc welding process

UAN:	F/601/1447
Level:	Level 2
Credit value:	54
GLH:	196
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 4: Joining Materials by the Manual Metal Arc Welding Process (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to prepare and operate manual metal arc welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the workholding equipment and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that all the leads/cables, electrode holder and workpiece earthing arrangements are securely connected and free from damage. In preparing to weld, the learner will need to set and adjust the welding conditions in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly, and make any necessary adjustments to settings in line with their permitted authority, in order to produce the welded joints to the required specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the welding activities undertaken, and to report any problems with the welding equipment, or welding activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an understanding of how the manual metal arc process works. The learner will know about the equipment, materials and consumables, in adequate depth to provide a sound background for the welding operations to be performed, and for ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the welding equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. join materials by the manual metal arc welding process	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 follow the relevant joining procedure and job instructions

1.3 check that the joint preparation complies with the specification

1.4 check that joining and related equipment and consumables are as specified and fit for purpose

1.5 make the joints as specified using the appropriate thermal joining technique

1.6 set up, check, adjust and use manual metal arc welding and related equipment, to include either:

- alternating current (AC) equipment
- direct current (DC) equipment

1.7 produce welded joints which incorporate both:

- fillet welds
- butt welds

1.8 weld joints according to approved welding procedures, in good access situations in two of the following BS EN287 positions:

- Flat (PA)
- Horizontal vertical (PB)
- Horizontal (PC)
- Vertical upwards (PF)
- Vertical downwards (PG)

1.9 use two types of electrode from the following, including two different sizes of each chosen type:

- rutile
- basic
- nickel alloy
- cellulosic
- stainless steel

- other electrodes

1.10 produce joints in one form of specified material from the following:
- plate
- section
- pipe/tube
- other forms

1.11 produce joints of the required quality and of specified dimensional accuracy which:
- achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (eg, EN 25817 / ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification
- meet the required dimensional accuracy within specified tolerances

1.12 shut down the equipment to a safe condition on completion of joining activities

1.13 deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures

1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to join materials by the manual metal arc welding process	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when working with MMA welding equipment (general workshop and site safety; appropriate personal protective equipment; fire prevention; protecting other workers from stray arcs; safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the hazards associated with MMA welding (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 explain the manual metal arc welding process (basic principles of fusion welding, AC and DC power sources, ancillary equipment; care of equipment; consumables; power ranges)

2.4 describe the types of electrodes; correct control, storage and drying of electrodes

2.5 describe the types of welded joints to be produced (fillet and butt welds, single and multi-run welds, joints in pipe, plate and sections, welding positions)

2.6 explain how to set up and restrain the joint (the use of jigs and fixtures, manipulators and positioners, restraining devices, tack welding size and spacing in relationship to material thickness)

2.7 describe the checks to be made prior to welding (confirming correct set-up of joint and cleanliness of materials; condition of electrical connections, power return and earthing arrangements; operating parameters; calibration before use; care and

2.8	explain the techniques of operating the welding equipment to produce a range of joints in the various joint positions (fine tuning parameters; correct manipulation of electrode; safe closing down of the welding equipment)
2.9	explain the importance of complying with the job instructions and the welding procedure specification
2.10	describe the problems that can occur with the welding activities and explain how these can be overcome (causes of distortion and methods of control; effects of welding on materials and sources of weld defects; methods of prevention)
2.11	describe the organisational quality control systems used, and weld standards to be achieved
2.12	explain the weld inspection and test procedures used (including destructive and non-destructive methods)
2.13	explain the personal approval tests and their applicability to their work
2.14	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.15	explain the reporting lines and procedures, line supervision and technical experts.

Unit 205 Joining materials by the manual MIG/MAG and other continuous wire processes

UAN:	J/601/1451
Level:	Level 2
Credit value:	54
GLH:	196
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 5: Joining Materials by the Manual MIG/MAG and Other Continuous Wire Processes (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to prepare and operate manual MIG, MAG or cored-wire arc welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the workholding equipment and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that all the leads/cables, shielding gas system, hoses and wire feed mechanisms are securely connected and free from damage. In preparing to weld, the learner will need to set and adjust the welding conditions, in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly and make any necessary adjustments to settings, in line with their permitted authority, in order to produce the welded joints to the required specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the welding activities undertaken, and to report any problems with the welding equipment, or welding activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an understanding of how the MIG, MAG or cored-wire arc welding process works. The learner will know about the equipment, materials and consumables, in adequate depth to provide a sound background for the welding operations to be performed, and for ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the welding equipment. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. join materials by the manual MIG/MAG and other continuous wire processes	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and job instructions 1.3 check that the joint preparation complies with the specification 1.4 check that joining and related equipment and consumables are as specified and fit for purpose 1.5 make the joints as specified using the appropriate thermal joining technique 1.6 set up, check, adjust and use welding and related equipment for one of the following welding processes: • MIG • MAG • cored wire 1.7 produce welded joints which incorporates both: • Fillet welds • Butt welds 1.8 weld joints according to approved welding procedures, in good access situations, in two of the following BS EN287 positions: • Flat (PA) • Horizontal vertical (PB) • Horizontal (PC) • Vertical upwards (PF) • Vertical downwards (PG) 1.9 use consumables appropriate to the material and application, to include both of the following: • two wire types from different material groups • two different shielding gases (where applicable)	

1.10 produce joints in one form of specified material from the following:
- plate
- section
- other forms
- pipe/tube
- sheet (<3mm)

1.11 produce joints of the required quality and of specified dimensional accuracy which:
- achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (eg, EN 25817 / ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification
- meet the required dimensional accuracy within specified tolerance

1.12 shut down the equipment to a safe condition on completion of joining activities

1.13 deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures

1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to join materials by the manual MIG/MAG and other continuous wire processes	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when working with MIG, MAG or cored wire arc welding equipment (general workshop and site safety; appropriate personal protective equipment; fire prevention; protecting other workers from the effects of the welding arc; safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the correct handling and storage of gas cylinders (manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)

2.3 describe the hazards associated with arc welding (live electrical components; poor earthing; the electric arc; fumes and gases; gas supply leaks; spatter, hot slag and metal; elevated working; enclosed spaces; slips, trips and falls), and explain how they can be minimised

2.4 explain the manual MIG, MAG or cored wire arc welding process (basic principles of fusion welding, AC and DC power sources, ancillary equipment, power ranges, care of equipment)

2.5 describe the consumables associated with MIG, MAG or cored wire arc welding (types of wire and their application (solid and cored), types of shielding gas and their application, gas supply and control)

2.6 describe the types of welded joints to be produced (fillet and butt welds, single and multi-run welds, joints in pipe, plate, sheet and

2.7 explain how to set up and restrain the joint (the use of jigs and fixtures, manipulators and positioners, restraining devices, tack welding size and spacing in relationship to material thickness)

2.8 explain how to prepare the welding equipment and checks that need to be made to ensure that it is safe and ready to use (electrical connections, power return and earthing arrangements; wire feed mechanisms, gas supply, setting welding parameters, correct joint set-up, cleanliness of materials used; calibration before use; routine care and maintenance of equipment)

2.9 explain the techniques of operating the welding equipment to produce a range of joints in the various joint positions (fine tuning parameters, correct manipulation of the welding gun, safe closing down of the welding equipment)

2.10 explain the importance of complying with job instructions and the welding procedure specification

2.11 describe the problems that can occur with the welding activities and explain how these can be overcome (causes of distortion and methods of control, effects of welding on materials and sources of weld defects; methods of prevention)

2.12 describe the organisational quality systems used and weld standards to be achieved; weld inspection and test procedures used (including visual and non-destructive tests)

2.13 explain the personal approval tests, and their applicability to their work

2.14 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve

2.15 explain the reporting lines and procedures, line supervision and technical experts.

Unit 206 Joining materials by the manual TIG and plasma-arc welding processes

UAN:	K/601/1457
Level:	Level 2
Credit value:	54
GLH:	196
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 6: Joining Materials by the Manual TIG and Plasma-arc Welding Processes (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to prepare and operate manual TIG or plasma-arc welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the workholding equipment and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that all the leads/cables, hoses and torches are securely connected and free from damage. In preparing to weld, the learner will need to set and adjust the welding conditions, in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly and make any necessary adjustments to settings, in line with their permitted authority, in order to produce the welded joints to the required specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the welding activities undertaken, and to report any problems with the welding equipment, or welding activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an understanding of how the TIG or plasma-arc welding process works. The learner will know about the equipment, materials and consumables, in adequate depth to provide a sound background for the welding operations to be performed, and for ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the welding equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. join materials by the manual TIG and plasma-arc welding processes	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and job instructions 1.3 check that the joint preparation complies with the specification 1.4 check that joining and related equipment and consumables are as specified and fit for purpose 1.5 make the joints as specified using the appropriate thermal joining technique 1.6 Set up, check, adjust and use manual welding and related equipment for one of the following welding processes: • TIG • plasma-arc 1.7 produce welded joints which incorporate the following: • butt welds, and • fillet welds **or** • welds made autogenously (without filler wire). 1.8 weld joints according to approved welding procedures, in good access situations, in two of the following BSEN287 positions: • Flat (PA) • Horizontal (PC) • Vertical upwards (PF) • Horizontal vertical (PB) • Vertical downwards (PG) 1.9 use consumables appropriate to the material and application, to include both of the following: • one size of electrode • two types of filler wire from different material groups	

1.10 produce joints in one form of specified materials from the following:
- plate
- section
- pipe/tube
- sheet (<3mm)
- other forms

1.11 produce joints of the required quality and of specified dimensional accuracy which:
- achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (eg, EN 25817 / ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification
- meet the required dimensional accuracy within specified tolerance

1.12 shut down the equipment to a safe condition on completion of joining activities

1.13 deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures

1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:

2. know how to join materials by the manual TIG and plasma-arc welding processes

Assessment criteria

The learner can:

2.1 explain the safe working practices and procedures to be observed when working with TIG or plasma-arc welding equipment (general workshop and site safety; appropriate personal protective equipment; fire prevention; protecting other workers from the effects of the electric arc; safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the hazards associated with arc welding (live electrical components; poor earthing arrangements; the electric arc; fumes and gases; gas supply leaks; 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 correct handling and storage of gas cylinders (manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)

2.4 explain the manual TIG or Plasma-arc welding process (basic principles of fusion welding; power sources ancillary equipment; power ranges; arc initiation system; care and maintenance of equipment)

2.5 describe the consumables associated with TIG or plasma-arc welding (types of filler wire, types of shielding gas, welding electrodes, gas supply and control, control and storage of consumables)

2.6	describe the types of welded joints to be produced (fillet and butt welds, single and multi-run welds, joints in pipe plate, sheet and sections; welding positions)
2.7	explain how to set up and restrain the joint (confirming correct set-up of joint; cleanliness of materials used; the use of jigs and fixtures, manipulators and positioners, restraining devices; tack welding size and spacing in relationship to material thickness)
2.8	explain how to prepare the equipment, and checks that need to be made to ensure that it is safe to use (condition of electrical connections, power return and earthing arrangements, operating parameters)
2.9	explain the techniques of operating the welding equipment to produce a range of joints in the various joint positions (fine tuning parameters, correct manipulation of torch, safe closing down of the welding equipment)
2.10	explain the importance of complying with job instructions and the welding procedure specification
2.11	describe the problems that can occur with the welding activities and explain how these can be overcome (causes of distortion and methods of control, effects of welding on materials and sources of weld defects; methods of prevention
2.12	describe the organisational quality systems used and weld standards to be achieved; weld inspection and test procedures used (including visual and non-destructive tests)
2.13	explain personal approval tests and their applicability to their work
2.14	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.15	explain the reporting lines and procedures, line supervision and technical experts.

Unit 207 Joining materials by the manual gas welding process

UAN:	T/601/1459
Level:	Level 2
Credit value:	50
GLH:	175
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 7: Joining Materials by the Manual Gas Welding Process (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to prepare and operate gas-welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the workholding and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that the regulators, hoses, flashback arrestor and welding torch are securely connected and are free from leaks or damage. In preparing to weld, the learner will need to set and adjust the gas pressures/welding conditions, in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly and make any necessary adjustments to settings, in line with their permitted authority, in order to produce the welded joints to the required specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the welding activities undertaken, and to report any problems with the welding equipment, or welding activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an understanding of how the gas welding process works. The learner will know about the equipment, materials and consumables, in adequate depth to provide a sound background for the welding operations to be performed, and for ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the welding equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. join materials by the manual gas welding process	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and job instructions 1.3 check that the joint preparation complies with the specification 1.4 check that joining and related equipment and consumables are as specified and fit for purpose 1.5 prepare the gas welding equipment for use, to include all of the following: • checking regulators, hoses and valves are securely connected and free from leaks and damage • checking/fitting the correct gas nozzle to the torch • checking that a flashback arrestor is fitted • setting appropriate gas pressures • using the correct procedure for lighting, adjusting and extinguishing the welding flame • using appropriate and safe procedures for handling and storing of gas cylinders 1.6 make the joints as specified using the appropriate thermal joining technique 1.7 produce welded joints which incorporate the following: • butt welds, and • fillet welds **or** • welds made autogenously (without filler wire) 1.8 weld joints according to approved welding procedures, and in good access situations, in two of the following BS EN287 positions: • Flat (PA) • Horizontal (PC) • Horizontal vertical (PB)	

- Vertical upwards (PF)
- Vertical downwards (PG)

1.9 use a range of filler wire, to include both of the following:
- two different sizes
- two different material groups

1.10 produce joints in one form of specified materials from the following:
- plate
- section
- other forms
- pipe/tube
- sheet (<3mm)

1.11 produce joints of the required quality and of specified dimensional accuracy which:
- achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (eg, EN 25817/ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification
- meet the required dimensional accuracy within specified tolerance

1.12 shut down the equipment to a safe condition on completion of joining activities

1.13 deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures

1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to join materials by the manual gas welding process	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when working with gas welding equipment (general workshop and site safety, appropriate personal protective equipment, fire and explosion prevention, protecting other workers, safety in enclosed/confined spaces; fume control; accident procedure; statutory regulations; risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the correct handling and storage of gas cylinders (manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)

2.3 describe the hazards associated with gas welding (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot slag and metal, grinding and mechanical slag removal, elevated working, enclosed spaces, slips trips and falls), and how they can be minimised

2.4 explain the gas welding process (basic principles of gas welding and related equipment; care of the equipment)

2.5 describe the consumables associated with gas welding (types of filler wire, fluxes, gas supply and control)

2.6	describe the types of welded joints to be produced (fillet and butt welds, single and multi-run welds, welding positions, joints in sheet, pipe and plate)
2.7	explain how to set up and restrain the joint (the use of jigs/fixtures, manipulators and positioners, restraining devices, tack welding size and spacing in relationship to material thickness, correct joint set-up, cleanliness of materials used)
2.8	explain how to prepare the welding equipment, and checks that need to be made to ensure that it is safe and ready to use (connection of hoses, torch, flashback arrestors, hose check valves, regulators, connections for leaks, setting welding parameters)
2.9	explain the techniques of operating the welding equipment to produce a range of joints in the various joint positions (selection of nozzle, flame adjustment, correct manipulation of torch and filler rods, safe closing down of the welding equipment)
2.10	explain the importance of complying with job instructions and the welding procedure specification
2.11	describe the problems that can occur with the welding activities and explain how these can be overcome (causes of distortion and methods of control, effects of welding on materials and sources of weld defects; methods of prevention)
2.12	describe the organisational quality systems used and weld standards to be achieved; weld inspection and test procedures used (including visual and non-destructive tests)
2.13	explain personal approval tests and their applicability to their work
2.14	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.15	explain the reporting lines and procedures, line supervision and technical experts.

Unit 208 Producing fillet welded joints using a manual welding process

UAN:	L/601/1466
Level:	Level 2
Credit value:	44
GLH:	169
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 8: Producing Fillet Welded Joints using a Manual Welding Process (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce fillet welds in plate, sheet or sections, and/or fillet welded joints in pipe/tube, using a manual welding process such as manual metal arc, MIG, MAG, TIG, flux- cored wire, inert shield or gas welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the workholding equipment and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that all the leads/cables, hoses and wire feed mechanisms are securely connected and free from damage. In preparing to weld, the learner will need to set and adjust the welding conditions, in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly and make any necessary adjustments to settings, in line with their permitted authority, in order to produce the welded joints to the required specification. The learner will be required to demonstrate their capability to produce the fillet welds of the required quality, and this could be through tests according to BS 4872 or EN 287. The learner's responsibilities will require to comply with organisational policy and

procedures for the welding activities undertaken, and to report any problems with the welding equipment, or welding activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an understanding of how the particular welding process works. The learner will know about the equipment, materials and consumables, in adequate depth to provide a sound background for the welding operations to be performed, and for ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the welding equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce fillet welded joints using a manual welding process	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and job instructions 1.3 check that the joint preparation complies with the specification 1.4 check that joining and related equipment and consumables are as specified and fit for purpose 1.5 make the joints as specified using the appropriate thermal joining technique 1.6 set up, check, adjust and use welding and related equipment for one of the following welding processes: • Manual Metal Arc • MIG/MAG • TIG • Plasma Arc • cored wire • gas welding 1.7 weld joints according to approved welding procedures, in good access situations, in two of the following BS EN287 positions: • Flat (PA)	

- Horizontal (PC)
- Horizontal Vertical (PB)
- Vertical Upwards (PF)
- Vertical Downwards (PG)
- Overhead (PE or PD)

1.8 use consumables as specified in the welding procedure specification, covering **either**:
two types of electrode from:
- rutile
- basic
- cellulosic
- nickel alloy
- stainless steel
- other

or
two types of filler wire from different material groups

1.9 produce fillet welded joints in two of the following forms of material:
- plate
- sections
- pipe/tube
- sheet
- other

1.10 produce joints of the required quality and of specified dimensional accuracy which:
- achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (eg, EN 25817 / ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification
- meet the required dimensional accuracy within specified tolerance

1.11 shut down the equipment to a safe condition on completion of joining activities

1.12 deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures

1.13 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to produce fillet welded joints using a manual welding process	
Assessment criteria	
The learner can: 2.1 explain the safe working practices and procedures to be observed when working with the selected welding equipment (general workshop and site safety, appropriate personal protective equipment, fire prevention, protecting other workers from 'arc eye', safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	

2.2	describe the correct handling and storage of gas cylinders (manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)
2.3	describe the hazards associated with the selected welding process (live electrical components, poor earthing, arc radiation, fumes and gases, gas supply leaks, spatter, hot slag and metal, grinding and mechanical metal/slag removal; elevated working, enclosed spaces, slips, trips and falls), and explain how they can be minimised
2.4	explain the manual welding process selected and the different types of welding equipment (basic principles of fusion welding, AC and DC power sources, ancillary equipment, power ranges, care of equipment, terminology used in welding, flame setting)
2.5	explain how to extract information required from drawings and welding procedure specifications (interpretation of welding symbols, scope, content and application of the welding procedure specification)
2.6	describe the consumables associated with the chosen welding process (types of electrodes and/or filler metal and their application; types of shielding gas and their application, gas supply and control; correct control, storage and drying of electrodes and filler wire)
2.7	describe the types and features of welded joints in pipe (fillet and butt welds, single and multi-run welds, welding positions, weld quality)
2.8	explain how to set up and restrain the joint to achieve correct location of components and control of distortion (edge preparation, use of jigs and fixtures, manipulators and positioners, tack welding size and spacing in relationship to material thickness and component size, use of temporary attachments, pre-setting)
2.9	explain how to prepare the welding equipment, and checks that need to be made to ensure that it is safe and ready to use (electrical connections, power return and earthing arrangements; equipment calibration before use, setting welding parameters, care and maintenance of the equipment)
2.10	explain the techniques of operating the welding equipment to produce a range of joints in the various joint positions (fine tuning parameters, correct manipulation of the welding gun or electrode, safe closing down of the welding equipment)
2.11	explain the importance of complying with job instructions and the welding procedure specification
2.12	describe the problems that can occur with the welding activities, and explain how these can be overcome (causes of distortion and methods of control, effects of welding on materials and sources of weld defects; methods of prevention)
2.13	describe the organisational quality systems used and weld standards to be achieved; weld inspection and test procedures used (including visual and non-destructive tests)
2.14	explain the personal approval tests and their applicability to their work
2.15	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 209 Welding materials with mechanised arc welding equipment

UAN:	Y/601/1471
Level:	Level 2
Credit value:	37
GLH:	140
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 9: Welding Materials with Mechanised Arc Welding Equipment (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to operate one type of mechanised MIG/MAG, cored wire, submerged arc, TIG, or plasma arc welding installation, which has already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the equipment has been approved for production, and that sufficient supplies of all the required materials and consumables are present and correct, and ready for production operations to be performed. The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

The learner's responsibilities will require them to comply with organisational policy and procedures for operating the welding installation, and to report any problems or adjustments to the installation that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will be sufficient to provide a sound basis for their work, enabling them to adopt an informed approach to applying welding procedures and instructions. The learner will have an understanding of how the welding process works and is applied in mechanised form, and will know about the equipment, materials and consumables, in adequate depth to provide a sound background to the process operation and for carrying out the welding activities to the required specification.

The learner will understand the safety precautions required when working with the machine and its associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. weld materials with mechanised arc welding equipment	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and work instructions 1.3 operate one of the following mechanised arc welding processes in the specified materials, forms and positions: • MIG/MAG • cored wire • TIG • submerged arc • plasma arc 1.4 confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out 1.5 check all of the following before starting production: • the installation has been approved for production	

- supplies of components and consumables are adequate and correctly prepared
- machine settings comply with instructions and the welding procedure specification
- all machine functions operate correctly
- all safety equipment is in place and functioning correctly

1.6 check that the parent material, components, consumables and joint preparation comply with specifications

1.7 produce welded components covering both of the following:

- two different joint configurations
- two different material groups

1.8 carry out and monitor the machine operations in accordance with specifications and job instructions

1.9 monitor the process operation and machine functions, and make adjustments as required to parameters and mechanisms within their permitted authority and tolerances, to include adjusting all of the following:

- electrical parameters
- welding speed
- flux dispensing and recovery mechanisms
- safety devices
- wire feed rate
- gas shielding system
- mechanical functions (handling, loading, workholding, transfer)

1.10 achieve joints of the required quality and specified dimensional accuracy which:

- achieve a weld quality equivalent to the relevant level of EN 25817/ISO 5817, as required by the application standard (for aluminium, EN 30042/ISO 10042 applies)
- meet the required dimensional accuracy within specified tolerances

1.11 achieve the rate of output as specified

1.12 deal promptly and effectively with problems within their control and report those that they cannot solve

1.13 shut down the equipment to a safe condition on conclusion of the joining activities.

Learning outcome	The learner will:
2. know how to weld materials with mechanised arc welding equipment	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when operating mechanised arc welding installations (working with machinery; the use of personal protective equipment; protecting others from the effects of the electric arc; appropriate machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2	describe the hazards associated with arc welding machines (dangers from the electric arc; live electrical components; fumes and gases; hot metal; grinding and mechanical metal/slag removal; moving parts of machinery), and how they can be minimised
2.3	explain the basic principles of mechanised and automated welding (types of installations; machine functions; control systems; safety features)
2.4	describe the key components and features of the equipment used (power source; electrical parameters such as arc voltage, current, wire dispensing and feed mechanisms; flux dispensing and recovery; shielding gas supply; control and storage of consumables; how variations in the parameters influence weld features, quality and output)
2.5	explain how to extract the necessary information from drawings and welding procedure specifications; welding symbols and abbreviations used
2.6	explain the operation of the machine controls and their function; care of equipment
2.7	explain how to set up and align the workpiece, and the equipment to be used
2.8	explain how to monitor the installation during the welding process; how to recognise problems and action to be taken
2.9	describe the problems that can occur with the welding activities (distortion, material and weld defects)
2.10	explain the self inspection of completed work, methods and equipment to be used
2.11	describe the organisational quality systems (standards to be achieved; production records to be kept)
2.12	explain the personal approval tests and their applicability to their work
2.13	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.14	explain the reporting lines and procedures, line supervision and technical experts.

Unit 210 Welding materials using resistance spot, seam and projection welding machines

UAN:	Y/601/1485
Level:	Level 2
Credit value:	35
GLH:	129
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 10: Welding Materials using Resistance Spot, Seam and Projection Welding Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to operate resistance spot, seam or projection welding installations, which have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production, and that sufficient supplies of all required materials and consumables are present and correct, and ready for production operations to be performed. The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

The learner's responsibilities will require them to comply with organisational policy and procedures for operating the welding installation, and to report any problems or adjustments to the installation that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a sound basis for their work, enabling them to adopt an informed approach to applying welding procedures and instructions. The learner will have an understanding of how the resistance welding process works and is applied in mechanised form, and will know about the equipment, materials and consumables, in adequate depth to provide a sound background to the process operation and for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the machine and its associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. weld materials using resistance spot, seam and projection welding machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and work instructions 1.3 operate one of the following resistance welding installations: • spot welding • seam welding • projection welding 1.4 confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out 1.5 check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding	

- all machine functions operate correctly
- all safety equipment is in place and functioning correctly

1.6 check that the parent material, components, consumables and joint preparation comply with specifications

1.7 produce welded components in the specified materials and forms that cover both of the following:

- two different material thicknesses
- two different joint configurations

1.8 carry out and monitor the machine operations in accordance with specifications and job instructions

1.9 monitor the process operation, electrode condition and machine function and make adjustments to required parameters and mechanisms, to include all of the following as appropriate to the machine type:

- welding current
- welding and squeeze times
- electrode pressure cycle
- welding speed (seam)
- weld pitch (spot)
- mechanical functions

1.10 achieve joints of the required quality and specified dimensional accuracy which:

- achieve a weld quality as specified in the application standard
- spot and projection welds are correctly located
- seam welds are of the correct dimensions
- meet the required dimensional accuracy within specified tolerance

1.11 achieve the rate of output as specified

1.12 deal promptly and effectively with problems within their control and report those that they cannot solve

1.13 shut down the equipment to a safe condition on conclusion of the joining activities.

Learning outcome	The learner will:
2. know how to weld materials using resistance spot, seam and projection welding machines	
Assessment criteria	
The learner can: 2.1 explain the specific safety precautions to be taken when operating resistance welding installations (working with machinery; the use of appropriate personal protective equipment machine guards; operation of machine safety devices; stopping the machine in an emergency; closing down the machine on completion of the welding activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials) 2.2 describe the hazards associated with resistance welding machines (dangers from live internal electrical components, fumes, hot metal, expulsion of hot particles, moving parts of machines), and how they can be minimised	

2.3	explain the basic principles of resistance welding and the terminology used in welding
2.4	explain the basic principles of mechanised and automated welding (types of installation; machine functions; control systems; safety features)
2.5	describe the key components and features of the equipment used (power source; electrical parameters such as arc voltage, current, electrode pressure and welding time; systems for parameter control; how variation in the parameters influence weld features, quality and output)
2.6	explain how to extract the information required from drawings and welding procedure specifications
2.7	explain the operation of the machine controls and their function; clamping and transfer of components; equipment care procedures
2.8	explain how to set up and align the workpiece
2.9	explain how to monitor the installation during the welding process; how to recognise problems, and action to be taken
2.10	describe the problems that can occur with the welding activities, materials and weld defects
2.11	explain the self inspection of completed work
2.12	describe the organisational quality systems (standards to be achieved; production records to be kept)
2.13	explain the personal approval tests and their applicability to their work
2.14	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.15	explain the reporting lines and procedures, line supervision and technical experts.

Unit 211 Welding materials using laser welding machines

UAN:	H/601/1490
Level:	Level 2
Credit value:	37
GLH:	140
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 11: Welding Materials using Laser Welding Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to operate laser welding installations that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production and that sufficient supplies of all required materials and consumables are present and correct, and ready for production operations to be performed. The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance. The learner's responsibilities will require them to comply with organisational policy and procedures for operating the welding installation, and to report any problems or

adjustments to the installation that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, enabling them to adopt an informed approach to applying welding procedures and instructions. The learner will have an understanding of how the laser welding process works and is applied in mechanised form, and will know about the equipment, materials and consumables, in adequate depth to provide a sound background to the process operation and for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the machine and its associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. weld materials using laser welding machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and work instructions 1.3 confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out 1.4 check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • all machine functions operate correctly • all safety equipment is in place and functioning correctly 1.5 check that the parent material, components, consumables and joint preparation comply with specifications 1.6 produce welded components covering both of the following: • two different components • two different material groups	

1.7 carry out and monitor the machine operations in accordance with specifications and job instructions

1.8 monitor the process operation and machine function and make adjustments as required to parameters and mechanisms, to include all of the following, as appropriate to the machine type:

- electrical parameters
- welding speed
- weld alignment and characteristics
- beam tracking
- beam characteristics (focal spot)
- gas shielding (where applicable)
- mechanical mechanisms for workholding, traversing and transfer

1.9 achieve joints of the required quality and specified dimensional accuracy which:

- achieve a weld quality equivalent to the relevant level of EN/ISO 13919, as required by the application standard
- meet the required dimensional accuracy within specified tolerances

1.10 achieve the rate of output as specified

1.11 deal promptly and effectively with problems within their control and report those that they cannot solve

1.12 shut down the equipment to a safe condition on conclusion of the joining activities.

Learning outcome	The learner will:
2. know how to weld materials using laser welding machines	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when operating laser welding installations (working with machinery; care when working with laser beams; the use of appropriate personal protective equipment; protecting other workers; machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the hazards associated with laser welding machines (dangers from the laser beam; live electrical components; fumes and gases; hot metal; moving parts of machinery), and how they can be minimised

2.3 explain the basic principles of laser welding and the terminology used in welding

2.4 describe the key components and features of the equipment (types of laser beam generators, beam characteristics, power ranges; beam guiding and focusing arrangements; power sources; materials and thickness capabilities; facilities for manipulating the components for welding; safety features; shielding gas supply and control)

2.5 explain the basic principles of mechanised and automated welding (types of installations; machine functions; safety features)

2.6	explain how to extract the information required from drawings and welding procedure specifications
2.7	explain the operation of the machine; controls and their function; care of equipment
2.8	explain how to set up and align the workpiece
2.9	explain how to monitor the installation during the welding process; how to recognise problems, and action to be taken
2.10	describe the problems that can occur with the welding activities, materials and weld defects
2.11	explain the self inspection of completed work
2.12	describe the organisational quality systems (standards to be achieved; production records to be kept)
2.13	explain the personal approval tests and their applicability to their work
2.14	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.15	explain the reporting lines and procedures, line supervision and technical experts.

Unit 212 Welding materials using electron beam welding machines

UAN:	T/601/1493
Level:	Level 2
Credit value:	37
GLH:	140
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 12: Welding Materials using Electron Beam Welding Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to operate electron beam welding installations that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production and that sufficient supplies of all required materials and consumables are present and correct, and are ready for production operations to be performed. The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

The learner's responsibilities will require them to comply with organisational policy and procedures for operating the welding installation, and to report any problems or adjustments to the installation that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, enabling them to adopt an informed approach to applying welding procedures and instructions. The learner will have an understanding of how the electron beam welding process works and is applied in mechanised form, and will know about the equipment, materials and consumables, in adequate depth to provide a sound background to the process operation and for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the machine and its associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. weld materials using electron beam welding machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and work instructions 1.3 confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out 1.4 check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • all machine functions operate correctly • all safety equipment is in place and functioning correctly	

1.5 check that the parent material, components, consumables and joint preparation comply with specifications

1.6 produce welded components covering both of the following:

- two different components
- two different material groups

1.7 carry out and monitor the machine operations in accordance with specifications and job instructions

1.8 monitor the process operation and machine function and make adjustments as required to parameters and mechanisms, to include all of the following, as appropriate to the machine type:

- electrical parameters
- welding speed
- chamber pressure
- weld alignment and characteristics
- beam tracking
- mechanical functions

1.9 achieve joints of the required quality and specified dimensional accuracy which:

- achieve a weld quality equivalent to the relevant level of EN/ISO 13919, as required by the application standard
- meet the required dimensional accuracy within specified tolerances

1.10 achieve the rate of output as specified

1.11 deal promptly and effectively with problems within their control and report those that they cannot solve

1.12 shut down the equipment to a safe condition on conclusion of the joining activities.

Learning outcome	The learner will:
2. know how to weld materials using electron beam welding machines	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when operating electron beam welding installations (working with machinery; care in presence of high voltage; the use of appropriate personal protective equipment; protecting other workers; machine guards; operation of machine safety devices; x-ray dosimeters; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the hazards associated with electron beam welding machines (dangers from the mains and high voltage supplies; live electrical components; emission of x-rays, fumes and gases; hot metal; moving parts of machinery), and how they can be minimised

2.3 explain the principles of electron-beam welding and the terminology used in welding

2.4 describe the key components and features of the equipment (electron gun and control of beam power and characteristics; vacuum chamber and its construction; vacuum system and controls; in-chamber manipulating equipment; power sources and power range; material and thickness capabilities; safety features;

2.5 explain how to extract the information required from drawings and welding procedure specifications

2.6 explain the operation of the machine; controls and their function; care of equipment

2.7 explain how to set up and align the workpiece

2.8 explain how to monitor the installation during the welding process; how to recognise problems, and action to be taken

2.9 describe the problems that can occur with the welding activities (materials and weld defects; beam instability, loss of alignment, increase in chamber pressure)

2.10 explain the self inspection of completed work

2.11 describe the organisational quality systems (standards to be achieved; production records to be kept)

2.12 explain the personal approval tests and their applicability to their work

2.13 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve

2.14 explain the reporting lines and procedures, line supervision and technical experts.

Unit 213 Welding materials using friction welding machines

UAN:	R/601/1498
Level:	Level 2
Credit value:	35
GLH:	129
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 13: Welding Materials using Friction Welding Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to operate friction welding installations that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production and that sufficient supplies of all required materials and consumables are present and correct, and are ready for production operations to be performed. The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation, using the in-process monitoring features of the welding machine, and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

The learner's responsibilities will require them to comply with organisational policy and procedures for operating the welding installation, and to report any problems or adjustments to the installation that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, enabling them to adopt an informed approach to applying welding procedures and instructions. The learner will have an understanding of how the friction welding process works and is applied in mechanised form, and will know about the equipment, materials and consumables, in adequate depth to provide a sound background to the process operation and for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the machine and its associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. weld materials using friction welding machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and work instructions 1.3 confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out 1.4 check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • all machine functions operate correctly • all safety equipment is in place and functioning correctly 1.5 check that the parent material, components, consumables and joint preparation comply with specifications	

1.6 produce welded components covering both of the following:
- two different components
- two different material groups

1.7 carry out and monitor the machine operations in accordance with specifications and job instructions

1.8 monitor the process operation and machine functions and make adjustments as required to settings and mechanisms, to include all of the following, as appropriate to the machine type:
- friction and forge cycle time
- friction and forge loads (forces)
- rotational speed or other friction conditions, eg, orbital
- frictional burn-off characteristics and forge displacement
- weld appearance (correct up-set)
- braking effort

1.9 achieve joints of the required quality and specified dimensional accuracy which:
- achieve a weld quality as specified in the application standard or specification
- meet the required dimensional accuracy within specified tolerances

1.10 achieve the rate of output as specified

1.11 deal promptly and effectively with problems within their control and report those that they cannot solve

1.12 shut down the equipment to a safe condition on conclusion of the joining activities.

Learning outcome	The learner will:
2. know how to weld materials using friction welding machines	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when operating friction welding installations (working with machinery; the use of appropriate personal protective equipment; machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the hazards associated with friction welding machines (dangers from live electrical components; fumes; hot metal; moving parts of machinery and components), and how they can be minimised

2.3 explain the principles of friction welding and the terminology used in welding

2.4 describe the key components and features of the equipment (types of machines; constructional features, mechanical features, drive train, driven and stationary component holding devices, force generation and control systems, braking systems; welding cycle control; feedback and recording)

2.5 explain the basic principles of mechanised and automated welding; types of installations; machine functions; safety features

2.6	explain how to extract the information required from drawings and welding procedure specifications
2.7	explain the operation of the machine; controls and their function; care of equipment
2.8	explain how to set up and align the workpiece
2.9	explain how to monitor the installation during the welding process; the various types of monitoring features used on friction welding machines; how to recognise problems, and action to be taken
2.10	describe the problems that can occur with the welding activities, materials and weld defects
2.11	explain self inspection of the completed work
2.12	describe the organisational quality systems (standards to be achieved; feedback from machine; corrective actions; production records to be kept)
2.13	explain the personal approval tests and their applicability to their work
2.14	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.15	explain the reporting lines and procedures, line supervision and technical experts

Unit 217 Joining materials by manual torch brazing and soldering

UAN:	H/601/1912
Level:	Level 2
Credit value:	35
GLH:	129
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 17: Joining Materials by Manual Torch Brazing and Soldering (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to set up and use manual torch brazing and soldering equipment, in accordance with approved instructions or procedures. The learner will be required to check that all the hoses and equipment are correctly connected, free from leaks or damage, and are ready for use. The learner will be required to set and adjust the brazing conditions, in line with the specification. The learner will also need to select and use workholding and manipulating devices that are appropriate to the size and shape of materials and joint configuration being produced. The learner must operate the equipment safely and correctly and make any adjustments to settings, in order to produce the joints to the required specification. The learner's responsibilities will require them to comply with organisational policy and procedures for carrying out the brazing activities, and to report any problems with the brazing equipment, or brazing activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an understanding of how the torch brazing process works. The learner will know about the equipment, materials and consumables, in adequate depth to provide a sound background for the brazing operations to be performed, and for ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the brazing equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. join materials by manual torch brazing and soldering	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and job instructions 1.3 check that the joint preparation complies with the specification 1.4 check that joining and related equipment and consumables are as specified and fit for purpose 1.5 make the joints as specified using the appropriate thermal joining technique 1.6 set up, check, adjust and use one of the following processes and related equipment: • brazing • soldering 1.7 use specified consumables appropriate to the parent metals, to include both of the following: • two different filler metals • appropriate fluxes 1.8 produce brazed or soldered joints according to work procedures, and in good access situations, covering both of the following: • two different components or assemblies • two different parent metal groups 1.9 produce joints of the required quality and of specified dimensional accuracy which: • achieve the specified joint quality as required by the application standard • meet the required dimensional accuracy within specified tolerance • are of good appearance, free from flux residues and excess filler metal	

1.10	shut down the equipment to a safe condition on completion of joining activities
1.11	deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures
1.12	deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to join materials by manual torch brazing and soldering	
Assessment criteria	
The learner can:	
2.1	explain the safe working practices and procedures to be observed when working with gas brazing and soldering equipment (general workshop and site safety, appropriate personal protective equipment, fire and explosion prevention, fume extraction, protecting other workers, safety in enclosed/confined spaces, statutory regulations, risk assessment procedures and COSHH regulations)
2.2	describe the hazards associated with torch brazing and soldering (naked flames, explosive gas mixes, oxygen enrichment, fumes and gasses, hot metal, enclosed spaces), and how they can be minimised
2.3	explain the torch brazing and soldering process (basic principles of the process, wetting and capillary flow, role of fluxes, equipment type and its care)
2.4	describe the types of filler metal and fluxes; forms of filler metal
2.5	describe the types of joints to be produced
2.6	explain how to set up and locate the joint (methods of cleaning joint faces; use of jigs and fixtures, restraining devices; self-locating joints; pre-placement of filler metal and flux)
2.7	explain how to prepare to braze or solder (checks to confirm correct set-up and cleanliness; use of gauges, setting up the equipment, checking connections for leaks, checking operating parameters)
2.8	explain the techniques of operating the equipment to produce a range of joints (selection of nozzle and flame adjustment, application of flux, correct manipulation of torch and filler wire, safe closing down of the equipment)
2.9	explain the importance of complying with job instructions and the joining procedure specification
2.10	describe the problems that can occur with the joining activities and explain how these can be overcome (causes of distortion and methods of control; effects of heat on materials and sources of defects; methods of prevention)
2.11	describe the methods of removing flux residues and cleaning the finished joint
2.12	describe the organisational quality control systems and standards to be achieved; visual and non-destructive tests
2.13	explain the personal approval tests and their applicability to their work
2.14	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.15	explain the reporting lines and procedures, line supervision and technical experts.

Unit 221 Marking out components for fabrication

UAN:	J/601/1921
Level:	Level 2
Credit value:	15
GLH:	63
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 21: Marking Out Components for Fabrication (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required for marking out sheet and plate work, rolled sections, and pipes/tubes using templates and basic tools, in accordance with approved procedures. The learner will be required to select the required materials to use and the appropriate marking out tools and equipment, based on the information presented to them and the accuracy to be achieved. Marking out will be the preparation required for cutting and shaping sheet materials, plate and sections, as appropriate to the application, and will include marking out workpiece datums, centre lines and cutting details, including hole centring and outlining details. Items to be marked out may include ferrous and non-ferrous materials. Certain materials will require the learner to take the grain flow into account to avoid later production process problems. The learner's responsibilities will require them to comply with organisational policy and procedures for the marking out activities undertaken, and to report any problems with the materials, equipment or marking out activities that they cannot resolve them self, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying marking out procedures. The learner will have an understanding of the marking out process, and its application, and will know about the materials as well as the care and use of the tools used, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety procedures required when using marking mediums, and when carrying out the marking out activities. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. mark out components for fabrication	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 obtain and use the correct information for marking out 1.3 obtain the appropriate marking out equipment and check that it is in a usable condition 1.4 mark out directly onto sheet or plate from drawings, using four of the following tools and instruments: • scriber • punch • rule and tape • straight edge • square • dividers or trammels • chalk, bluing or paint • templates 1.5 prepare suitable datums and marking out surfaces 1.6 mark out using appropriate methods 1.7 mark out sheet, plate or section materials on two appropriate materials from the following: • hot-rolled mild steel (black) • cold-rolled mild steel (bright) • coated mild steel (tinned or galvanised) • stainless steel • aluminium • brass • copper • non-metallic materials	

1.8 mark out sheet or plate for three of the following forms/shapes of component:
- bar and section lengths
- cutting detail for flat covers and plates
- frames or structures
- fish plates, gussets
- spars and brackets
- pipe/tube sections
- structural support pads, bed plates
- columns, beams or struts
- simple seatings (eg, boiler saddles, tank cradles)

1.9 mark out material to include three of the following features:
- datum and centre lines
- square/rectangular profiles
- circles
- curved profiles
- cutting detail
- hole centring and outlining (circular and linear)

1.10 check that the marking out complies with the specification

1.11 produce marked out components which meet all of the following quality and accuracy standards:
- dimensionally accurate (to drawing or specification)
- uses recognised marking out conventions
- clearly defined for required processes

1.12 deal promptly and effectively with problems within their control and report those that cannot be resolved.

Learning outcome	The learner will:
2. know how to mark out components for fabrication	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working in a fabrication environment with sheet, plate or rolled section materials (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, etc)

2.3 explain the correct methods of moving or lifting sheet, plate and rolled-section materials

2.4 describe the hazards associated with marking out fabricated components (such as working in a fabrication environment, lifting and handling sheet/fabricated components, slivers/burrs on sheet materials, using marking out mediums, working with laser marking out equipment), and how they can be minimised

2.5 explain the procedures to be adopted to obtain the necessary drawings and job instructions

2.6	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
2.7	describe the preparations that need to be carried out on the material, prior to marking out, to enhance clarity and accuracy, and safety
2.8	explain the principles of marking out, developing basic shapes (flat, rectangular and cylindrical) from flat sheet, plate or rolled section materials
2.9	describe the effective use and care of tools/instruments
2.10	explain the use of marking out conventions, datum edges/lines and centre lines
2.11	explain the ways of laying out the shapes/patterns to maximise the use of plate or sheet material
2.12	explain how to set and adjust tools, such as squares and protractors
2.13	describe the methods of marking out large or long shapes
2.14	explain how to mark out and transfer information from templates
2.15	explain the importance of using tools only for the purpose intended; the care that is required when using the equipment and tools; the proper way of preserving and storing tools and equipment between operations
2.16	explain the need for clear marks and dimensional accuracy in marking out to specifications/drawings
2.17	describe the things that can go wrong in marking out fabrication components, and explain how these can be avoided
2.18	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.19	explain the reporting lines and procedures, line supervision and technical experts.

Unit 222 Cutting sheet metal to shape using hand and machine tools

UAN:	Y/601/1924
Level:	Level 2
Credit value:	28
GLH:	133
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 22: Cutting Sheet Metal to Shape using Hand and Machine Tools (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to cut and shape sheet metal (up to and including 3 mm), in order to fabricate clips, brackets, covers and similar components, in accordance with approved procedures. The learner will be required to select the appropriate equipment to use for the material, thickness and accuracy to be achieved, and will use hand tools, hand power tools and machinery, as applicable. The cutting and shaping will involve producing straight cuts and external curved contours. Items to be cut and shaped may include ferrous and non-ferrous materials. This will call for care in selecting the right tools, so as to avoid damage to the tools and danger to oneself. The learner's responsibilities will require them to comply with organisational policy and procedures, seeking out relevant information, and to report any problems with the cutting equipment, materials or cutting activities that they cannot personal resolve, or are outside their permitted authority, to the relevant person. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying sheet metal cutting and shaping procedures. The learner will have an understanding of the cutting processes used, the equipment and its application, and will know about the materials in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with fabrication tools and machinery. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. cut sheet metal to shape using hand and machine tools	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow relevant specifications for the component to be produced 1.3 obtain the appropriate tools and equipment for the shaping operations and check they are in a safe and usable condition 1.4 shape the materials using appropriate methods and techniques 1.5 cut and finish material to the marked out shape, using four of the following tools: • tin snips • bench shears • guillotine • hacksaw • band saw • hand power tools (drill, nibbling) • pillar drill • files • punch/cropping machine 1.6 perform cutting operations to produce all of the following shapes: • straight cuts • external curved contours • round holes 1.7 use sheet metal of various thicknesses, up to and including 3 mm, for two appropriate materials and two thicknesses from the following: • hot-rolled mild steel (black) • cold-rolled mild steel (bright) • coated mild steel (eg, tinned, galvanised)	

- stainless steel
- aluminium
- brass
- copper

1.8 check that all the required shaping operations have been completed to the required specification

1.9 produce cut and shaped components which meet all the following quality and accuracy standards:

- dimensionally accurate (to drawing or specifications)
- free from distortion
- free from sharp edges, slivers or burrs

1.10 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to cut sheet metal to shape using hand and machine tools	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working with sheet metal equipment and materials in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, etc)

2.3 explain the correct methods of moving or lifting sheet metal

2.4 explain the safe working practices and procedures to be observed when using manual and power-operated tools

2.5 describe the hazards associated with fabrication work (such as using dangerous or badly maintained tools and equipment, operating guillotines, and when using hand and bench shears), and how they can be minimised

2.6 explain the procedures for obtaining the necessary drawings and specifications, and how to check that they are the latest issue

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 the marking out conventions on the materials to be cut and shaped (such as cutting lines, centre lines, etc)

2.9 describe the tools and techniques available for cutting and shaping sheet metal (such as tin snips, bench shears, guillotines, portable power tools, bench drills, saws, etc)

2.10 describe what preparations may have to be carried out on the material prior to cutting it

2.11 explain the material characteristics and process considerations that need to be taken into account when cutting and shaping sheet metal

2.12 explain the use and care of tools and equipment, including checks that need to be made to ensure that the tools are fit for purpose (sharp, undamaged, plugs and cables secure and free from

2.13 explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations

2.14 describe the things that can go wrong with cutting and shaping sheet metal, and explain how these can be avoided

2.15 explain the importance of using the machine guards and safety protection equipment at all times

2.16 describe the inspection techniques that can be applied to check that shape and dimensional accuracy are to specification and within acceptable limits

2.17 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve

2.18 explain the reporting lines and procedures, line supervision and technical experts.

Unit 223 Forming sheet metal using hand and machine tools

UAN:	D/601/1925
Level:	Level 2
Credit value:	28
GLH:	133
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 23: Forming Sheet Metal using Hand and Machine Tools (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to form sheet metal (up to and including 3mm) using hand tools and machine tools, in accordance with approved procedures. The learner will be required to select the appropriate equipment to use, based on the operations required, material to be formed and the accuracy to be achieved, and this will include such things as hammers and stakes, formers, bending machines and rolling machines. The components/shapes to be produced will include bends, folds, cylinders and curved sections, ducting or trunking. The learner's responsibilities will require them to comply with organisational policy and procedures for the forming activities undertaken, and to report any problems with the tools and equipment, materials or activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying sheet metal forming procedures. The learner will have an understanding of the forming processes, the equipment used and

its application, and will know about the materials and forming techniques, in adequate depth to provide a sound basis for carrying out the activities and producing the components to the required specification.

The learner will understand the safety precautions required when working with the forming machines and their associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. form sheet metal using hand and machine tools	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 follow the correct component drawing and any other related specifications for the component to be produced

1.3 determine what has to be done and how this will be achieved

1.4 use the appropriate tools and equipment for the pressure shaping operations and check that they are in a safe and usable condition by carrying out all of the following checks:

- hand tools are in a usable condition (hammer shafts secure; stakes, formers and striking faces free from defects and damage)
- the appropriate machine is selected for the operation being performed
- the machine guards and safety devices are in position and function correctly
- forming tools are appropriate and in a serviceable condition (secure, correct shape, free from damage)

1.5 shape the materials to the required specification using appropriate methods and techniques

1.6 use two of the following types of forming equipment/techniques:

- hammers
- stakes and formers
- bending machine (hand or powered)
- rolling machine (hand or powered)

1.7 carry out forming operations which produce three of the following shapes:

- bends
- folds
- curved panels
- cylindrical sections
- ducting or trunking

1.8 produce components made from two different materials from the following:
- bright mild steel
- tinned steel
- galvanised plate
- stainless steel
- aluminium
- brass
- copper

1.9 check that all the required shaping operations have been completed to the required standard

1.10 produce components which meet all of the following quality and accuracy standards:
- dimensional accuracy is within specification tolerances
- finished components meet the required shape
- completed components are free from excessive tooling marks, deformation or cracking

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to form sheet metal using hand and machine tools	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working with sheet metal equipment and materials in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather apron and gloves, eye protection, safety helmets, etc)

2.3 explain the correct methods of moving or lifting sheet or plate materials

2.4 describe the hazards associated with sheet metalwork (such as handling sheet/fabricated components, using machinery, using dangerous or badly maintained tools and equipment), and how they can be minimised

2.5 explain how to obtain the necessary drawings, specifications and work instructions

2.6 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)

2.7 explain the marking out conventions used in sheet metalwork, and how to recognise cutting detail and bending and folding lines

2.8 explain how hand tools are used in the sheet metal forming activities, and typical operations that they are used for (range of hammers, stakes)

2.9 describe the various machine-tool forming equipment that can be used to produce a range of shapes (such as bends, cylinders and

2.10	explain how the materials are to be prepared for the forming operations
2.11	explain the tool and equipment care and maintenance procedures
2.12	describe the dimensional and forming inspection checks that need to be carried out, and the tools and equipment to be used
2.13	explain the limitations of the various forming processes, and the accuracy that may realistically be achieved
2.14	describe ways of avoiding inaccuracies in forming activities
2.15	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.16	explain the reporting lines and procedures, line supervision and technical experts.

Unit 224 Producing sheet metal assemblies

UAN:	M/601/1931
Level:	Level 2
Credit value:	35
GLH:	119
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 24: Producing Sheet Metal Assemblies (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce basic sheet metal (up to and including 3mm) assemblies, in accordance with approved procedures. The learner will be required to work in accordance with instructions, to bring together, prepare for joining and assemble, in the right order, sheet metal components and/or light sections, in order to construct complete fabricated assemblies or sub-assemblies, such as ducting, tanks, cylindrical sections, etc. The learner will be required to lay out and secure the various component parts of the structure using mechanical fastenings, clamps or jigs, ready for welding or to use self-securing methods, in the correct order, and the learner will ensure they are assembled in a manner that is fit for purpose. The learner's responsibilities will require them to comply with organisational policy and procedures for the sheet metal fabrication activities to be undertaken, and to report any problems with the activities, tools and equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying sheet metal fabrication techniques and their assembly and fixing procedures. The learner will have an understanding of the requirements of the manufacturing and assembling procedures, the techniques used and their application. The learner will know about the methods of assembling components of the required strength, which are fit for purpose, in adequate depth to provide a sound basis for carrying out the activities to ensure the work output is produced to the required specification.

The learner will understand the safety precautions required when working with sheet metal components and their associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce sheet metal assemblies	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the sheet metal assembly operations: • correctly prepare and set up the components and faces to be joined • use the correct datum faces • use the specified or appropriate fixing method • correctly align the components and faces to be joined • assemble/fabricate the sheet metal components in the correct order or manner • produce an assembly which meets the required specification 1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 check that the specified components are available and that they are in a usable condition 1.5 use three of the following types of components in the assemblies produced: • sheet metal covers • pre-fabricated square/rectangular components • pre-fabricated cylindrical/conical components • brackets • flanges	

- pipes
- light rolled section (angle, channel or tee section)
- stiffeners and frame components

1.6 use the appropriate methods and techniques to assemble the components in their correct positions

1.7 assemble sheet metal components using two of the following methods:

- temporary tack welding
- soldering or brazing
- resistance spot welding
- riveting (hollow or solid)
- adhesive bonding
- flanged and mechanically fastened (bolts, screws)

1.8 secure the components using the specified connectors and securing devices

1.9 produce four of the following sheet metal assemblies:

- frames
- tanks
- ducting
- guards
- hoods
- panels
- sectional trunking
- square, rectangular and box sections
- cylindrical sections
- conical sections
- reduction pieces

1.10 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification to include all of the following:

- all components are correctly assembled and aligned in accordance with the specification
- overall dimensions are within specification tolerances
- assemblies meet appropriate geometric tolerances (square, straight, angles free from twists)
- where appropriate, pitches of erection holes meet specification requirements
- completed assemblies have secure and firm joints, and are clean and free from burrs or flash

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to produce sheet metal assemblies	
Assessment criteria	
The learner can: 2.1 explain the specific safety precautions to be taken when working in a fabrication environment and when producing sheet metal assemblies (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials) 2.2 describe the personal protective clothing and equipment that needs to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, ear protection, etc) 2.3 explain the safe working practices and procedures to be used when producing sheet metal assemblies 2.4 explain the correct methods of moving or lifting bulky fabrications 2.5 describe the hazards associated with sheet metal fabrication and assembly work (such using dangerous or badly maintained tools and equipment, lifting and handling long and heavy components, cuts, slips trips and falls), and how they can be minimised 2.6 explain how to obtain the necessary drawings and joining 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 marking out conventions (cutting lines, centre lines, etc) 2.9 describe the preparations that need to be carried out on the components prior to assembling them 2.10 describe the various methods of securing the assembled components; the range of mechanical fastening devices that are used (such as nuts and bolts, screws, special fasteners, resistance and tack welding methods and techniques, adhesive bonding of components) 2.11 explain how to set up and align the various components, and the tools and equipment to be used 2.12 describe the methods of temporarily holding the joints together to aid the assembly activities (clamps, rivet clamps) 2.13 explain the use and care of tools and equipment, and their control procedures 2.14 explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations 2.15 describe the things that can go wrong when producing sheet metal assemblies, and explain how these can be avoided 2.16 describe the inspection techniques that can be applied to check that shape (including straightness) and dimensional accuracy are to specification and within acceptable limits 2.17 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve 2.18 explain the reporting lines and procedures, line supervision and technical experts	

Unit 225 Heat treating materials for fabrication activities

UAN:	F/601/1934
Level:	Level 2
Credit value:	10
GLH:	56
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 25: Heat Treating Materials for Fabrication Activities (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to heat treat ferrous and non-ferrous materials in order to assist with the fabrication activities, in accordance with approved procedures. The learner will be required to identify and use the appropriate materials, apply the relevant processes and use appropriate tools and equipment, based on the information presented to them, in order to achieve the required condition. The heat treatment processes will include hardening, tempering, annealing and normalising/stress relieving, and can be applied to the fabricator's tools, such as punches, chisels and scribers, or to the component/materials to be worked on. The learner's responsibilities will require them to comply with organisational policy and procedures for the heat treatment activities undertaken, and to report any problems with the heat treatment equipment, materials used or heat treatment activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide a sound approach to

applying the heat treatment procedures. The learner will have an understanding of the principles and application of heat treatment, and will know about the effects on the structure and characteristics of the materials, in sufficient depth to provide a sound basis for ensuring the process is carried out to the required specification.

The learner will understand the safety precautions to be observed when carrying out heat treatment processes and when using the associated equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. heat treat materials for fabrication activities	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 carry out all the following during the heat treatment activities:

- use the correct heat treatment procedure and quality documentation
- follow relevant COSHH and risk assessment procedures
- apply the required heat treatment processes, safely and correctly
- ensure the safety of self and others while carrying out the processes
- leave the work area in a safe condition on completion of the activities

1.3 ensure the materials to be processed are suitably prepared for the processing operations to be carried out

1.4 apply the appropriate heat treatment process to one of the following:

- ferrous components/sections
- ferrous high carbon tools (punches, chisels, scribes)
- hot steel rivets
- non-ferrous sheet or plate

1.5 check and monitor that the processing equipment is set up and maintained at satisfactory operating conditions throughout the processing operations

1.6 carry out the process in accordance with operating procedures and the workpiece specification requirements

1.7 carry out one of the following heat treatment processes/techniques:

- hardening
- tempering
- annealing

- pre-heating
- normalising/stress relieving

1.8 ensure that the processed workpiece achieves the required characteristics and meets the processing specification

1.9 carry out heat treatment processes to all of the following quality and accuracy standards, as applicable to the process carried out:

- tools are of the correct hardness for the application and, where appropriate, suitably tempered
- hardened materials are free from cracks
- materials/components are suitably treated to allow working
- distortion is limited and controlled

1.10 deal promptly and effectively with problems within their control and report those that they cannot solve

1.11 dispose of waste and excess materials in line with agreed organisational procedures

1.12 shut down the processing equipment to a safe condition on completion of the processing activities.

Learning outcome	**The learner will:**

2. know how to heat treat materials for fabrication activities

Assessment criteria

The learner can:

2.1 explain the specific safety precautions to be taken and safe working practices to be employed when carrying out the heat treatment of materials in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when working on heat treatment processes (gloves, eye protection, etc)

2.3 explain the handling precautions and correct methods of moving materials, particularly when they are hot

2.4 describe the hazards associated with fabrication heat treatment processes (such as handling sheet/fabricated components, handling hot materials, overheating quenching oils), and how they can be minimised

2.5 explain the reasons for heat treating materials

2.6 explain the various heat treatment processes, methods and procedures that may be applied

2.7 describe the type of equipment that can be used to carry out the various heat treatment processes (furnaces, blacksmiths forge, gas torches)

2.8 explain the safe handling techniques for hot metal components

2.9 explain how the materials need to be prepared in readiness for the heat treatment operations

2.10 describe the type of materials that can be heat treated, and the processes that may be applied

2.11 describe the various cooling and quenching techniques that are applied to the processes, and why it is important to use the correct process (water, oil, sand, air)

2.12	explain ways of limiting distortion during the heat treatment process
2.13	describe the quality control procedures and recognition of defects
2.14	explain the limitations of the various processes
2.15	describe the organisational procedures for disposing of and recycling of waste
2.16	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.17	explain the reporting lines and procedures, line supervision and technical experts.

Unit 226 Cutting and shaping materials using NC/CNC laser profiling machines

UAN:	R/601/1937
Level:	Level 2
Credit value:	37
GLH:	154
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 26: Cutting and Shaping Materials using NC/CNC Laser Profiling Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out cutting and profiling operations using NC/CNC laser profiling machines, in accordance with approved procedures. The learner will take charge of the prepared machine and check that it is ready for the machining operations to be performed. This will involve checking that all the required materials and consumables are present, and that the machine has been approved for production. In operating the machine, the learner will be expected to follow the correct procedures for calling up the machine-operating program, dealing with any error messages, and executing the program activities safely and correctly. The components produced will have a number of different features, including square and rectangular profiles, angular profiles, curved profiles, circles, slots, holes linearly positioned and holes radially positioned. The learner will be required to continuously monitor the cutting operations, making any necessary adjustments to machine parameters, in line with their permitted authority. Meeting production targets will be an important issue, and the learner's production records must show consistent and satisfactory performance.

The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the equipment, program or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying CNC laser cutting and profiling procedures. The learner will have an understanding of the CNC cutting/profiling process, and its application, and will know about the equipment, materials and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the laser cutting/profiling machine and its associated equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. cut and shape materials using NC/CNC laser profiling machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation by checking all of the following: • the machine has been approved for production • all safety equipment and guards are in place and functioning correctly • materials are correctly positioned and held securely without distortion • the laser lens is clean and in a suitable condition • the operating program is at the correct start point • safe working practices and start up procedures are observed • machine settings are adjusted as required to maintain accuracy 1.3 follow the defined procedures for starting and running the operating system 1.4 deal promptly and effectively with error messages or equipment	

1.5 monitor the computer process and ensure that the production output is to the required specification

1.6 produce cut and shaped components which cover five of the following features:

- square/rectangular profiles
- angular profiles
- curved profiles
- circles
- ellipses
- holes linearly positioned
- holes radially positioned
- slots and apertures
- other features

1.7 machine one of the following types of material:

- ferrous
- non-ferrous
- stainless steel
- alloy steel
- other appropriate material

1.8 produce components within all of the following quality and accuracy standards:

- dimensional accuracy is within the tolerance specified on the drawing/specification or within +/- 1.5mm
- angled cuts are within specification requirements (perpendicular/angularity)
- cuts are clean and smooth
- components are free from distortion

1.9 shut down the equipment to a safe condition on conclusion of the activities.

Learning outcome	The learner will:
2. know how to cut and shape materials using NC/CNC laser profiling machines	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when operating NC/CNC laser cutting and profiling machines (care when working with high power laser beams; machine guards; ventilation and fume extraction; machine safety devices)

2.2 explain how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities

2.3 explain the importance of ensuring the machine is isolated from the power supply before working with machinery; and the care needed, particularly when working with laser beams

2.4 explain the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy

2.5	describe the hazards associated with using laser cutting and profiling machines (dangers from the laser beam; live electrical components; moving parts of machinery), and how they can be minimised
2.6	explain the principles and operation of lasers and laser machines and explain the terminology used
2.7	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)
2.8	explain how to interpret the visual display and understand the various messages displayed
2.9	explain the function of error messages, and what to do when an error message is displayed
2.10	explain how to find the correct restart point in the program when the machine has been stopped before completion of the program
2.11	explain the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons)
2.12	explain how to operate the machine using single block run, full program run and speed override controls
2.13	explain how to make adjustments to machine-operating programs to take account of out-of-specification components
2.14	explain how to take care of equipment and operating programs, including safe storage of material away from electromagnetic forces
2.15	explain how to monitor the machine during the cutting process; recognition of problems and action to be taken
2.16	describe the problems that can occur during the laser cutting activities, and how to prevent them
2.17	describe the organisational quality systems (standards to be achieved; production records to be kept)
2.18	describe the extent of their own authority and explain whom they should report to if they have problems they cannot resolve.

Unit 227 Cutting and shaping using NC/CNC plasma or gas cutting machines

UAN:	J/601/1949
Level:	Level 2
Credit value:	37
GLH:	154
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 27: Cutting and Shaping using NC/CNC Plasma or Gas Cutting Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out cutting and profiling operations using NC/CNC plasma or gas cutting and profiling machines, in accordance with approved procedures. The learner will take charge of the prepared machine and check that it is ready for the cutting operations to be performed. This will involve checking that all the required materials and consumables are present, and that the machine has been approved for production. In operating the machine, the learner will be expected to follow the correct procedures for calling up the machine-operating program, dealing with any error messages, and executing the program activities safely and correctly. The components produced will have a number of different features, including square and rectangular profiles, angular profiles, curved profiles, circles, slots, holes linearly positioned and holes radially positioned. The learner will be required to continuously monitor the cutting and shaping operations, making any necessary adjustments to machine parameters, in line with their permitted authority. The learner's responsibilities will require them to comply with organisational policy

and procedures for the activities undertaken, and to report any problems with the equipment, program or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying CNC plasma or gas cutting/profiling procedures. The learner will have an understanding of the CNC cutting process, and its application, and will know about the equipment, materials and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the plasma/gas cutting machine and its associated equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. cut and shape using NC/CNC plasma or gas cutting machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 use one of the following thermal cutting methods: • oxy-fuel gas cutting • plasma gas cutting 1.3 confirm that the equipment is set up and ready for operation to include checking all of the following: • the machine has been approved for production • all safety equipment and guards are in place and functioning correctly • materials are correctly positioned and held securely without distortion • the cutting nozzles are clean and in a suitable condition • the operating program is at the correct start point • the workpiece is clear of the machine spindle • safe working practices and start-up procedures are observed • machine settings are adjusted as required to maintain accuracy 1.4 follow the defined procedures for starting and running the operating	

1.5 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved

1.6 monitor the computer process and ensure that the production output is to the required specification

1.7 produce components which are cut and shaped, and which cover six of the following features:

- square/rectangular profiles
- angular profiles
- curved profiles
- circles
- ellipses
- round holes
- slots and apertures
- angled cuts
- bevelled edge – weld preparations
- other features

1.8 machine one of the following types of material:

- mild steel
- carbon steel
- stainless steel
- other alloy steels
- other appropriate material

1.9 produce components within all of the following quality and accuracy standards:

- dimensional accuracy is within the tolerance specified on the drawing/specification or within +/- 1.5mm
- angled cuts are within specification requirements (perpendicular/angularity)
- cuts are clean and smooth with minimal drag lines
- components are free from distortion

1.10 shut down the equipment to a safe condition on conclusion of the activities.

Learning outcome	The learner will:
2. know how to cut and shape using NC/CNC plasma or gas cutting machines	
Assessment criteria	

The learner can:

2.1 explain the safe working practices and procedures to be observed when operating NC/CNC plasma and gas cutting/ profiling machines (general workshop and site safety, appropriate personal protective equipment, fire and explosion prevention, protecting other workers; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials; machine safety devices)

2.2 explain how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities

2.3 explain the importance of ensuring the machine is isolated from the power supply before working with machinery; and the care needed

2.4 describe the equipment that needs to be worn when working with fabrications and thermal cutting equipment (leather aprons and gloves, eye protection, safety helmets, etc)

2.5 describe the hazards associated with using CNC thermal cutting equipment (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal, moving parts of machinery), and explain how they can be minimised

2.6 explain the correct methods of moving or lifting plate materials and components

2.7 explain the principles and operation of the plasma or gas cutting equipment, and the terminology used in thermal cutting, in relation to the operations being performed

2.8 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)

2.9 explain how to interpret the visual display and understand the various messages displayed

2.10 explain the function of error messages, and what to do when an error message is displayed

2.11 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program

2.12 explain the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons)

2.13 explain how to operate the machine using single block run, full program run and speed override controls

2.14 explain how to make adjustments to machine-operating programs to take account of out-of-specification components

2.15 explain how to set up the correct operating conditions; flame control and the effects of mixtures and pressures associated with thermal cutting

2.16 explain the effects of oil, grease, scale or dirt on the cutting process

2.17 explain how to take care of equipment and operating programs, including safe storage of material away from electromagnetic forces

2.18 explain how to monitor the machine during the cutting process; recognition of problems and action to be taken

2.19 describe the actions to be taken prior to cutting (setting up the material/workpiece, checking cleanliness of materials used)

2.20 describe the work holding methods that are used to aid thermal cutting, and equipment that can be used

2.21 describe the problems that can occur with thermal cutting and explain how they can be avoided; causes of distortion during thermal cutting and methods of controlling distortion

2.22 describe the organisational quality systems (standards to be achieved; production records to be kept)

2.23 describe the extent of their authority and explain whom they should report to if they have problems that they cannot resolve

2.24 explain the reporting lines and procedures, line supervision and technical experts.

Unit 228 Assembling components using mechanical fasteners

UAN:	F/601/1951
Level:	Level 2
Credit value:	18
GLH:	70
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 28: Assembling Components using Mechanical Fasteners (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to undertake the preparation and making of joints between fabricated components, using mechanical means, in accordance with approved procedures. The learner will be required to produce suitable and appropriate joints, using appropriate methods for the materials to be joined that meet the specified conditions and subsequent operating conditions to be demanded of the joint. Particular attention will be needed in the preparation and finishing of the materials, so that the finished component is fit for purpose and meets the level of accuracy required. The mechanical fastenings used will include rivets, self-tapping screws, bolts and screwed fittings, anchor nuts and proprietary fasteners, as appropriate to the application and/or specification. The joint will be of two or more materials, and may include non-metallic materials and joints of dissimilar metals. The learner's responsibilities will require them to comply with organisational policy and procedures, or those of the fastener manufacturers. The learner will be expected to report any problems with the mechanical fasteners, or the joining activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own

actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to the mechanical joining activities carried out. The learner will have an understanding of the basic characteristics of the materials to be joined, the various processes used and the appropriate procedures that go with them, in adequate depth to provide a sound basis for achieving a sound and cohesive joint that is fit for purpose.

The learner will understand the safety precautions required when working with the tools and equipment, especially those for use in hot metal processes, and the safeguards necessary for undertaking the joining processes. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. assemble components using mechanical fasteners	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant instructions, assembly drawings and any other specifications 1.3 check that the specified components are available and that they are in a usable condition 1.4 carry out all of the following during the joining process: • correctly prepare the faces of the materials to be joined • select the appropriate/specified fixings • correctly align the materials and faces to be joined • assemble the components in the correct order or manner • produce a joint that meets the requirements of the specification 1.5 use the appropriate methods and techniques to assemble the components in their correct positions 1.6 use four of the following assembly methods and techniques: • riveting using cold or/and hot rivets • riveting using pop/blind rivets • self-tapping screws • use of proprietary fasteners • crimping • assembling using bolt fittings	

- using screw fittings to tapped components
- nuts and (spot welded) screw studs
- locking methods and devices
- clinching

1.7 produce assemblies which include four of the following:
- flat and flanged joints on flat or curved surfaces
- square/rectangular trunking
- circular trunking
- access flanges and cover plates
- tanks and tank covers
- joints with gasket or sealant
- pipes
- structural components
- long or critical alignments
- permanent and temporary assemblies

1.8 join the components in three of the following joining positions or access and environmental conditions:
- horizontal
- vertical
- overhead
- in workshop conditions
- in the field
- internal and confined spaces

1.9 secure the components using the specified connectors and securing devices

1.10 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification

1.11 produce joints to all of the following quality and accuracy standards, as applicable to the application:
- joints are accurately assembled and aligned in accordance with the specifications
- joints are secure and firm
- bolted and screwed joints are tightened to the correct torque
- riveted joints are free from excessive material deformation and hammer marks
- pitch of holes meet the specification
- completed joints are clean and free from burrs

1.12 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to assemble components using mechanical fasteners	
Assessment criteria	
The learner can: 2.1 explain the specific safety precautions to be followed when working in a fabrication environment and when carrying out joining activities using fabricated components (general workshop and site safety, appropriate personal protective equipment, accident	

procedure; statutory regulations, risk assessment procedures and COSHH regulations)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the joining activities (leather gloves, eye protection, safety helmets, etc)

2.3 describe the hazards associated with the joining operations (such as handling sheet/fabricated components, using hot metal riveting techniques, handling and using sealants and cleaning agents, dangerous or badly maintained tools and equipment), and how they can be minimised

2.4 explain how to obtain the necessary drawings and joining procedure specifications

2.5 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)

2.6 explain the use of manufacturers' specifications for the types of fasteners used

2.7 describe the various joining processes that are used, and the tools and equipment required

2.8 describe the preparations to be carried out on the materials/components prior to joining them (such as materials to be degreased, dry and clean, with holes and flanges de-burred)

2.9 explain how to set up and align the joints prior to fixing, and the tools and methods that can be used (such as clamps, rivet gripping tools, temporary fixings, jacking and supporting devices)

2.10 explain how to produce a secure joint using blind rivets, and the type of riveting tools that are available

2.11 explain how to produce a good hot or cold riveted joint, and the use of the various riveting tools

2.12 explain how to determine the length of the rivets required to give a properly formed rivet head

2.13 describe the range of bolts and screwed fasteners that are to be used; why it is important to use the correct type of washer; sequence of tightening bolts on flanged joints; and the tools and equipment used to ensure they are tightened to the required torque

2.14 describe the checks to be carried out on the tools and equipment prior to use to ensure that they are in a safe and usable condition (such as condition of plugs and leads on power tools, condition of striking faces on hammers, condition of riveting tools and rivet snaps)

2.15 explain the equipment setting, operating and care procedures; explain why equipment and tools need to be correctly set up and in good condition

2.16 explain the importance of using the tools only for the purpose intended; the care that is required when using the equipment and tools; the proper way of preserving and storing tools and equipment between operations

2.17 describe the things that can go wrong with the joining operations, and how these can be avoided

2.18 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve

2.19 explain the reporting lines and procedures, line supervision and technical experts.

Unit 229 Bonding engineering materials using adhesives

UAN:	H/601/1960
Level:	Level 2
Credit value:	14
GLH:	56
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 29: Bonding Engineering Materials using Adhesives (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to undertake the joining of engineering materials using adhesive bonding processes, in accordance with approved procedures. The learner will be required to work to instructions, using appropriate or specified bonding agents for the materials to be joined, that meet the specified conditions and subsequent operating conditions to be demanded of the joint. Particular attention will be needed in the preparation of the materials and the application of the bonding agent, as well as the means of securing the joint until the setting or curing process has been completed, so that the finished component meets the level of accuracy required. The adhesive bonding agents used will include impact adhesives, cold curing adhesives, rubber mastic, solvent adhesives, epoxy resins and thermally cured adhesives. The joint will be of two or more materials and may include metallic and/or non-metallic materials and joints of dissimilar materials. The learner's responsibilities will require them to comply with organisational policies and procedures, and/or those of the bonding agent manufacturers. The learner will be expected to report any problems with the bonding agents, materials or bonding activities that they cannot resolve them self, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal

responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to the adhesive bonding activities carried out. The learner will have an understanding of the basic characteristics of the materials to be joined, the bonding agents used and the procedures that go with them, in adequate depth to provide a sound basis for carrying out the activities safely and correctly and for achieving a sound and cohesive joint that is fit for purpose.

The learner will understand the precautions required when working with the various bonding agents, and the safeguards necessary for undertaking the process. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. bond engineering materials using adhesives	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the adhesive bonding process: • correctly prepare the materials for bonding • select the right constituents and bonding methods • check the surfaces to be bonded mate properly to make a sound joint possible • ensure the joint is rigidly secure during the curing period • remove surplus material and clean up at the appropriate time 1.3 follow the relevant bonding procedure specification and job instructions 1.4 check that the materials to be bonded and bonding agents comply with the specification 1.5 carry out adhesive bonding activities using two of the following types of material: • metallic • non-metallic • combinations 1.6 use two of the following types of adhesives: • impact adhesives • cold curing adhesives • rubber mastic	

- solvent adhesives
- epoxy resins
- thermally cured adhesives

1.7 correctly prepare the parent materials and bonding agents in line with the bonding specification

1.8 carry out the bonding operations using the specified processes and techniques to position and bond the materials in their correct locations

1.9 produce bonded joints in three of the following types of component:

- flat and flanged joints on flat surfaces
- flat and flanged joints on curved surfaces
- vertical components
- horizontal components
- rectangular trunking
- circular trunking
- access flanges, panels and cover plates
- tanks and tank covers
- pipework

1.10 use a range of bonding equipment and devices, to include four of the following:

- mixing vessels
- spatulas, brushes, knives
- spray equipment
- jigs
- formers
- clamps
- presses
- weights
- temporary fixtures (clips, wiring)

1.11 use a range of preparation and cleaning agents, to include two of the following:

- detergents
- solvents
- petroleum products
- acids

1.12 ensure that any equipment used to maintain surface contact during the bonding activities is set up and used correctly

1.13 achieve bonds of the required quality and within the specified dimensional accuracy which comply with all of the following:

- components are dimensionally accurate and of the correct orientation
- joints meet the required application standard
- completed joints are clean and free from surplus adhesive
- the completed joint has the required appearance

1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to bond engineering materials using adhesives	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when bonding engineering materials using adhesives in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory regulations, risk assessment procedures and COSHH regulations)

2.2 describe the personal protective clothing and equipment to be worn when carrying out bonding as part of the fabrication activities (gloves, eye protection, safety helmets, respiratory protection, etc)

2.3 explain the importance of good workshop practice and house keeping, ventilation and fume control equipment, first aid procedures and actions, hazardous substances and relevant sections of COSHH

2.4 explain the correct methods of moving or lifting sheet or plate materials

2.5 describe the hazards associated with bonding fabricated components, and explain how they can be minimised

2.6 explain how to obtain the necessary drawings and joining 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 the work undertaken)

2.8 describe the material preparations that are required, and the equipment and consumables that are used

2.9 explain the importance of working to organisational and bonding agent manufacturers' instructions whilst carrying out the bonding activities

2.10 describe the methods and techniques used for bonding the materials (such as gluing, impact, chemical and thermal reaction techniques)

2.11 explain the basic characteristics of the adhesives that are to be used

2.12 explain the application of, and precautions to be taken when using, adhesives and solvents

2.13 explain the maintenance and care of tools and equipment

2.14 explain the methods of degreasing components and producing a keying surface

2.15 explain the type and suitability of the adhesives; setting or curing requirements and time, strength and appearance

2.16 describe the common causes of defects associated with the bonding processes, and how to avoid them

2.17 explain the effects of the environment on the bonding process (such as temperature, humidity, cleanliness)

2.18 explain how to identify, select, use, and clean, the appropriate bonding agent holding vessels, brushes, stirrers and spatulas, scrapers, knives, clamps and weights

2.19 explain the importance of cleaning up after use, to ensure everything can be used again and to minimise the need for replacement of equipment

2.20	explain the reasons for checking that components are assembled in the correct sequence, are positioned dimensionally accurately and to the correct orientation, in accordance with the specifications, prior to bonding
2.21	explain how to check that completed joints are firm, sound and fit for purpose
2.22	describe the procedures for cleaning off surplus adhesive and tidying up the appearance of joints
2.23	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.24	explain the reporting lines and procedures, line supervision and technical experts.

Unit 230 Joining materials by resistance spot welding

UAN:	J/601/1966
Level:	Level 2
Credit value:	7
GLH:	35
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 30: Joining Materials by Resistance Spot Welding (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to set up and use portable, and simple fixed spot welding machines, in accordance with approved instructions or welding procedures. The learner will be expected to check that the equipment is fit for purpose, that electrodes are correctly profiled, and that the component parts are in the correct condition for spot welding. In preparing the equipment, the learner will need to set the welding current, welding and squeeze times and electrode pressure. The learner must operate the equipment safely and correctly, and make any necessary adjustments to the equipment settings and parameters within permitted tolerances, in order to achieve a weld quality and tolerances that meet the specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the welding activities undertaken, and to report any problems or adjustments to the equipment that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a sound basis of their work, and will enable them to adopt an informed approach

to applying spot welding procedures and instructions. The learner will understand how the resistance spot welding process works, and will know about the equipment, materials and consumables, in adequate depth to provide a sound background to the process operation and for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the resistance spot welding equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. join materials by resistance spot welding	
Assessment criteria	
the learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the resistance spot welding equipment is fit for purpose, by carrying out all of the following checks: • equipment range is suitable for the operations to be performed • portable equipment power leads are undamaged and securely connected • electrodes are of the correct type, size and profile • all equipment mechanical and electrical systems operate correctly • supplies of components are adequate and suitably prepared • appropriate safety screens are available 1.3 follow the relevant joining procedure and work instructions 1.4 confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out 1.5 set up, check, adjust and operate one of the following resistance spot welding machines: • portable spot welding machines • fixed simple spot welding machines 1.6 set up the equipment parameters in accordance with instructions and the welding procedure specification, to include setting all of the following: • electrode tip diameter/profile • welding current • welding and squeeze times • electrode pressure 1.7 check that the parent material, components, consumables and joint preparation comply with specifications 1.8 carry out and monitor the machine operations in accordance with specifications and job instructions	

1.9 monitor the process operation and make adjustments to parameters, in order to produce welded components covering both of the following:
- two different components
- two different material thicknesses

1.10 achieve joints of the required quality and specified dimensional accuracy

1.11 produce welded components which meet all the following requirements:
- achieve a weld quality as specified in the application standard
- spot welds are correctly pitched out
- welded components meet the required dimensional accuracy within specified tolerance

1.12 make sure that the rate of output is as specified

1.13 deal promptly and effectively with problems within their control and report those that they cannot solve

1.14 shut down the equipment to a safe condition on conclusion of the joining activities.

Learning outcome	The learner will:
2. know how to join materials by resistance spot welding	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when operating resistance welding equipment (working with machinery, the use of appropriate personal protective equipment; the use of safety screens; operation of machine safety devices; closing down the machine on completion of the welding activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the hazards associated with resistance welding equipment (dangers from live internal electrical components, fumes, hot metal, expulsion of hot particles, moving parts of machines), and how they can be minimised

2.3 explain the basic principles of resistance welding; heat and pressure to form a weld; heating effect of welding current; principal features of the welded joint; heat input; welding and pressure cycles; terminology used in welding

2.4 describe the key components and features of the equipment used (power source; welding head; power range; electrical parameters (such as arc voltage, current, electrode pressure and welding time); systems for parameter control; how variation in the parameters influence weld features, quality and output)

2.5 explain how to extract the information required from the drawings and welding procedure specifications

2.6 explain the operation of the machine controls and their function; equipment care procedures

2.7 explain how to monitor the equipment during the welding process; fine tuning parameters to maintain quality; recognition of problems and action to be taken

2.8 describe problems that can occur with the welding activities; materials and weld defects

2.9	explain self inspection of completed work
2.10	describe the organisational quality systems (standards to be achieved; production records to be kept)
2.11	explain the personal approval tests and their applicability to their work
2.12	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.13	explain the reporting lines and procedures, line supervision and technical experts.

Unit 231 Slinging, lifting and moving materials and components

UAN:	Y/601/1969
Level:	Level 2
Credit value:	14
GLH:	56
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 31: Slinging, Lifting and Moving Materials and Components (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to move loads by slinging and lifting, in accordance with approved procedures. The learner will be required to use correctly specified items of lifting gear, which will include hand, and/or power operated cranes and winches, and associated lifting accessories. The learner must check that the lifting equipment is within current authorisation dates, is undamaged and within the permitted safe working load. The learner will be expected to correctly estimate the weight of the load to be moved, and attach the appropriate slings to suitable or designated lifting points on the load in order to achieve a safe and balanced lift. The learner must check the area that the load will move through, to ensure that it is free from obstructions and is safe for the load to be moved. The learner will also be expected to give the correct hand and verbal signals during the lifting activities. The learner's responsibilities will require them to comply with organisational policy and procedures for the slinging, signalling and lifting activities undertaken, and to report any problems with the slinging and lifting equipment or the lifting activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with minimum supervision, taking personal responsibility for their own actions and for the safety and integrity of the materials being moved. The learner's knowledge will be sufficient to provide a good understanding of their work, and

will provide an informed approach to applying slinging, signalling and lifting procedures. The learner will have an understanding of the slinging, signalling and lifting techniques used, and their application, and will know about the lifting equipment and accessories for lifting, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will need to understand the safety precautions required when slinging and lifting components, and the safeguards that are necessary for undertaking the activities. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. sling, lift and move materials and components	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment to be used is suitable for the components being lifted, and is in a safe and usable condition, by checking all of the following: • equipment is certified and is compliant, within current test dates • all lifting equipment registers are up to date • all slings are free from obvious defects • the lifting equipment selected is suitable and has a sufficient SWL for the application • the identification number and SWL are clearly marked on the equipment selected • the equipment selected is suitable for the environment of operation 1.3 find the weight of the materials/loads to be moved using all of the following, as applicable: • check against documentation • calculation from drawings • by estimation • by converting metric-imperial 1.4 use two of the following lifting and moving methods and techniques: • crane • winch • powered lifting equipment • lifting appliances • pulling appliances • multi-sheaved block combinations	

- hand operated lifting equipment
- jacks, skates and trolleys

1.5 position the moving equipment so that the weight of the load is evenly distributed

1.6 attach the appropriate handling equipment securely to the load, using approved methods to eliminate slippage

1.7 use two of the following slinging methods:

- single-leg slings
- two-leg slings
- three- and four-leg slings

1.8 confirm that the load is secure before moving

1.9 move the load over the selected, suitable route

1.10 move two of the following types of loads:

- sheet materials
- pipes, bars, joists, etc (single and in bundles)
- fragile items
- hot/radiant items
- components with evenly distributed weight
- components with uneven distributed weight
- awkward shaped loads
- corrosive substances/chemicals

1.11 move loads safely and correctly, to be re-positioned in two of the following positions:

- to differing elevations
- as part of an assembly
- through complex rigging operations
- along the same elevation
- turn a load

1.12 position and release the load safely in its intended final location.

Learning outcome	The learner will:
2. know how to sling, lift and move materials and components	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when slinging and lifting loads, and the need for ensuring load security (general workshop and site safety, appropriate personal protective equipment, protecting other workers during the lifting operations; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the hazards associated with slinging and lifting of loads, and how they can be minimised

2.3 explain their understanding of ACOP for safe use of lifting equipment, and Lifting Operation & Lifting Equipment Regulations (LOLER)

2.4 explain the specific requirements for the marking of lifting equipment, and the specific method used in the organisation in which they are working

2.5	describe the range of equipment to be used for the lifting operations (such as hand and power operated cranes, winches pulling equipment)
2.6	describe the lifting equipment accessories to be used (such as slings, chains, wire ropes, eye bolts)
2.7	describe the checks that should be made on the lifting equipment prior to use, and things that they should look for
2.8	explain how to carry out in-service inspections of the equipment, and what to do should any defective equipment be identified
2.9	explain how to determine the approximate weight of the load to be moved
2.10	explain the factors which affect the selection of the lifting equipment and lifting accessories (such as weight, type of load, operating environment)
2.11	explain how to check that the lifting equipment is capable of lifting the load to be moved
2.12	explain how to determine the centre of gravity of the load, and how to determine suitable slinging and lifting points
2.13	explain how to plan and prepare a route for moving loads, and the things that they will need to take into account
2.14	explain the specific requirements in their organisation for the use of lifting equipment and lifting operations
2.15	explain the signalling techniques used to communicate with crane drivers (to include both hand signals and verbal commands)
2.16	explain how lifting equipment should be stored, handled and maintained
2.17	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.18	explain the reporting lines and procedures, line supervision and technical experts.

Unit 232 Cutting plate and sections using shearing machines

UAN:	D/601/1973
Level:	Level 2
Credit value:	21
GLH:	98
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 32: Cutting Plate and Sections using Shearing Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required for cutting and shaping metal plate and sections (3 mm thickness and above) for fabrications using guillotines and section cropping machines, in accordance with approved procedures. The learner will be required to select the appropriate equipment and machine settings to use, for the material, thickness and the accuracy to be achieved. Items to be cut and shaped may include ferrous and non-ferrous materials, and will include parallel cuts, square cuts, and cuts that are at an angle. These cuts will be achieved by working to marking out, and by setting the machine's backstop when multiple cutting is required. This will call for care in selecting the right tools, so as to avoid damage to the materials and tools, or danger to oneself. The learner's responsibilities will require them to comply with organisational policy and procedures, seeking out relevant information for the activities undertaken, and to report any problems with the equipment, materials or cutting activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying metal shearing procedures. The learner will have an understanding of the shearing processes, the equipment and its application, and will know about the process in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with shearing machines and their associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. cut plate and sections using shearing machines	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 confirm that the equipment is safe and fit for purpose by carrying out all of the following checks:

- the appropriate equipment/machine is selected for the operation being performed
- the machine guards and safety devices are in position and function correctly

1.3 confirm that the machine is set up and ready for the machining activities to be carried out

1.4 cut metal plate using both of the following types of shearing machine:

- guillotines
- section cropping machine

1.5 manipulate the machine tool controls safely and correctly in line with operational procedures

1.6 cut materials using both of the following techniques:

- to markings
- using machine backstop for multiple cutting

1.7 perform operations that produce straight and accurate cuts, which include both of the following:

- parallel cuts
- square cuts

1.8 cut plate, sections or bars for one appropriate material from the following:

- black mild steel
- stainless steel
- aluminium

- brass or copper
- tin plate
- other specific materials

1.9 produce components to the required quality and within the specified dimensional accuracy which meet all of the following:
- dimensional accuracy is within the tolerances specified on the drawing/specification
- cut components are free from excessive distortion
- cut edges are neat and free from false tool cuts and shearing slivers

1.10 carry out quality sampling checks at suitable intervals

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved

1.12 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to cut plate and sections using shearing machines	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working in a fabrication environment and when working with shearing machines (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, etc)

2.3 explain the safe working practices and procedures for operating machine tools

2.4 explain the correct methods of moving or lifting heavy plate, and the equipment to be used

2.5 describe the hazards associated with fabrication work and shearing operations (such as using dangerous or badly maintained tools and equipment; lifting and handling plate; operating machinery), and how they can be minimised

2.6 explain how to obtain the necessary drawings and 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 marking out conventions; cutting lines, centre lines, etc

2.9 explain the various shearing machine cutting methods and techniques (such as cutting to marking out; using machine backstops)

2.10 explain the material handling and preparation methods (such as degreasing, de-burring, straightening)

2.11 explain the material cutting characteristics and process considerations that need to be taken into account when shearing plate material

2.12 explain how to set and adjust guillotine blades for the material thickness

2.13	describe the tool and equipment care and control procedures, and explain how to recognise when the cutting blades require changing
2.14	explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations
2.15	describe the safety mechanisms and devices that are on the machine, and explain why they must always be used (machine guards, interlocks, safety operating devices)
2.16	describe the things that can go wrong when shearing materials, and explain how these can be avoided
2.17	describe the inspection techniques that can be applied to check that shape and dimensional accuracy are to specification and within acceptable limits
2.18	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.19	explain the reporting lines and procedures, line supervision and technical experts.

Unit 233 Cutting materials using hand operated thermal cutting equipment

UAN:	A/601/1978
Level:	Level 2
Credit value:	28
GLH:	133
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 33: Cutting Materials using Hand Operated Thermal Cutting Equipment (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required for cutting and shaping plate (3mm thickness and above), rolled sections, pipe and tube for fabrications, using portable thermal cutting equipment, in accordance with approved procedures. The equipment to be used will include hand held gas cutting equipment, plasma cutting equipment and simple portable machines running on tracks. The learner will be required to assist in assembling and setting up the appropriate equipment to be used, for the material and thickness to be cut, the type of operation to be carried out and the accuracy to be achieved. Materials to be cut and shaped may include mild steel, stainless steel, special steels and other appropriate materials, and will include guided cuts, external curved contours, round and square holes and demolition work, as appropriate. This will call for care in the use of the equipment and tools, so as to avoid damage to the material and tools, and danger to oneself. The learner's responsibilities will require them to comply with organisational policy and procedures for the cutting operations undertaken, and to report any problems with the equipment, materials, consumables or cutting activities that they cannot personally resolve, or are outside their permitted

authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying thermal cutting procedures. The learner will have an understanding of the processes, and will know about the equipment and its application, the materials and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the thermal cutting equipment, especially those with regard to fire and potential explosion, and the safeguards necessary for undertaking the activities safely and correctly. The learner will be expected to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. cut materials using hand operated thermal cutting equipment	
Assessment criteria	
the learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 use one of the following thermal cutting methods: • hand held oxy-fuel gas cutting equipment • hand held plasma gas cutting equipment • simple portable track driven cutting equipment (electrical or mechanical) 1.3 confirm that the machine is set up and ready for the machining activities to be carried out by carrying out all of the following checks: • regulators, hoses and valves are securely connected and free from leaks and damage • the correct gas nozzle is fitted to the cutting torch • that a flashback arrestor is fitted to gas equipment • gas pressures are set and maintained as instructed • the correct procedure is used for lighting, adjusting and extinguishing the cutting flame • hoses are safely routed and protected at all times • gas cylinders are handled and stored safely and correctly	

1.4 manipulate the machine tool controls safely and correctly in line with operational procedures

1.5 perform thermal cutting operations to produce four of the following features:

- down-hand straight cuts (freehand)
- down-hand straight cuts (track guided)
- vertical cuts
- square/rectangular shapes
- irregular shapes
- angled cuts
- external curved contours
- round holes
- square holes
- rough cutting (demolition)
- weld preparations

1.6 produce thermal cuts in two of the following forms of material (metal of 3mm and above, and two different thickness):

- plate
- bar
- rolled sections
- pipe/tube
- structures

1.7 produce cut profiles for one type of material from the following:

- mild steel
- stainless steel
- special steels
- other appropriate metal

1.8 produce components to the required quality and within the specified dimensional accuracy

1.9 produce thermally cut components which meet all of the following:

- dimensional accuracy is within the tolerances specified on the drawing/specification or within +/- 3 mm
- angled cuts are within specification requirements (perpendicular/angularity)
- cuts are clean and smooth with minimal drag lines

1.10 carry out quality sampling checks at suitable intervals

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved

1.12 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to cut materials using hand operated thermal cutting equipment	
Assessment criteria	
The learner can: 2.1 explain the specific safety precautions to be taken when working with thermal cutting equipment in a fabrication environment (general workshop and site safety, appropriate personal protective	

equipment, fire and explosion prevention, protecting other workers, safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment that needs to be worn when working with fabrications and thermal cutting equipment (leather aprons and gloves, eye protection, safety helmets, etc)

2.3 explain the correct methods of moving or lifting plate materials and components

2.4 describe the hazards associated with thermal cutting (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal, elevated working, enclosed spaces), and how they can be minimised

2.5 explain 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, permit-to-work procedures and emergency shutdown procedures

2.6 explain how to obtain the necessary drawings and thermal cutting 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 the thermal cutting process (basic principles of thermal cutting and related equipment; the various techniques and their limitation; care of the equipment to ensure that it is safe and ready to use)

2.9 describe the various types of thermal cutting equipment available, and typical applications of each type

2.10 describe the accessories that can be used with hand held thermal cutting equipment to aid cutting operations (such as guides, trammels, templates); arrangements for attaching cutting aids to the equipment

2.11 explain the types of 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 (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 that need to be carried out prior to cutting (checking connections for leaks, setting gas pressures, setting up the material/workpiece, checking cleanliness of materials used)

2.14 explain the holding methods that are used to aid thermal cutting, and the equipment that can be used

2.15 explain how to set the correct operating conditions (flame control and the effects of mixtures and pressures associated with thermal cutting)

2.16 explain the correct procedure for lighting and extinguishing the flame, and the importance of following the procedure

2.17 explain the procedures to be followed for cutting specific materials, and explain why these procedures must always be adhered to

2.18	explain the material thermal cutting characteristics and material preparation requirements
2.19	explain the terminology used in thermal cutting in relation to the operations being performed
2.20	describe the problems that can occur with thermal cutting, and explain how they can be avoided; causes of distortion during thermal cutting and methods of controlling distortion
2.21	explain the effects of oil, grease, scale or dirt on the cutting process
2.22	explain the causes of cutting defects, how to recognise them, and methods of correction and prevention
2.23	describe the quality requirements of the type of work being undertaken
2.24	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.25	explain the reporting lines and procedures, line supervision and technical experts.

Unit 234 Cutting and shaping materials using gas cutting machines

UAN:	K/601/1992
Level:	Level 2
Credit value:	28
GLH:	133
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 34: Cutting and Shaping Materials using Gas Cutting Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required for cutting and shaping plate (3mm thickness and above), rolled sections, pipe and tube for fabrications using gas cutting machines, in accordance with approved procedures. The learner will be required to assist in the assembling and setting up of the appropriate equipment to be used, for the material and thickness to be cut, the type of operation to be carried out and the accuracy to be achieved. Materials to be cut and shaped may include mild steel, stainless steel, special steels and other appropriate materials, and will include straight cuts, external curved contours, round and square holes and internal curved contours. This will call for care in the use of the equipment and tools so as to avoid damage to the material, tools and danger to oneself. The learner's responsibilities will require them to comply with organisational policy and procedures for the thermal cutting operations undertaken, and to report any problems with the equipment, materials, consumables or cutting activities that they cannot personally resolve, or are outside their personal responsibilities, to the relevant authority. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to

provide a good understanding of their work, and will provide an informed approach to applying machine gas cutting procedures. The learner will have an understanding of the gas cutting processes, and their application, and will know about the equipment, materials and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the gas cutting equipment, especially those with regard to fire and potential explosion, and the safeguards necessary for undertaking the activities safely and correctly. The learner will be expected to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. cut and shape materials using gas cutting machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the cutting activities to be carried out by carrying out all of the following checks: • hoses and equipment are securely connected, and are free from leaks and damage • the correct gas nozzle is fitted to the cutting torch • appropriate gas pressures are set and maintained, as instructed • the correct procedure is used for lighting, adjusting and extinguishing the cutting flame • hoses are safely routed and protected at all times • where appropriate, gas cylinders are handled and stored, safely and correctly 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 perform thermal cutting operations to produce four of the following features: • straight cuts • square/rectangular shapes • irregular shapes • angled cuts • external curved contours • round holes • square holes • internal curved contours	

- weld preparations

1.5 produce thermal cuts in two of the following forms of material (metal of 3mm and above, and two different thickness):
- plate
- bar
- rolled sections
- pipe/tube

1.6 produce cut profiles for one type of material from the following:
- mild steel
- stainless steel
- special steels
- other appropriate metal

1.7 produce components to the required quality and within the specified dimensional accuracy

1.8 produce cut components which meet all of the following quality and accuracy standards:
- dimensional accuracy is within the tolerances specified on the drawing/specification or within +/- 2 mm
- angled cuts are within specification requirements (perpendicular/angularity)
- cuts are clean and smooth with minimal drag lines

1.9 carry out quality sampling checks at suitable intervals

1.10 deal promptly and effectively with problems within their control and report those that cannot be solved

1.11 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to cut and shape materials using gas cutting machines	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working with gas cutting machines in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, fire and explosion prevention, protecting other workers, safety in enclosed/confined spaces; fume control; accident procedure; statutory regulations)

2.2 describe the personal protective clothing and equipment that needs to be worn when working with fabrication materials and gas cutting equipment (leather aprons and gloves, eye protection, safety helmets, etc)

2.3 explain the correct methods of moving or lifting plate materials and components

2.4 describe the hazards associated with using gas cutting machines (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal), and explain how they can be minimised

2.5 explain the safe working practices and procedures for using gas cutting machines in line with British Compressed Gas Association (BCGA) Codes of practice to include setting up procedures, permit-to-work procedures and emergency shutdown procedures

2.6	explain how to obtain the necessary drawings and gas cutting specifications
2.7	explain how to interpret the drawings or sketches in first or third angle projection
2.8	explain the gas cutting process (basic principles of gas cutting and related equipment, the various techniques and their limitation, care of the equipment to ensure that it is safe and ready to use)
2.9	explain the types of gases used in thermal cutting; gas identification and colour codes; their particular characteristics and safety procedures
2.10	describe the preparations that need to be carried out prior to cutting (checking connections for leaks, setting gas pressures, setting up the material/workpiece, checking cleanliness of materials used)
2.11	explain the holding methods that are used to aid gas cutting, and the equipment that can be used
2.12	explain how to setup the correct operating conditions; flame control and the effects of mixtures and pressures associated with gas cutting machines
2.13	explain the correct procedure for lighting and extinguishing the flame, and explain the importance of following the procedure
2.14	explain the procedures for cutting specific materials, and explain why these procedures must always be adhered to
2.15	explain the terminology used in gas cutting, in relation to the operations being performed
2.16	describe the problems that can occur with gas cutting, and how they can be avoided; causes of distortion during gas cutting, and methods of controlling distortion
2.17	explain the effects of oil, grease, scale or dirt on the cutting process
2.18	explain the causes of cutting defects, how to recognise them, and methods of prevention and correction
2.19	describe the quality requirements for the type of work being undertaken
2.20	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 235 Cutting materials using saws and abrasive discs

UAN:	M/601/1993
Level:	Level 2
Credit value:	13
GLH:	42
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 35: Cutting Materials using Saws and Abrasive Discs (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to cut and shape materials using saws and abrasive discs, in accordance with approved procedures. The learner will be required to select the appropriate equipment for the operations to be carried out, and to check that it is in a safe and usable condition. In carrying out the cutting and shaping operations, the learner will be expected to use both saws and abrasive discs to cut and shape the materials to the required accuracy and specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the cutting activities undertaken, and to report any problems with the equipment or the cutting activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying cutting procedures when using saws and abrasive discs. The learner will have an understanding of the suitability of the cutting processes, and their applications, and will know about the characteristics of

the materials and the appropriate processes and techniques, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the cutting and shaping activities. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. cut materials using saws and abrasive discs	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 use two of the following types of cutting equipment:

- machine saw
- band saw
- hand held portable abrasive disc
- radiac abrasive disc

1.3 ensure that the equipment is fit for purpose and used safely by carrying out all of the following:

- selecting the appropriate equipment/machine for the operation being performed
- checking that machine guards and safety devices are in position and function correctly
- checking that cutting discs/blades are in a serviceable condition (sharp, and free from damage or chips)
- isolating the equipment from its power supply whilst changing blades or discs
- using the equipment safely and correctly and only for its intended purpose

1.4 confirm that the machine is set up and ready for the machining activities to be carried out

1.5 manipulate the machine tool controls safely and correctly in line with operational procedures

1.6 carry out all of the following cutting and shaping activities:

- straight sawing
- abrasive disc cutting
- contour shaping using saws

1.7 cut and shape components which contain all of the following features:

- straight parallel cuts
- square cuts
- curved contours
- angled/mitred cuts

1.8 cut and shape three of the following forms of material:
- flat plate
- solid bar (square, round, hexagonal etc)
- rolled sections (angle, channel, RSJ)
- pipe/tube
- rail section
- non-ferrous material

1.9 produce components to the required quality and within the specified dimensional accuracy

1.10 produce components that comply with all of the following quality and accuracy standards:
- material dimensional accuracy is within specification tolerances
- cuts are square, clean and free from excessive burrs
- angled cuts are within specification requirements

1.11 carry out quality sampling checks at suitable intervals

1.12 deal promptly and effectively with problems within their control and report those that cannot be solved

1.13 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to cut materials using saws and abrasive discs	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working in a fabrication environment and when working with power operated saws and abrasive disc cutting machines (statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, etc)

2.3 explain the safe working practices and procedures to be observed when working with the machines (including emergency shutdown procedures)

2.4 explain the correct methods of moving or lifting heavy plate or rolled sections

2.5 describe the hazards associated with fabrication work and cutting operations (such using dangerous or badly maintained tools and equipment; airborne particles; hot metal; burrs and sharp edges), and explain how they can be minimised

2.6 explain how to obtain the necessary drawings, specifications and work instructions

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 marking out conventions (cutting lines, centre lines, etc)

2.9 describe the range of machine saws available (such as power hacksaws, circular saws and bandsaws)

2.10	describe the abrasive cutting equipment available (to include hand held portable machines and bench type radiac cutting machines)
2.11	explain the selection and fitting of abrasive cutting discs; cutting disc identification markings, and how to identify the correct type of disc for the type of material being cut
2.12	explain the statutory regulations regarding the fitting and use of abrasive discs
2.13	explain the material cutting characteristics and process considerations to be taken into account when cutting materials
2.14	describe the use and care of tools and equipment (such as checking that trailing leads, plugs and sockets are in a safe and usable condition)
2.15	explain the use of safety screens to protect other uses from flying sparks whilst using abrasive cutting discs
2.16	explain the importance of ensuring that machine guards are correctly fitted and positioned before using the equipment
2.17	explain how to set and adjust power saws for the various operations being performed
2.18	explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations
2.19	describe the things that can go wrong when cutting materials using saws or abrasive discs, and explain how these can be avoided
2.20	describe the inspection techniques that can be applied to check that shape and dimensional accuracy is to specification and within acceptable limits
2.21	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.22	explain the reporting lines and procedures, line supervision and technical experts.

Unit 236 Bending and forming plate using power operated machines

UAN:	F/601/1996
Level:	Level 2
Credit value:	28
GLH:	133
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 36: Bending and Forming Plate using Power Operated Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required for bending and forming plate (of 3mm and above) for fabrications using power operated equipment such as press brakes, bending machines and power presses, in accordance with approved procedures. The learner will be required to operate the appropriate bending and forming equipment, in accordance with the instructions for the operations being performed. The learner will need to ensure that all the required safety devices are operating correctly, and that the machine guards are in place and correctly adjusted. Items to be bent and formed may include ferrous and non-ferrous materials, and tasks will include producing bends of various angles, setting plate ends for rolling operations, and producing curved sections. This will call for care in selecting the right tools, so as to avoid damage to the tools and danger to oneself. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the equipment, materials, tooling or bending activities that they cannot personally resolve, or are outside their personal authority, to the relevant people. The learner will be expected to work to

instructions, with a minimum of supervision, taking personal responsibility for their r own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying the power pressing procedures required. The learner will have an understanding of the bending processes, and will know about the equipment and its application, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with power operated presses, and the safeguards necessary for undertaking the activities safely and correctly. The learner will be required to demonstrate safe working practices and procedures throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. bend and form plate using power operated machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 operate one of the following types of power-operated bending equipment: • press brakes • powered bending machine • power press • rolls 1.3 confirm that the equipment is safe to use and fit for purpose, by carrying out all of the following checks: • the appropriate machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly 1.4 confirm that the equipment is set up correctly and is ready for use 1.5 manipulate the machine controls safely and correctly in line with operational procedures 1.6 perform operations that produce all of the following: • bends at 90° • bends of various angles using various bend radii • set plate ends • box, square and rectangular sections	

- curved plates

1.7 bend and form metal plate of 3mm or greater thickness, for one appropriate material and two thicknesses:
- black mild steel
- stainless steel
- aluminium
- special metals

1.8 produce components to the required specification

1.9 produce components that conform to all of the following quality and accuracy standards:
- bend position and dimensional accuracy is within the specification tolerances
- the form or sharpness of the bend conforms to best practice and or specification, without deformation or cracking
- the bend conforms to the required shape/geometry (to the template profile)

1.10 carry out quality sampling checks at suitable intervals

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved

1.12 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to bend and form plate using power operated machines	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working with power-operated bending and forming equipment such as press brakes or/and bending machines in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the correct protective clothing, and handling precautions to be taken, when working with heavy platework

2.3 explain the correct methods of moving or lifting sheet or plate materials

2.4 describe the hazards associated with power operated bending and forming processes (such as handling heavy sheet materials and components; operating moving equipment; using faulty or badly maintained tools and equipment), and how they can be minimised

2.5 explain the safe working practices and procedures required for operating power-operated bending machines

2.6 explain how to obtain the necessary drawings and bending 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 the marking out conventions applicable to the bending process (centre lines; bending lines)

2.9	describe the various types of power-operated bending machines that are used, and their typical applications
2.10	explain ways of limiting distortion, marking and creases in the finished workpiece
2.11	describe the preparations to be carried out on the materials prior to bending them
2.12	explain the basic characteristics of the materials with regard to the bending operations undertaken
2.13	explain the need to take care of the bending tools and equipment; how to recognise faulty or damaged forming tools; how bending and forming tools should be stored
2.14	describe the problems that can occur with the bending and forming activities, and explain how they can be avoided
2.15	describe the organisational quality control procedures that are used, and explain how to recognise defects in the bends that they produce
2.16	explain how to make dimensional and forming inspection checks, and the tools and equipment that can be used
2.17	describe the accuracy and limitations of processes
2.18	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.19	explain the reporting lines and procedures, line supervision and technical experts.

Unit 237 Forming platework using power rolling machines

UAN:	J/601/1997
Level:	Level 2
Credit value:	28
GLH:	133
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 37: Forming Platework using Power Rolling Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to bend and form plate for fabrications, in accordance with approved procedures, using power-operated pinch or pyramid rolls which may be hand adjusted or console controlled. The learner will be required to operate the power rolling machine as instructed, based on the operations to be performed and the thickness and size of the material to be rolled. Setting the rolls will involve setting and adjusting the gap between feed and forming rolls to suit plate thickness, positioning side roller(s) and adjusting to suit the required radius, checking and setting parallelism of rollers, and applying suitable pressure to rollers throughout the forming operation. The learner will be expected to carry out the rolling operation in a manner that ensures material is formed to the required profile without flats or deformities. The learner will also need to ensure that all the required safety devices are operating correctly, and that the machine guards are in place and correctly adjusted. Items to be rolled may include ferrous and non-ferrous materials, and will include operations such as rolling cylinders and cones, producing curved sections, counter-curved sections, pipe sections and plate straightening. This will call for care in using the right machine for the job, and using it in the correct way, so as to avoid damage to the tools and danger to oneself.

The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the equipment, materials, or rolling activities that they cannot personally resolve, or are outside their personal authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying the power-rolling procedures required. The learner will have an understanding of the rolling process and its application, and will know about the equipment and materials, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with power rolls, and the safeguards necessary for undertaking the activities safely and correctly. The learner will be required to demonstrate safe working practices and procedures throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. form platework using power rolling machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 use one of the following types of power rolling machine: • powered rolls (hand adjusted) • powered rolls (console adjusted) • different roll sizes (diameter) and power 1.3 confirm that the equipment is safe to use and fit for purpose, by carrying out all of the following checks: • the rolls are appropriate for the material used and the operations being performed • the machine guards and safety devices are in position and operating correctly • rolls are appropriate for the operation and are in a serviceable condition (suitable diameter; free from damage) • roll settings are suitable for the material thickness and	

- equipment for supporting the plate at the start of the rolling operations is in place

1.4 confirm that the equipment is set up correctly and is ready for use

1.5 manipulate the machine controls safely and correctly in line with operational procedures

1.6 perform rolling operations that produce three of the following:

- cylinders
- cones
- segments of a cylindrical tank
- curved section or sector of an otherwise flat plate
- counter-curved sections
- pipe sections
- flattening or straightening plate

1.7 carry out rolling operations on one type of material from the following:

- carbon steel
- stainless steel
- aluminium
- special metals

1.8 produce components to the required specification

1.9 produce rolled components that conform to all of the following quality and accuracy standards:

- dimensional accuracy is within the specification tolerances
- the rolled section conforms to best practice and/or specification, without deformation or cracking
- the component conforms to the required shape/geometry (to the template profile)

1.10 carry out quality sampling checks at suitable intervals

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved

1.12 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to form platework using power rolling machines	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working with rolling machines in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the checks that need to be carried out to ensure that the power rolls are safe and are in a fit condition to use

2.3 describe the personal protective clothing and equipment to be worn when working with heavy platework (gloves, eye protection, safety helmets, etc)

2.4 explain the handling precautions and correct methods of moving or lifting sheet or plate materials

2.5	describe the hazards associated with fabrication work (such as handling sheet/fabricated components, using hot metal techniques, using dangerous or badly maintained tools and equipment, moving parts of power rolling machines), and how they can be minimised
2.6	explain how to obtain the necessary drawings, specifications and job instructions
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 the marking out conventions used in platework, and how to recognise the bending, forming and cutting lines
2.9	explain the basic principle of operation of the power rolling machine used, and the type of work it can perform
2.10	explain how to set up the machine to produce the required form (cylinders, cones, curved sections, straightening plates)
2.11	explain the techniques of rolling (including pre-setting plate edges, adjusting pressure throughout the rolling operations, checking component for parallelism or form throughout the operations)
2.12	explain how to release the rolls and remove the workpiece when rolling cylindrical and conical sections
2.13	explain the ways of limiting distortion, marking, creases and flats in curved sections
2.14	explain how the materials need to be prepared prior to rolling, and the effects of raw material scale or burrs on the finished article
2.15	explain the material characteristics with regard to forming using rolling machines
2.16	describe the care and maintenance procedures to be observed to ensure the machines are in a serviceable condition
2.17	describe the organisational quality control procedures, and explain how to recognise rolling defects
2.18	describe the inspection checks to be carried out, and the tools and equipment that are used
2.19	describe the accuracy that can be achieved by rolling, and explain the limitations of the rolling processes
2.20	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.21	explain the reporting lines and procedures, line supervision and technical experts.

Unit 238 Producing platework assemblies

UAN:	L/601/1998
Level:	Level 2
Credit value:	30
GLH:	133
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 38: Producing Platework Assemblies (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce heavy platework (3mm thick plate and above) assemblies, in accordance with instructions and approved procedures. The learner will be required to interpret specifications and drawings correctly, to bring together, prepare for joining and assemble, in the right order, platework components and sections, in order to construct completed fabricated assemblies or sub-assemblies, such as square and rectangular plate structures, covers and side plates, tanks, pressure vessels, cylindrical sections, conical sections, reduction pieces, simple and complex boiler seatings, etc. The learner will be required lay out and secure the various component parts of the structure, using mechanical fastenings, temporary tack welding, flanged and mechanically fastened or adhesive bonding techniques, in the correct order and ensuring they are assembled in a manner that is fit for purpose. The learner's responsibilities will require them to comply with organisational policy and procedures for the platework fabrication activities to be undertaken, and to report any problems with the activities, tools and equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying platework fabrication techniques and their assembly and fixing procedures. The learner will have an understanding of the assembly techniques used, the requirements of the manufacturing and assembling procedures, and their application. The learner will know about the methods of assembling the components of the required strength and that are fit for purpose, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with heavy platework components and their associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce platework assemblies	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the platework assembly operations: • correctly prepare and set up the components and faces to be joined • use the correct datum faces • use the specified or appropriate fixing method • correctly align the components and faces to be joined • assemble/fabricate the platework components in the correct order or manner • produce an assembly which meets the required specification 1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 confirm that the specified components are available and that they are in a usable condition 1.5 use four of the following types of components in the assemblies produced: • plates or covers • pre-fabricated square/rectangular components • pre-fabricated cylindrical/conical components • brackets • flanges	

- pipes
- rolled section components (angle, channel or tee section)

1.6 use the appropriate methods and techniques to assemble the components in their correct positions

1.7 assemble platework components, using two of the following methods:

- temporary tack welding
- clamped or jigged
- riveting (hot or cold)
- flanged and mechanically fastened (nuts and bolts)
- adhesive bonding

1.8 secure the components using the specified connectors and securing devices

1.9 produce four of the following platework assemblies:

- frames
- tanks
- covers and side plates
- square, rectangular and box sections
- cylindrical
- conical
- reduction pieces
- segmented bends
- steel and composite material assemblies
- simple or complicated seatings (tank or boiler seats)

1.10 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification

1.11 produce platework assemblies which meet all of the following quality and accuracy standards:

- all components are correctly assembled and aligned in accordance with the specification
- overall dimensions are within specification tolerances
- assemblies meet appropriate geometric tolerances (square, straight, angles, free from twists)
- where appropriate, pitches of erection holes meet specification requirements
- completed assemblies have secure and firm joints, and are clean and free from burrs or flash

1.12 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to produce platework assemblies	
Assessment criteria	
The learner can: 2.1 explain the specific safety precautions to be taken when working in a fabrication environment and when producing platework assemblies (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials) 2.2 describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, ear protection, etc) 2.3 explain the safe working practices and procedures for producing platework assemblies 2.4 explain the correct methods of moving or lifting bulky and heavy fabrications 2.5 describe the hazards associated with platework fabrication and assembly work (such using dangerous or badly maintained tools and equipment; lifting and handling long and heavy components; cuts, slips trips and falls), and how they can be minimised 2.6 explain how to obtain the necessary drawings and joining 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 the marking out conventions (cutting lines; centre lines, etc) 2.9 describe the preparations to be carried out on the components prior to assembling them 2.10 describe the various methods of securing the assembled components (nuts and bolts; tack welding methods and techniques; hot and cold riveting; adhesive bonding of components) 2.11 explain how to set up and align the various components, and describe the tools and equipment to be used 2.12 explain how to hold the joints together to aid the assembly activities (jigs, clamps, rivet clamps, jacks and wedges) 2.13 explain the use and care of tools and equipment, and describe their control procedures 2.14 explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations 2.15 describe the things that can go wrong when producing platework assemblies, and explain how these can be avoided 2.16 describe the inspection techniques that can be applied to check that shape (including straightness) and dimensional accuracy is to specification and within acceptable limits 2.17 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve 2.18 explain the reporting lines and procedures, line supervision and technical experts.	

Unit 239 Producing holes using drilling machines

UAN:	R/601/1999
Level:	Level 2
Credit value:	10
GLH:	49
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 39: Producing Holes using Drilling Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce holes in sheet, plate, rolled section or pipe, using drilling machines, in accordance with approved procedures. The learner will be required to select the appropriate drilling equipment to use, based on the operations to be performed and the size of the component worked on. The learner will be expected to use appropriate workholding methods and techniques to secure the work piece for the drilling operations, and this will include the use of jigs, clamps, machine vice and other appropriate holding devices. In drilling the holes, the learner will need to position the drill bits accurately and use appropriate speeds and feeds to drill and finish the holes to the required specification. Drilling and finishing operations will include through holes, blind holes, counterbored holes, countersunk holes, spot facing, reaming and tapping. The learner's responsibilities will require them to comply with organisational policy and procedures for the drilling activities undertaken, and to report any problems with the equipment or drilling activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying the drilling and finishing procedures. The learner will have an understanding of the drilling equipment used and its application, together with the material characteristics and the appropriate tooling for carrying out the drilling and finishing process. The learner will know about the basic principles and requirements of securing the work piece prior to carrying out the process, in adequate depth to provide a sound basis for carrying out the drilling activities, correcting faults and ensuring the work output meets the required specification.

The learner will understand the safety precautions required when carrying out the drilling and finishing activities. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce holes using drilling machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 use two of the following drilling machines: • hand held drilling machine • pillar/bench drill • radial arm drill 1.3 use two of the following workholding devices: • jigs/fixtures • machine vice • clamps 1.4 ensure that the equipment is fit for purpose and used safely, by carrying out all of the following: • selecting the appropriate drilling equipment/machine for the operation being performed • checking that machine guards and safety devices are in position and function correctly • checking that drill bits and cutting tools are in a serviceable condition (sharp, free from damage or chips) • isolating the equipment from its power supply whilst changing drill bits • securely clamping/restraining the components during the drilling operations	

- using the equipment safely and correctly and only for its intended purpose

1.5 confirm that the machine is set up and ready for the machining activities to be carried out

1.6 manipulate the machine tool controls safely and correctly in line with operational procedures

1.7 carry out three of the following drilling and finishing operations:

- drilling through holes
- drilling holes to a depth
- counterboring holes
- countersinking holes
- centre drilling
- spot facing
- trepanning holes
- tapping holes
- jig or template drilling
- component alignment drilling

1.8 produce drilled holes in two of the following material types:

- ferrous sheet metal
- stainless steel sheet metal
- non-ferrous sheet metal
- ferrous plate or components
- stainless steel plate or components
- non-ferrous plate or components
- non-metallic materials
- composite materials

1.9 produce components to the required quality and within the specified dimensional accuracy which meet all of the following, as applicable to the process:

- dimensional and positional accuracy is within specification tolerances
- drilled holes are correctly formed and free from excessive tool marks
- counterbores, countersinks and spot facings meet job requirements

1.10 carry out quality sampling checks at suitable intervals

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved

1.12 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to produce holes using drilling machines	
Assessment criteria	
The learner can: 2.1 explain the specific safety precautions to be taken when working in a fabrication environment and when carrying out drilling and finishing operations on materials used in fabrication (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk	

	assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)
2.2	describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, etc)
2.3	explain the correct methods of moving or lifting materials
2.4	explain the safe working practices and procedures to be used when using portable power operated tools and drilling machines (including emergency stop procedures for the machines)
2.5	describe the hazards associated with drilling work (such as using dangerous or badly maintained tools and equipment; insecure or poorly clamped workpieces; airborne metal particles; sharp edges and splinters), and how they can be minimised
2.6	explain how to obtain the necessary drawings, specifications and work instructions
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 marking out conventions (cutting lines, centre lines, etc)
2.9	explain the various types and application of drilling machines (including portable power tools, bench and pedestal machines and radial arm machines)
2.10	explain the range of drilling and hole finishing tools available (including twist drills, reamers, counterbore tools, countersink tools, spot facing tools)
2.11	explain the methods of holding and securing the drills and finishing tools into the machine spindle (chucks, taper shank sleeves, collet chucks)
2.12	explain how to hold and secure the workpieces for drilling (including jigs and fixtures, machine vices, clamps and restraining devices)
2.13	explain the methods used to align the drill with the workpiece, and explain the use of centre drills and pilot drills
2.14	explain how to check that the drill hole is in the correct position before drilling to the full diameter
2.15	explain how to correct a drill that has been started off centre
2.16	explain how to determine the correct speeds and feeds for drilling, reaming and finishing operations
2.17	explain how to select the correct cutting fluids and compounds for drilling
2.18	explain how to set and adjust the tools and equipment (use of depth stops, etc)
2.19	explain the material characteristics and process considerations to be taken into account when carrying out drilling operations
2.20	describe the care and control of tools and equipment; checking portable power tool leads, plugs and sockets are in a safe and usable condition
2.21	explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations
2.22	describe the things that can go wrong with drilling operations, and explain how these can be avoided

2.23	describe the inspection techniques that can be applied to check that dimensional accuracy and finish is to specification and within acceptable limits
2.24	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.25	explain the reporting lines and procedures, line supervision and technical experts.

Unit 240 Forming structural sections using machines

UAN:	F/601/2002
Level:	Level 2
Credit value:	35
GLH:	119
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 40: Forming Structural Sections using Machines (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to bend and form rolled sectional material using presses, bending machines and power rolls, in accordance with instructions and approved procedures. The learner will be required to use the most appropriate type and size of machine, based on the operations to be performed and the type and section of material being used. In producing the components, the learner will be required to operate the equipment safely and correctly to form the material to the required profile without flats or deformities. The operations to be performed will include bending beams, curved beams, circular sections, counter curved sections, twisted beams and straightening of beams. The learner's responsibilities will require them to comply with organisational policy and procedures for the use of the machines and the process activities undertaken, and to report any problems with the forming equipment, materials or forming activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to

forming structural section material using power machine procedures. The learner will have an understanding of the forming equipment being used, the forming principles, and their application, and will know about the processes involved and their limitations, in sufficient depth to provide a sound basis for carrying out the activities, correcting any faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the forming machines and their associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. form structural sections using machines	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 use one of the following types of machines: • power press • hammer machines • section bending machine • powered rolls • special-purpose machines 1.3 confirm that the equipment is set up correctly and is ready for use by carrying out all of the following checks: • the appropriate machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly • forming tools are appropriate and in a serviceable condition (secure, correct shape, free from damage) • machine settings are suitable for the material thickness and operations to be performed 1.4 manipulate the machine controls safely and correctly in line with operational procedures 1.5 produce formed structural sections which contain three of the following features: • right-angled bends • angular bends • curved beams • circular sections • counter-curved sections	

- twisted section
- straightening

1.6 bend and form structural components made from three of the following forms of material:
- rolled steel joists (RSJ)
- angle section
- channel section
- tee angle
- structural tubes/pipes
- extrusions
- other specific components

1.7 produce components to the required specification

1.8 produce structural components which meet all of the following quality and accuracy standards:
- bend position and dimensional accuracy is within the specification tolerances
- the form or sharpness of the bend conforms to best practice and/or specification, without deformation or cracking
- the bend conforms to the required shape/geometry (to the template profile)

1.9 carry out quality sampling checks at suitable intervals

1.10 deal promptly and effectively with problems within their control and report those that cannot be solved

1.11 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to form structural sections using machines	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working with power operated bending and forming equipment (such as presses, bending machines and rolling machines) in a fabrication environment

2.2 explain the general workshop and site safety requirements, statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials

2.3 describe the correct protective clothing and handling precautions to be taken when working with structural section materials (gloves, eye protection, safety helmets, ear protection)

2.4 explain the handling precautions and correct methods of moving or lifting heavy structural section (RSJs, etc)

2.5 describe the hazards associated with power-operated bending processes (such as handling heavy structural materials and components; operating moving equipment; using faulty or badly maintained tools and equipment), and how they can be minimised

2.6 explain the safe working practices and procedures for operating power operated bending and forming machines

2.7 explain how to obtain the necessary structural drawings and bending procedure specifications

2.8	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)
2.9	explain the marking out conventions applicable to the bending process (centre lines, bending lines)
2.10	describe the various types of power-operated bending machines that are used for structural section materials, and their typical applications
2.11	explain how to prepare the machine for a range of different bends (angled bends, curved sections, twisted sections and straightening of sections)
2.12	describe the types of bending tools that are used for the various operations, and explain how they are secured and set to the machine's toolholding device
2.13	explain ways of limiting distortion, marking and creases in the finished workpiece
2.14	describe the preparations to be carried out on the materials prior to bending them
2.15	explain the basic characteristics of the materials with regard to the bending operations undertaken
2.16	explain why some materials may require a heating process before bending begins
2.17	explain the need to take care of the bending tools and equipment; how to recognise faulty or damaged forming tools; how bending and forming tools should be stored
2.18	describe the problems that can occur with the bending and forming activities, and explain how they can be avoided
2.19	describe the organisational quality control procedures that are used, and how to recognise defects in the bends that they produce
2.20	explain how to make dimensional and forming inspection checks, and the tools and equipment that can be used
2.21	describe the accuracy and limitations of the processes
2.22	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.23	explain the reporting lines and procedures, line supervision and technical experts.

Unit 241 Producing structural steel ancillary components

UAN:	R/601/2005
Level:	Level 2
Credit value:	24
GLH:	111
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 41: Producing Structural Steel Ancillary Components (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to cut and shape plate or section materials to produce structural steel components such as fishplates, gussets, brackets, support pads and bed plates, in accordance with approved procedures. The learner will be required to interpret drawings, mark out simple shapes and hole positions, cut out and shape plate and sections, drill and prepare structural components ready for the assembly of major structural components. The learner's responsibilities will require them to comply with organisational policy and procedures for the marking out, shaping and preparation activities undertaken, and to report any problems with the interpretation, equipment used, materials or manufacturing activities that they cannot personal resolve, or are outside their permitted authority, to the relevant person. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying structural steel shaping and fabrication procedures. The learner will have an understanding of the fabrication processes, the equipment and its application, and will know about the

materials and how to produce structural component parts, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with fabrication tools and machinery. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce structural steel ancillary components	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the manufacturing activities: • use the tools and equipment safely and correctly and only for its intended purpose • mark out the components accurately using recognised conventions • set up and hold the components firmly during the shaping operations • use approved and safe cutting and shaping methods at all times • produce the components to the correct size and shape • ensure all holes are of the correct size and are at the correct centres for fixings 1.3 follow relevant specifications for the component to be produced 1.4 obtain the appropriate tools and equipment for the shaping operations and check they are in a safe and usable condition 1.5 shape the materials using appropriate methods and techniques 1.6 cut and shape material to the marked-out shape, using three of the following methods: • shearing/cropping • sawing • burning • drilling • bending 1.7 produce structural steel components, to include three of the following: • fishplates • gussets • brackets • support pads • flanges • bed plates	

- tie bars
- stiffening plates

1.8 produce structural steel components from both of the following:
- steel plate (3mm or greater thickness)
- rolled steel section

1.9 check that all the required shaping operations have been completed to the required specification

1.10 produce structural steel components which are cut and shaped to meet all the following quality and accuracy standards:
- company/customer standards requirements
- dimensionally accurate (to drawing or specifications)
- free from distortion
- free from sharp edges, slivers or burrs

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to produce structural steel ancillary components	

Assessment criteria

The learner can:

2.1 explain the specific safety precautions to be taken when working in a fabrication environment and when cutting plate or rolled sections to shape (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (leather gloves, eye protection, safety helmets, etc)

2.3 explain the correct methods of moving or lifting plate and rolled section materials

2.4 explain the safe working practices and procedures to be observed when using manual and power-operated tools

2.5 describe the hazards associated with fabrication work (such as using dangerous or badly maintained tools and equipment; operating shearing machines; handling plate and fabricated components; using hot metal techniques), and how they can be minimised

2.6 explain the procedures for obtaining the necessary drawings and specifications, and explain how to check that they are the latest issue

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 describe the preparations to be carried out on the material prior to marking out, to enhance clarity, accuracy and safety

2.9 explain the principles of marking out, and the tools and equipment that are used

2.10 explain the use of marking out conventions (datums, cutting detail, centre lines, etc)

2.11	explain ways of laying out the shapes/patterns to maximise the use of plate or sheet materials
2.12	explain how to mark out and transfer information from templates, and how to transfer information to the underside of the plate
2.13	describe the tools and techniques available for cutting and shaping plate and section materials (such as shearing machines, saws, burning equipment, drills, etc)
2.14	explain the use and care of tools and equipment, including checks that need to be made to ensure that the tools are fit for purpose (cutting tools are sharp and undamaged; plugs and cables secure and free from damage; machine guards or safety devices operating correctly)
2.15	explain how to produce weld preparations, and the type of preparations required for different joints and material thicknesses
2.16	explain how to set and adjust the tools and equipment and the use of backstops on guillotines, etc
2.17	explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations
2.18	explain the safety and control procedures for shaping plate and rolled steel sections
2.19	describe the things that can go wrong with cutting and shaping plate and section materials, and explain how these can be avoided
2.20	explain the use of machine guards and safety protection equipment
2.21	describe the inspection techniques that can be applied to check that shape and dimensional accuracy is to specification and within acceptable limits
2.22	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.23	explain the reporting lines and procedures, line supervision and technical experts.

Unit 242 Assembling structural steelwork

UAN:	D/601/2007
Level:	Level 2
Credit value:	35
GLH:	119
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 42: Assembling Structural Steelwork (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to assist in the trial assembly of pre-fabricated structural steelwork, prior to its assembly and erection on site, to specification and in accordance with approved procedures. Steelwork can include any structural framing material, and will include such things as support structures, building frames and roofs, mezzanine platforms, rigs, access staging and platforms. The learner's responsibilities will require them to comply with organisational policy and procedures for the safe assembly of the structure and the associated assembly activities to be undertaken, and to report any problems with the component parts, equipment or construction activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying structural steel assembly procedures. The learner will have an understanding of the principles and processes associated with the assembly of the structures, and their application. The

learner will know about the ways of handling structural steelwork and the means of fixing them in position, as well as the care and use of the tools and equipment, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when assembling the structural components and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. assemble structural steelwork	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 determine what has to be done and how this will be achieved 1.3 carry out all of the following during the structural assembly operations: • comply with health and safety and site regulations at all times • use safety and personal equipment (such as hard hat, footwear and gloves) • use the correct construction drawings and interpret them correctly • correctly prepare the components and faces to be erected and assembled • use the correct datum faces • assemble the structural components in the correct order and manner • correctly align the components and faces to be joined • use the specified or appropriate fixing method, and ensure all bolts are tightened to the required torque • produce an assembly which meets the required specification 1.4 select the appropriate construction elements and check that they are in a usable condition 1.5 use four of the following types of components in the assemblies produced: • columns • beams • roof trusses • frames • bed plates • staircases • bulkheads	

- roof sheeting/cladding
- fishplates
- brackets
- support plates
- guards and hand rails
- safety cages
- platforms and ladders

1.6 position and secure the construction elements in line with the specification

1.7 assemble structural steelwork for one of the following:

- building frames and roofs
- support structures
- mezzanine platforms
- rigs
- access staging and platforms

1.8 use all of the following during the assembly activities:

- hand tools and equipment (podger, crow bar, spanners, torque wrenches)
- assembly and alignment techniques and procedures (levels, plumb lines, laser equipment)
- mechanical fastening techniques and procedures (bolted, riveted)
- slinging and lifting techniques (ropes, chains, cranes)
- temporary staging or mobile platforms

1.9 produce assemblies which meet all of the following quality and accuracy standards:

- all components are correctly assembled and aligned, in accordance with the specification
- overall dimensions are within specification tolerances
- assemblies meet appropriate geometric tolerances (square, straight, angles, free from twists)
- completed assemblies meet specification

1.10 securely fix any necessary temporary support facilities

1.11 take appropriate measures to protect the finished construction

1.12 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to assemble structural steelwork	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working in a steel construction environment and when assembling structural components (general site safety, appropriate personal protective equipment, accident procedure; working at height and statutory regulations relating to it, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.2 describe the personal protective clothing and equipment to be worn when carrying out the assembly activities (leather gloves, eye

2.3 explain the safe working practices and procedures for assembling structural components

2.4 explain the correct methods of moving or lifting heavy structural sections

2.5 describe the hazards associated with assembling structural components (such as using dangerous or badly maintained tools and equipment, lifting and handling long and heavy components, working at height, slips trips and falls), and how they can be minimised

2.6 explain how to obtain the necessary construction and site drawings and joining 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 describe the preparations to be carried out on the components prior to assembling them

2.9 describe the equipment and temporary installations that may be required to support the structure during the assembly activities

2.10 describe the various methods of securing the assembled components (the range of nuts and bolts used, including close-tolerance location bolts; temporary tack welding methods and techniques)

2.11 explain how to set up and align the various components, and the tools and equipment that is used for this

2.12 explain the use and care of tools and equipment, and their control procedures

2.13 explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations

2.14 describe the things that can go wrong when producing structural components/assemblies, and explain how these can be avoided

2.15 describe the inspection techniques that can be applied to check that the construction is to specification and within acceptable limits

2.16 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot solve

2.17 explain the reporting lines and procedures, line supervision and technical experts.

Unit 243 Forming pipework by machine bending

UAN:	D/601/2010
Level:	Level 2
Credit value:	35
GLH:	126
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 43: Forming Pipework by Machine Bending (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to bend and form pipes using pipe bending machines, in accordance with approved procedures. The learner will be required to work to instruction with the appropriate type and size of machine and former, based on the pipe type, size and operations to be performed. In producing the components, the learner will be required to operate the equipment safely and correctly, or to direct operations for their effective use, and to bend and form the pipe to the required profile without flats or deformations. The pipe bending and forming operations will include bending at right angles, bending to other angles, producing offsets, bridge sets, curved sections and expansion loops. The learner's responsibilities will require them to comply with organisational policy and procedures for the use of the machines and the process activities undertaken, and to report any problems with the pipe forming equipment, materials or forming activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to

forming pipework using machine procedures. The learner will have an understanding of the characteristics of the equipment being used, the forming principles, and their application, and will know about the processes involved and their limitations, in sufficient depth to provide a sound basis for carrying out the activities, correcting any faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the forming machines and their associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. form pipework by machine bending	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 use one of the following types of pipe bending machines: • hand operated manual bending machines (small diameter pipe) • hydraulically operated bending machines • powered pipe bending machines • CNC bending machines • power press with different former radii and sizes (pipe diameter) 1.3 confirm that the equipment is set up correctly and is ready for use by carrying out all of the following checks: • the appropriate machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly • forming tools are appropriate and in a serviceable condition (secure, correct diameter, free of damage) • machine settings are suitable for the pipe diameter, material thickness and operations to be performed 1.4 manipulate the machine controls safely and correctly in line with operational procedures 1.5 bend and form one of the following types of pipework: • heavy duty pipes • small bore lubrication/fuel piping • cable ducting pipework • structural pipes • high pressure pipes 1.6 produce pipework forms that include three of the following:	

- right-angled bends
- angular bends
- offsets
- bridge sets
- expansion loops
- curved sections

1.7 bend and form pipes made from one of the following types of material:
- ferrous steel
- non-ferrous
- special metals

1.8 produce components to the required specification

1.9 produce pipe bends and forms which comply with all of the following quality and accuracy standards, as applicable:
- meet drawing, specification, template or job requirements
- meet customer requirements
- have the required dimensional accuracy within specified tolerances
- the form or sharpness of the bend conforms to best practice and or specification without deformation or cracking
- the bend conforms to the required shape/geometry (to the template profile)

1.10 carry out quality sampling checks at suitable intervals

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved

1.12 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to form pipework by machine bending	
Assessment criteria	

The learner can:

2.1 explain the specific safety precautions to be taken when working with pipe bending equipment/bending machines in a fabrication environment

2.2 explain the general workshop and site safety requirements (statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)

2.3 explain the safe working practices and procedures for operating power-operated bending and forming machines

2.4 describe the specific personal protective equipment to be worn when carrying out the pipe bending activities (gloves, eye protection, safety helmets, ear protection, etc)

2.5 explain the handling precautions and correct methods of moving or lifting long lengths or heavy pipes

2.6 describe the hazards associated with the pipe bending activities (handling long pipe lengths; using power operated bending equipment; using dangerous or badly maintained tools and equipment; using heating equipment), and how they can be minimised

2.7 explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to

2.8 explain the principles and methods of marking out pipework, and the type of equipment used (direct marking; use of templates; use of set wires; marking out conventions applicable to the bending process (centre lines, bending lines)
2.9 explain how to prepare the pipes in readiness for the bending and forming activities (visually checking for defects, cleaning the materials, removing burrs and sharp edges)
2.10 explain the characteristics of the various materials used, with regard to the bending operations and explain why some materials may require the addition of heat to aid the bending process
2.11 describe the various types of machines used to bend and form the pipe (including the use of hand bending machines, hydraulic bending equipment, power-operated equipment and heating methods)
2.12 explain how to prepare and set up the machine for a range of different bends (angled bends, curved sections, twisted sections and straightening of sections)
2.13 explain how to produce the various bends required (such as angled bends, dog-leg sets, bridge sets and expansion loops)
2.14 explain ways of limiting distortion, wrinkles, marking and creases in the finished workpiece
2.15 describe the problems that can occur with the bending and forming activities, and explain how they can be avoided
2.16 describe the organisational quality control procedures that are used, and explain how to recognise defects in the bends that they produce
2.17 explain how to make dimensional and forming inspection checks, and the tools and equipment that can be used
2.18 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve
2.19 explain the reporting lines and procedures, line supervision and technical experts.

Unit 245 Producing composite mouldings using wet lay-up techniques

UAN:	A/601/2015
Level:	Level 2
Credit value:	42
GLH:	151
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 45: Producing Composite Mouldings using Wet Lay-up Techniques (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce composite mouldings using wet lay-up techniques, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to produce the composite mouldings, using the correct wet lay-up production techniques. The learner will produce a range of composite mouldings, incorporating a variety of features and using a range of techniques and processes. Mouldings produced will include laminates and sandwich structures, using a range of resin, fibre and core materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the composite moulding activities undertaken, and to report any problems with the moulding activities, equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying composite moulding wet lay-up techniques and procedures. The learner will have an understanding of the production techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, recognising faults, and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the wet lay-up moulding activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce composite mouldings using wet lay-up techniques	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 carry out all of the following during the moulding activities:

- use the correct issue of production documentation (instructions, drawings, job cards)
- use relevant health and safety documentation (material data sheets, COSHH sheets)
- use the correct tools and equipment for the activity and ensure they are safe to use
- use the correct materials and consumables, as specified in the production documentation
- apply safe and appropriate wet lay-up working practices and procedures at all times
- keep the work area in a safe condition

1.3 follow the correct component drawing or any other related specifications for the component to be produced

1.4 determine what has to be done and how this will be achieved

1.5 obtain and prepare the appropriate tools, equipment and materials

1.6 prepare the moulds and materials for the production activities, to include all of the following:

- cleaning of tooling and removal of resin build-ups
- checking of tooling for surface defects
- correctly applying sealants/release agents
- dispensing and applying the correct measure and mix of resin/catalyst

1.7 carry out the moulding or laying-up activities using the correct methods and techniques

1.8 produce a range of mouldings, using two of the following application techniques:
- spray application of fibre/resin
- application of a gel coat
- brush application of fibre/resin
- roller application of fibre/resin
- removal of voids and air pockets
- use of vacuum bagging
- use of bleed plies

1.9 produce a range of mouldings incorporating one of the following in the lay-up:
- feathered joins
- overlap joins
- orientated plies
- inserts
- fixtures
- butt joins

1.10 produce a range of mouldings, incorporating two of the following shape features:
- internal corner
- external corner
- double curvature
- concave surface
- convex surface
- vertical surface

1.11 produce a range of mouldings using all the following:
- resin (such as polyester, epoxy, phenolic, vinyl ester)
- fibre (such as glass, carbon, polyethylene, aramid)
- reinforcement (such as braids, roving, tapes, chopped strand, continuous filament, woven)
- core material (such as wood, coremat, structural foam, honeycomb)

1.12 produce components to the required specification which comply with one or more of the following:
- ISO 9000 quality assurance procedures
- customer standards and requirements
- company standards and procedures

1.13 check that all the required operations have been completed to specification

1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to produce composite mouldings using wet lay-up techniques	
Assessment criteria	
The learner can: 2.1 explain the health and safety precautions to be taken, and procedures used in the specific work area, when working with	

	composite materials, consumables, tools and equipment
2.2	describe the hazards associated with working with composite materials, consumables, tools and equipment, and how to minimise these in the work area
2.3	describe the protective equipment that is needed for personal protection and, where required, the protection of others
2.4	explain the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables
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	explain how to interpret and use imperial and metric systems of measurement
2.7	describe the quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification, etc)
2.8	explain the conventions and terminology used for wet lay-up techniques (eg, resin and fibre weights/volumes, material orientation, material identification, material tailoring, mixing ratios, gel times, exotherm, bleed plies, etc)
2.9	explain the various type of resin, fibres and reinforcement used, and their applications
2.10	explain how to visually identify both raw and finished composite materials
2.11	explain the methods of preparation of the patterns, moulds and tooling (including the correct use of surface sealers and release agents)
2.12	explain the mixing ratios for gel coats, resins and catalysts, and their associated working times
2.13	describe the methods used in the application of the resin/fibre during the lay-up activity
2.14	describe tools and equipment used in the lay-up activities, and explain their care, preparation and control procedures
2.15	explain how to recognise faults that can occur during the lay-up process
2.16	describe the procedures and methods used for removing mouldings from the production tooling
2.17	explain how to identify defects in the composite moulding (such as de-lamination, voids, contaminants, etc)
2.18	describe the care and safe handling of production tooling and composite mouldings throughout the production cycle
2.19	explain the production controls used in the work area, and describe actions to be taken for unaccounted items
2.20	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 246 Producing composite mouldings using pre-preg laminating techniques

UAN:	D/601/2038
Level:	Level 2
Credit value:	42
GLH:	151
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 46: Producing Composite Mouldings using Pre-Preg Laminating Techniques (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce composite mouldings using pre-preg laminating techniques, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to produce the various mouldings, using the correct pre-preg laminating production techniques. The learner will produce a range of composite mouldings, incorporating a variety of features and using a range of techniques and processes. Mouldings produced will include laminates and sandwich structures, using a range of resin, fibre and core materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the pre-preg laminating activities undertaken, and to report any problems with the production activities, equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying pre-preg laminating techniques and procedures. The learner will have an understanding of the pre-preg laminating production techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, recognising faults, and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the pre-preg laminating activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace

Learning outcome	The learner will:
1. produce composite mouldings using pre-preg laminating techniques	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 carry out all of the following during the moulding activities:

- use the correct issue of production documentation (instructions, drawings, job cards)
- use relevant health and safety documentation (material data sheets, COSHH sheets, risk assessments)
- use the correct tools and equipment for the activity, and ensure they are safe to use
- use the correct materials as specified in the production documentation
- apply safe and appropriate pre-preg laminating working practices and procedures at all times
- keep the work area in a safe condition

1.3 follow the correct component drawing or any other related specifications for the component to be produced

1.4 determine what has to be done and how this will be achieved

1.5 obtain and prepare the appropriate tools, equipment and materials

1.6 prepare moulds and materials for production activities, to include carrying out all of the following:

- cleaning of tooling and removal of resin build ups
- checking of tooling for surface defects
- correctly applying sealants/release agents
- cutting materials to correct shape and orientation (where applicable)

1.7 carry out the moulding or laying-up activities using the correct methods and techniques

1.8 produce a range of mouldings, using techniques for two of the following types of production tools:
- metal
- wet lay-up
- glass pre-preg
- tooling block
- carbon pre-preg
- female tooling
- male tooling
- multi-part tools
- matched tooling
- closed tooling

1.9 produce composite fabrications, incorporating one of the following in the lay-up:
- butt joins
- overlap joins
- staggered joins
- orientated plies
- inverted plies
- inserts

1.10 produce composite fabrications, incorporating three of the following features:
- internal corners
- external corners
- double curvature
- concave surface
- convex surfaces
- return surfaces
- joggle details
- nett edges

1.11 use all of the following in the lay-up activities:
- resin (such as epoxy, phenolic, bismaleimide, cyanate ester)
- fibre (such as glass, polyethylene, aramid, carbon)
- reinforcement (such as continuous, uni-directional, braids, woven, multi-axis, tapes)
- core materials (such as wood, syntactic core, expanding core, foam, honeycomb)

1.12 use one of the following for applying temperature during the cure cycle:
- oven
- heated tools/moulds
- autoclave
- heated press

1.13 use one of the following for applying pressure during the cure cycle:
- pressure bags
- vacuum bags
- thermal mould expansion

- fibre tensioning

1.14 produce components to the required specification which comply with one of the following standards:
- ISO 9000 quality assurance procedures
- customer standards and requirements
- company standards and procedures

1.15 check that all the required operations have been completed to specification

1.16 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:

2. know how to produce composite mouldings using pre-preg laminating techniques

Assessment criteria

The learner can:

2.1 explain the health and safety precautions to be taken, and procedures used in the specific work area, when working with composite materials, consumables, tools and equipment

2.2 describe the hazards associated with working with composite materials, consumables, tools and equipment, and how to minimise these in the work area

2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others

2.4 explain the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables

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 explain how to interpret imperial and metric systems of measurement

2.7 describe the quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification, etc)

2.8 explain the conventions and terminology used for pre-preg laminating techniques (eg, material orientation, material identification, material templates, ply lay-up, pressure plates, vacuum bagging, cure cycles, exotherm, etc)

2.9 explain the various type of resin systems, fibres and reinforcements used, and their applications

2.10 describe the core, insert and filler materials used, and their applications

2.11 explain how to visually identify both raw and finished composite materials

2.12 explain the methods used in the application of pre-preg materials to tooling surfaces (including methods of tailoring and cutting)

2.13 explain the correct methods of storage and handling of ancillary and consumable materials

2.14 describe the tools and equipment used in the pre-preg laminating activities, and explain their care, preparation and control procedures

2.15	explain how to recognise faults that can occur during the moulding process
2.16	explain the importance of adhering to the cure cycle
2.17	describe the procedures and methods used for removing mouldings from production tooling
2.18	describe the care and safe handling of production tooling and composite mouldings throughout the production cycle
2.19	describe the production controls used in the work area, and actions to be taken for unaccounted items
2.20	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 247 Produce components by acrylic moulding

UAN:	D/601/2041
Level:	Level 2
Credit value:	32
GLH:	130
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 47: Produce Components by Acrylic Moulding (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce components by acrylic moulding, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to produce the various types of components. The learner will be expected to produce the acrylic components using the specified moulding process and techniques. This will involve using equipment such as air circulating ovens, presses, trimming and automated cutting equipment. The products produced will include deep drawn, double curvature, convex and concave shapes. The learner's responsibilities will require them to comply with organisational policy and procedures for the acrylic moulding activities undertaken, and to report any problems with the moulding activities, equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying acrylic moulding techniques and procedures. The learner will have an understanding of the production techniques

used, and their application, in adequate depth to provide a sound basis for carrying out the activities, recognising faults, and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the acrylic moulding activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce components by acrylic moulding	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the moulding activities: • use the correct issue production documentation (work instructions, drawings, job cards) • use relevant health and safety documentation (material data sheets, COSHH sheets) • use the correct tools and equipment for the activity, and ensure they are safe to use • use the correct materials and consumables, as specified in the production documentation • apply safe and appropriate acrylic moulding practices and procedures at all times • keep the work area in a safe condition 1.3 follow the correct component drawing or any other related specifications for the component to be produced 1.4 determine what has to be done and how this will be achieved 1.5 obtain and prepare the appropriate tools, equipment and materials 1.6 carry out the moulding or laying-up activities using the correct methods and techniques 1.7 carry out one of the following moulding methods and techniques: • vacuum moulding • deep drawing • shape clamping • positive pressure shaping • stress relieving 1.8 carry out three of the following operations during the moulding process: • tool/equipment preparation • sheet preparation • trimming • setting and controlling temperatures	

- stress relieving
- sheet forming
- de-moulding

1.9 produce a range of components with two of the following features:
- box sections
- cylindrical section
- convex shapes
- concave shapes
- single curvatures
- double curvatures

1.10 produce components to the required specification which comply with one of the following:
- ISO 9000 quality assurance procedures
- customer standards and requirements
- company standards and procedures

1.11 check that all the required operations have been completed to specification

1.12 deal promptly and effectively with problems within your control and report those that cannot be solved.

Learning outcome	The learner will:

2. know how to produce components by acrylic moulding

Assessment criteria

The learner can:

2.1 explain the specific safety practices and procedures that they need to observe when working with acrylics, including any specific legislation, regulations/codes of practice for the activities, equipment or materials used

2.2 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them

2.3 describe the protective equipment that they need to use for both personal protection and, where appropriate, protection of others

2.4 describe the hazards associated with moulding acrylic materials, and with the tools and equipment used, and explain how they can be minimised

2.5 explain how to interpret the drawings, standards, quality control procedures and specifications used for the moulding activity, and the currency/issue checks of the documents they are working with

2.6 explain the principles of deep drawing, concave/convex moulding, positive pressure moulding and stress relieving

2.7 explain the different methods of heating materials, and the temperature control methods

2.8 explain the sheet profiling procedures, and material trimming methods/procedures

2.9 explain how acrylic sheet is supplied (such as colour, thickness, sheet size, surface texture, material protection)

2.10 explain the use of forming aids

2.11 describe the methods of sheet trimming and sheet cleaning prior to moulding

2.12	describe the preparation methods and procedures applied to the moulding surface
2.13	describe the material cleaning methods and procedures to be applied
2.14	describe the quality control procedures to followed during the moulding operations
2.15	describe the methods and techniques for lifting, handling and supporting the components, equipment and materials during the moulding activities
2.16	explain how to recognise moulding defects (such as misalignment, distortion, damage, contamination and surface defects)
2.17	describe the tools and equipment used in the moulding activities, and explain their calibration, care, preparation and control procedures
2.18	describe the problems that can occur with the moulding operations, and explain how these can be overcome
2.19	explain the recording documentation that needs to be completed for the moulding activities undertaken
2.20	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 248 Vacuum forming composite materials

UAN:	F/601/2047
Level:	Level 2
Credit value:	32
GLH:	130
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 48: Vacuum Forming Composite Materials (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to vacuum form components, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings and specifications, to produce the various types of components from thermoplastic sheet, fibre reinforced thermoplastic sheet and structural foam. This will require the learner to use a range of air circulating ovens, vacuum forming machines, trimming equipment and various types of tooling. The components produced will have a range of features, including male shapes, female shapes, double curvatures and stiffened mouldings. The learner's responsibilities will require them to comply with organisational policy and procedures for the vacuum forming activities undertaken, and to report any problems with the vacuum forming activities, equipment, materials or consumables that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide an understanding of their work, and will provide an informed approach to applying vacuum forming procedures. The learner will have an understanding of the vacuum forming procedures used, and their

application, and will know about the vacuum forming techniques, materials, tooling and consumables used, in adequate depth to provide a sound basis for carrying out the activities, recognising faults and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the vacuum forming operations and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. vacuum form composite materials	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 carry out all of the following during the vacuum forming activities:

- use the correct issue of production documentation (job instructions, drawings, specifications)
- use relevant health and safety documentation (material data sheets, relevant COSHH sheets, risk assessments)
- use the correct materials and consumables as specified in the production documentation (colour, size, composition)
- use the correct tools and equipment for the activity and check they are fit for purpose
- apply safe and appropriate vacuum forming techniques and working practices at all times
- leave the work area in a safe condition

1.3 use two of the following types of equipment:

- air circulating ovens
- vacuum forming machines
- tufnol tooling
- metal tooling
- wood tooling
- trimming equipment
- composite tooling

1.4 confirm that the equipment is set up correctly and is ready for use

1.5 manipulate the machine controls safely and correctly in line with operational procedures

1.6 carry out three of the following operations:

- bubble blowing to minimize webbing
- positioning of robbers
- cleaning tooling
- temperature control

- trimming techniques
- drying of sheet
- use of intensifiers
- sheet cleaning

1.7 produce a range of components with two of the following features:
- double curvatures
- male shapes
- female shapes
- stiffened mouldings

1.8 produce a range of components using one the following materials:
- thermoplastic sheet (such as polycarbonate, polysulphone, acrylic, polyvinyl chloride, ABS)
- fibre-reinforced thermoplastic sheet
- structural foams (polyvinyl chloride (PVC), polymethate (Rohacell), etc)

1.9 produce components to the required specification which complies with one of the following:
- ISO 9000 series and procedures
- customer standards and requirements
- company standards and procedures

1.10 carry out quality sampling checks at suitable intervals

1.11 deal promptly and effectively with problems within their control and report those that cannot be solved

1.12 shut down the equipment to a safe condition on conclusion of the machining activities.

Learning outcome	The learner will:
2. know how to vacuum form composite materials	
Assessment criteria	

The learner can:

2.1 explain the specific safety practices and procedures that they need to observe when working with vacuum forming equipment (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.2 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them

2.3 describe the protective equipment that they need to use for both personal protection and, where appropriate, protection of others

2.4 describe the hazards associated with carrying out vacuum forming activities, and with the tools and equipment used, and how they can be minimised

2.5 explain the application of COSHH regulations in relation to the storage, use and disposal of materials and consumables used in the vacuum forming process

2.6 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 the work undertaken)

2.7 explain how to interpret imperial and metric systems of measurement

2.8	describe the methods of sheet trimming and sheet cleaning, prior to forming
2.9	describe the preparation methods and procedures applied to the moulding surface
2.10	explain how to identify the correct male/female mould tooling
2.11	describe the methods and techniques of loading and aligning materials into the mould tooling
2.12	describe the methods and techniques for carrying out the de-moulding procedures
2.13	explain how to recognise vacuum forming defects (such as misalignment, distortion, damage, contamination and surface defects)
2.14	explain the importance of adhering to the vacuum forming cycle
2.15	describe the quality control procedures to be followed during the vacuum forming operations
2.16	describe the tools and equipment used in the vacuum forming activities, and explain their care, preparation and control procedures
2.17	describe the problems that can occur with the vacuum forming operations, and explain how these can be overcome
2.18	explain what production documentation needs to be completed for the vacuum forming activities undertaken
2.19	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 249 Trimming composite mouldings using hand tools

UAN:	D/601/2055
Level:	Level 2
Credit value:	32
GLH:	130
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 49: Trimming Composite Mouldings using Hand Tools (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to trim composite mouldings using hand tools, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to trim various composite mouldings, using the correct trimming techniques. The learner will be expected to select and use the correct tools and equipment for the trimming activity. The learner will trim a range of composite mouldings, incorporating a variety of features, by using cutting, sanding, drilling and polishing techniques and processes. Mouldings to be trimmed will include a range of resin and fibre materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the trimming activities undertaken, and to report any problems with the trimming activities, equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying composite moulding trimming techniques and procedures. The learner will have an understanding of the trimming techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, recognising faults and ensuring the trimmed mouldings are to the required specification.

The learner will understand the safety precautions required when carrying out the trimming activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. trim composite mouldings using hand tools	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the trimming activities: • use the correct issue of production documentation (job instructions, drawings, specifications) • use relevant health and safety documentation (material data sheets, relevant COSHH sheets, risk assessments) • use the correct tools and equipment for the activity, and ensure they are safe to use and suitably stored • apply safe and appropriate trimming techniques and working practices at all times • keep the work area in a safe condition 1.3 follow relevant specifications for the component to be produced 1.4 obtain the appropriate tools and equipment for the shaping operations and check they are in a safe and usable condition 1.5 shape the materials using appropriate methods and techniques 1.6 carry out all the following when preparing for the trimming activity: • check moulding is correct and complete • check for any defects in the moulding • identify and protect the moulding in the work area 1.7 mark out the mouldings using four of the following methods: • scriber • height gauge • moulded scribe lines • centre punch • trimming templates	

1.8 cut mouldings using two the following methods:
- cutting wheels/discs
- saws
- routers
- trim jigs

1.9 sand mouldings using three of the following methods:
- rubbing blocks
- diamond files
- pencil grinders
- disc sanders
- belt sanders

1.10 use a hand drill or pedestal drill to drill mouldings, using three of the following methods:
- drill jigs
- hole saws
- counterbores
- countersinks
- drill bits

1.11 polish mouldings using three of the following methods:
- wet sanding
- cutting compound
- polishing compound
- rubbing block
- orbital sander
- polisher

1.12 trim mouldings using techniques for both of the following:
- resins (such as polyester, vinyl ester, epoxy, phenolic, bismaleimide, cyanate ester)
- fibres (such as polyethylene, glass, aramid, carbon)

1.13 trim mouldings that require, or incorporate, eight of the following features:
- straight edges
- curved edges
- flat surfaces
- polished surfaces
- shaped surfaces
- radius corners
- returns
- nett edges
- joggle details
- removal of join lines
- holes
- multiple hole sizes
- countersinks
- counterbores
- further lay-up stages
- inserts to be drilled

- inserts to be tapped
- solid cores
- honeycomb cores
- edge filling

1.14 check that all the required shaping operations have been completed to the required specification and comply with one of the following:

- ISO 9000 quality assurance procedures
- customer standards and requirements
- company standards and procedures

1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:

2. know how to trim composite mouldings using hand tools

Assessment criteria

The learner can:

2.1 explain the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area

2.2 describe the hazards associated with trimming composite materials, consumables, tools and equipment, and explain how to minimise these in the work area

2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others

2.4 explain the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables

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 explain how to interpret drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.7 explain how to prepare for the trimming activities, and how to mark out the mouldings for the material that needs to be removed

2.8 describe the quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification, etc)

2.9 explain the conventions and terminology used for trimming activities (eg, scribe lines, sanding grades, types of cutting tools, speeds)

2.10 describe the different types of manual and power tools used in composite trimming operations

2.11 describe the different types of cutting tools and abrasives used in trimming composite materials, and their application

2.12 explain how to visually identify the cured composite materials

2.13 explain how to identify defects in the composite mouldings

2.14 describe the methods used in the trimming of composite mouldings

2.15 describe the care and safe handling of the composite mouldings throughout the trimming cycle

2.16 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 250 Identifying defects in composite mouldings

UAN:	A/601/2063
Level:	Level 2
Credit value:	23
GLH:	95
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 50: Identifying Defects in Composite Mouldings (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to identify and deal with defects in composite mouldings (moulds, panels, components, jigs), in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to identify and deal with defects in composites mouldings. The learner will be able to identify a range of defects in composite mouldings, using various methods and techniques. Defects will be identified in a range of mouldings with a variety of resin and fibre materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to identifying defects in composite mouldings. The learner will have an understanding of composite materials, and their application,

and will know about the associated defects, in adequate depth to provide a sound basis for identifying the defects in line with organisation practice and procedures.

The learner will understand the safety precautions required when working with the composite mouldings and when using associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. identify defects in composite mouldings	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the inspection activities: • use the correct issue production documentation (drawings, manuals, specifications, job cards) • use relevant health and safety documentation (material data sheets, COSHH sheets, risk assessments) • use the correct tools and equipment for the activity, and ensure they are safe to use • keep the work area in a safe condition 1.3 identify defects with regard to the product or asset specification 1.4 identify defects in composite mouldings using four of the following methods: • touch • sound • visual • measurement • mechanical tests • CMM • NDT • stage inspection 1.5 identify defects in six of the following types of composite mouldings: • trim • closing panels • housings • body panels • tubes • sections • sandwich panels • structural • aerodynamic	

- moulds
- jigs

1.6 identify defects applicable to two of the following resin types:
- polyester
- vinyl ester
- epoxy
- phenolic
- bismaleimide
- cyanate ester

1.7 identify defects applicable to two of the following fibre types:
- polyethylene
- glass
- aramid
- carbon

1.8 identify eight of the following types of defect in composite mouldings:
- incomplete curing
- dimensional
- tolerances
- ply orientation
- wrong join type
- surface finish
- distortion
- blisters
- bridging
- de-lamination
- wrinkles
- broken fibres
- splintering
- voids
- dents or 'dings'
- dis-bonds
- resin rich areas
- incorrect material
- excessive adhesive
- damaged cores
- wrong inserts
- insert positions
- impact damage

1.9 ensure that inspected mouldings comply with one of the following standards:
- ISO 9000 quality assurance procedures
- customer standards and requirements
- company standards and procedures

1.10 assess the defects and determine action required to return the products and assets to specified condition

1.11	report recommendations for action to the appropriate people promptly and in accordance with organisational procedures
1.12	record details of defects in accordance with quality assurance and control systems and procedures.

Learning outcome	The learner will:
2. know how to identify defects in composite mouldings	
Assessment criteria	
The learner can:	
2.1	explain the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area
2.2	describe the hazards associated with working with composite materials, consumables, tools and equipment, and explain how to minimise these in the work area
2.3	describe the protective equipment that is needed for personal protection and, where required, the protection of others
2.4	explain the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables
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	explain how to use imperial and metric systems of measurement, workpiece reference points and system of tolerancing
2.7	describe the quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification, etc) and the completion of such documents
2.8	explain the conventions and terminology used when identifying and rectifying defects (eg, dis-bonds, de-lamination, resin injection, resin voids, core potting, repair patches)
2.9	describe failure modes for various composite mouldings, and explain what can contribute to these
2.10	explain the correct methods of storage and handling of composite materials
2.11	describe the tools and equipment used for checking the various composite mouldings
2.12	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 251 Applying surface finishes to composite mouldings

UAN:	Y/601/2068
Level:	Level 2
Credit value:	32
GLH:	130
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 51: Applying Surface Finishes to Composite Mouldings (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to apply finishes to composite mouldings (moulds, panels and components), in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to apply finishes, using the correct techniques. The learner will apply finishes to composite mouldings using a range of techniques and processes. A variety of finishes will be applied to a range of resin and fibre materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the finishing activities undertaken, and to report any problems with the finishing activities, equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with minimum supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying finishing techniques and procedures to composite mouldings. The learner will have an

understanding of the finishing techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, recognising faults and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the finishing operations and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. apply surface finishes to composite mouldings	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 carry out all of the following during the finishing activities:

- use the correct issue production documentation (drawings, manuals, specifications, job cards)
- use relevant health and safety documentation (material data sheets, COSHH sheets, risk assessments)
- use the correct tools and equipment for the activity and ensure they are safe to use
- keep the work area in a safe condition

1.3 carry out all the following activities when preparing for the finishing activity:

- check mouldings are correct and complete
- check for any defects in the mouldings
- check availability of ancillary materials required
- select correct equipment for the activity
- check equipment is suitable for use
- identify and protect the moulding in the work area

1.4 ensure the material surfaces to be treated are suitably prepared for the finishing operations to be carried out

1.5 prepare the surfaces of composite mouldings, using two of the following methods:

- abrading
- bead blasting
- water cleaning
- solvent cleaning
- priming

1.6 check that the finishing equipment and treatment solutions are set up and maintained at satisfactory operating conditions and levels

1.7 carry out the treatment process in accordance with operating procedures and the component specification requirements

1.8 apply finishes to composite mouldings, using two of the following techniques:
- cloth application
- brush
- spray
- laying films
- roller

1.9 apply two types of finishes to composite mouldings from the following:
- surface sealers
- primers
- top coats
- adhesive films
- UV coatings
- heatproof coatings
- speciality coatings
- flexible coatings

1.10 apply finishes to composite mouldings, using three of the following:
- one-part finishes
- two-part finishes
- multiple coatings
- combination coats
- solvent based
- adhesive based
- water based
- single coatings

1.11 apply finishes to composite mouldings, using four of the following consumable materials:
- abrasives
- masking tapes
- masking films
- polishes
- thinners
- solvents
- stoppers
- fillers
- sealers
- primers
- cutting compounds
- cleaning agents

1.12 apply finishes to composite mouldings suitable for two of the following resin types:
- polyester
- vinyl ester
- epoxy
- phenolic
- bismaleimide

- cyanate ester

1.13 apply finishes to composite mouldings suitable for two of the following fibre types:
- polyethylene
- glass
- aramid
- carbon

1.14 ensure that the treated workpiece achieves the required characteristics and meets the finishing specification

1.15 apply finishes to a range of mouldings, which comply with one of the following standards:
- meets company standards and procedures
- meets customer standards and requirements
- has an appropriate surface finish and is free from defects or surface blemishes

1.16 deal promptly and effectively with problems within their control and report those that cannot be solved

1.17 dispose of waste and excess materials in line with agreed organisational procedures

1.18 shut down the finishing equipment to a safe condition on completion of the processing activities.

Learning outcome	The learner will:
2. know how to apply surface finishes to composite mouldings	
Assessment criteria	

The learner can:

2.1 explain the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area

2.2 describe the hazards associated with composite materials, consumables, tools and equipment, and explain how to minimise these in the work area

2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others

2.4 explain the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables

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 quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification, etc), and the completion of such documents

2.7 explain the conventions and terminology used for applying finishes (eg, surface keying, finish thickness, matt finish, gloss finish, treatment reactions)

2.8 explain the different types of composite resin systems, fibres and reinforcements, and their merits

2.9 describe the different finishes that can be applied to composites, and explain their merits

2.10 explain the correct methods of storage, handling and disposal of finishing materials

2.11	describe the methods of preparation for applying different finishes
2.12	explain the mixing ratios for two-part finishes, and the associated working times
2.13	describe the methods of application for different finishes
2.14	describe the problems that can occur during the finishing process, including defects such as contamination
2.15	explain how defects can be overcome during the finishing activity
2.16	describe the tools and equipment used in finishing activities, and their care, preparation and control procedures
2.17	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 252 Bonding composite mouldings

UAN:	R/601/2070
Level:	Level 2
Credit value:	23
GLH:	95
Relationship to NOS:	This unit has been derived from Semta national occupational standard Fabrication and Welding Engineering Unit 52: Bonding Composite Mouldings (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to bond composite mouldings, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to bond composite materials, using the correct production techniques. The learner will produce a range of bonded composite mouldings, incorporating a variety of features and using a range of techniques and processes. Bonded mouldings produced will include a range of resin, fibre and adhesive materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the composite bonding activities undertaken, and to report any problems with the bonding activities, equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying composite bonding techniques and procedures. The learner will have an understanding of the bonding techniques used, and their application, in adequate depth to provide a sound basis for carrying

out the activities, recognising faults, and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the bonding activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. bond composite mouldings	
Assessment criteria	
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the bonding activities: • use the correct issue production documentation (drawings, job cards) • use relevant health and safety documentation (material data sheets, COSHH sheets, risk assessments) • use the correct tools and equipment for the activity, and ensure they are safe to use and suitably stored • apply safe and appropriate bonding techniques at all times • keep the work area in a safe condition 1.3 carry out all the following when preparing for the bonding activity: • check that mouldings are correct and complete • check for any defects in the mouldings • identify and protect the moulding and bonding materials in the work area • check that bonding materials are correct and complete 1.4 follow the relevant bonding procedure specification and job instructions 1.5 check that the materials to be bonded and bonding agents comply with the specification 1.6 correctly prepare the parent materials and bonding agents in line with the bonding specification 1.7 prepare bonding surfaces, using three of the following methods: • peel plies • templates • abrading • bead blasting • water cleaning • solvent cleaning • dry fitting • acid etching • priming	

- surface masks

1.8 carry out the bonding operations using the specified processes and techniques to position and bond the materials in their correct locations

1.9 bond composite mouldings, using techniques for one of the following:

- one-part pastes
- two-part pastes
- film adhesives
- syntactic films

1.10 use two of the following methods when bonding the composite mouldings:

- dry fitting
- bonding sequences
- shimming materials
- mixing adhesives
- wetting-out by brush
- applicator gun
- laying film adhesives
- oven curing
- heated press

1.11 bond composite mouldings using techniques for one of the following:

- sandwich panels
- butt joins
- overlap joins
- joggle joins
- return joins

1.12 bond composite mouldings using techniques for two of the following:

- flat surfaces
- shaped surfaces
- internal surfaces
- external surfaces

1.13 use appropriate techniques for bonding one of the following materials to the composite moulding:

- other composites
- metals
- ceramics
- plastics
- wood-based materials

1.14 bond composite mouldings using adhesives suitable for both of the following:

- resins (such as polyester, epoxy, phenolic, bismaleimide, cyanate ester, vinyl ester)
- fibres (such as polyethylene, glass, aramid, carbon, other specific types)

1.15 ensure that any equipment used to maintain surface contact during the bonding activities is set up and used correctly to include one of the following:

- weighting down

- bonding jigs
- pinning joins
- clamping
- press
- vacuum bagging

1.16 achieve bonds of the required quality and within the specified dimensional accuracy which comply with one of the following standards:

- ISO 9000 quality assurance procedures
- customer standards and requirements
- company standards and procedures

1.17 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to bond composite mouldings	
Assessment criteria	

The learner can:

2.1 explain the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area

2.2 describe the hazards associated with bonding composite materials, consumables, tools and equipment, and explain how to minimise these in the work area

2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others

2.4 explain the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables

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 explain how to use imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.7 describe the quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification, etc)

2.8 explain the conventions and terminology used for bonding (eg, gel points, cure times, bond thickness, bond strength, peel strength)

2.9 explain the correct methods of storage and handling of bonding agents

2.10 describe the methods of preparation for bonding different materials

2.11 describe the methods of application for different bonding agents

2.12 describe the methods of retaining the bond during the curing process, and explain their merits

2.13 describe the tools and equipment used in bonding activities, and explain their care, preparation and control procedures

2.14 explain how to identify bonding defects

2.15 describe the problems that can occur during the bonding process

2.16 describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Unit 253 Producing composite assemblies

UAN:	H/601/2073
Level:	Level 2
Credit value:	42
GLH:	151
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 53: Producing Composite Assemblies (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta. It will be assessed via a portfolio of evidence.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce composite assemblies from composite components and non-composite components, in accordance with approved procedures. The learner will be required to work instructions, specifications and documentation to produce the composite assemblies, using the correct techniques. The learner will produce a range of composite assemblies, incorporating a range of features and using a range of techniques and processes. The learner's responsibilities will require them to comply with organisational policy and procedures for the composite assembly activities undertaken, and to report any problems with the assembly activities, equipment or materials that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to applying composite assembly techniques and procedures. The learner will have an understanding of the composite assembly techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, recognising faults, and ensuring the finished assembly is to the required specification.

The learner will understand the safety precautions required when carrying out the assembly activities and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome	The learner will:
1. produce composite assemblies	
Assessment criteria	

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 carry out all of the following during the assembly activities:

- use the correct issue production documentation (job instructions, drawings, manuals, specifications,)
- use relevant health and safety documentation (material data sheets, COSHH sheets, risk assessments)
- use the correct tools and equipment for the activity and ensure they are safe to use
- ensure the components to be used are of the correct type, and that all mouldings are free from defects
- apply safe and appropriate assembly techniques at all times
- keep the work area in a safe condition

1.3 follow the relevant instructions, assembly drawings and any other specifications

1.4 check that the specified components are available and that they are in a usable condition

1.5 use the appropriate methods and techniques to assemble the components in their correct positions

1.6 produce one of the following types of composite assembly:

- one-off assemblies
- batch assemblies
- assembly line

1.7 produce assemblies that incorporate two of the following features:

- loose fit tolerances
- close fit tolerances
- non-permanent fixing
- shape location
- joggle joins
- permanent fixing
- return joins
- overlap joins

1.8 produce composite assemblies that require two of the following methods to be used:

- fettling
- pinning

- clamping
- trial fitting
- aligning
- assembly jigs

1.9 assemble composite components which include two of the following:

- trim
- closing panels
- body panels
- tubes
- structural
- aerodynamic
- core materials
- sections
- inserts
- housings

1.10 produce assemblies which include one of the following non-composite components:

- brackets
- fixtures
- fittings
- trim
- tapes
- memory foam
- films

1.11 secure the components using the specified connectors and securing devices to include one of the following:

- thread inserts
- quick-release fasteners
- rivets
- mechanical fasteners
- anchor nuts

1.12 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification and complies with one of the following:

- ISO 9000 quality assurance procedures
- customer standards and requirements
- company standards and procedures

1.13 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome	The learner will:
2. know how to produce composite assemblies	
Assessment criteria	
The learner can: 2.1 explain the health and safety precautions to be taken and procedures used in the specific work area, when working with composite materials, consumables, tools and equipment	

2.2	describe the hazards associated with assembling composite materials, and with the consumables, tools and equipment used, and explain how to minimise these in the work area
2.3	describe the protective equipment that is needed for personal protection and, where required, the protection of others
2.4	explain the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables
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	explain how to use imperial and metric systems of measurement, workpiece reference points and system of tolerancing
2.7	describe the quality procedures used in the workplace to ensure production control
2.8	describe the methods of assembling composite components using mechanical methods (such as screw fasteners, rivets, special purpose fittings)
2.9	explain the methods for handling composite assemblies throughout the assembly activities
2.10	describe the tools and equipment used in assembly activities, and explain their care, preparation and control procedures
2.11	describe the things that can go wrong with the assembly activities, and explain how they can be avoided
2.12	describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve.

Appendix 1 Relationships to other qualifications

Links to other qualifications

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:

- Level 2 NVQ in Fabrication and Welding Engineering (1681)

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/57650.html**

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.

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 such on such things as:

- **Walled Garden**: how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF)**: general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for GOLA/e-volve assessments.

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

If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: **feedbackandcomplaints@cityandguilds.com**

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 Land Based Services (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).

Published by City & Guilds, a registered charity established to promote education and training

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