QUALIFICATION HANDBOOK

Level 3 NVQ Diploma in Fabrication and Welding – Plateworking (3 mm upwards) (1782-30)

September 2018 version 1.2

City & Guilds

Qualification at a glance

Subject area	**Engineering**
City & Guilds number	1782-30
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	GLH	TQT	City & Guilds number	Accreditation number
Level 3 NVQ Diploma in Fabrication and Welding Engineering – Plateworking (3mm upwards)	393	1240	1782-30	601/0078/3

Version and date	Change detail	Section
1.1 August 2017	Added TQT details Deleted QCF	**Qualification at a glance, Structure** **Throughout**
1.2 September 2018	Changed from a seven to a nine	**Unit 201 Assessment criteria 2.3**

Contents

1 Introduction

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

Area	Description
Who is the qualification for?	It is for learners who work or want to work as fabrication and welding engineers in the engineering sector.
What does the qualification cover?	It allows learners to learn, develop and practise the skills required for employment and/or career progression in the fabrication and welding engineering sector.
Is the qualification part of a framework or initiative?	It serves as a competence qualification, in the Engineering Apprenticeship framework.
Who did we develop the qualification with?	It was developed in association with SEMTA, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
What opportunities for progression are there?	It allows learners to progress into employment or to the following City & Guilds qualifications: • Level 3 NVQ Extended Diploma in Fabrication and Welding Engineering

Structures

The minimum credit required to achieve this qualification is **133 credits.**

To achieve the **Level 3 NVQ Diploma in Fabrication and Welding Engineering (Plateworking (3 mm upwards))**, learners **must** achieve 15 units from the mandatory units (201-202, 303) and **must** achieve a minimum of **21** credits and **one** unit from optional group A (units 322, 327), plus a minimum of **13** credits and any **one** unit from optional group B (units 235, 332-333, 366), plus **49** credits and **two** units from optional group C (units 335-338), plus a minimum of **35** credits and **two** more units from optional group D, units (328, 331, 339).

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
K/601/5055	303	Working efficiently and effectively in engineering	5
Optional group A			
F/504/9184	322	Marking Out Components for Metalwork	21
D/504/9189	327	Developing and Marking Out Templates for Metalwork	28
Optional group B			
L/504/9219	235	Cutting Materials using Saws and Abrasive Discs	13
D/504/9192	332	Cutting Plate and Sections using Shearing Machines	28
H/504/9193	333	Cutting and Shaping Materials using Portable Thermal Cutting Equipment	35
D/504/9211	366	Operating CNC Fabrication Equipment	40
Optional group C			
M/504/9195	335	Bending and Forming Plate using Press Brakes or Bending Machines	35
T/504/9196	336	Forming Platework using Power Rolling Machines	35
A/504/9197	337	Producing and Finishing Holes using Drilling Machines	14
F/504/9198	338	Producing Platework Assemblies	35

Optional group D			
R/504/9190	328	Joining Fabricated Components using Mechanical Fasteners	21
Y/504/9191	331	Producing Fillet Welded Joints using a Manual Welding Process	76
J/504/9199	339	Slinging, Lifting and Moving Materials and Components	14

- If the learner is undertaking this pathway as part of the Extended Diploma, the Extended Diploma handbook must be referred to in order to determine the additional qualification and credit requirements.

Total Qualification Time

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

Title and level	GLH	TQT
Level 3 NVQ Diploma in Fabrication and Welding – Plateworking (3 mm upwards)	393	1240

2 Centre requirements

Approval

Centres currently offering the City & Guilds Level 3 NVQ in Fabrication and Welding Engineering (1781) will be automatically approved to run this new qualification.

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

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

Resource requirements

Centre staffing

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

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

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

Assessors and internal verifier

Assessor Requirements to Demonstrate Effective Assessment Practice

Assessment must be carried out by competent Assessors that as a minimum must hold the 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 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 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 Awarding Organisation's assessment recording documentation used for the 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 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 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 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 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 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 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 NVQ units against which the assessments and verification are to be carried out, the appropriate Regulatory Body's systems and procedures and the relevant Awarding Organisation's documentation,

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

Candidate entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that candidates have the potential and

opportunity to gain the qualification successfully so should have the opportunity to gather work based evidence.

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 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 takes the same form as in the workplace

Age restrictions

City & Guilds cannot accept any registrations for candidates under 16 as this qualification is 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[s].
- any units they have already completed, or credit they have accumulated which is relevant to the qualification[s].
- 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[s], 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 Assessments

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 may be 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 (qualifications consultant) 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 learner's 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 (the Sector Skills Council) 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 (RPL)

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

RPL is allowed and is also sector specific.

5 Units

Availability of units

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

Structure of units

These units each have the following:

- City & Guilds reference number
- unit accreditation number (UAN)
- 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.

Unit 201 Complying with statutory regulations and organisational safety requirements

UAN:	**A/601/5013**
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).
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
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: a. applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act b. identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as: oeye protection and personal protective equipment (PPE) oCOSHH regulations orisk assessments c. identifying the warning signs and labels of the main groups of hazardous or dangerous substances d. 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: a. identifying the appropriate qualified first aiders and the location of first aid facilities b. identifying the procedures to be followed in the event of injury to themselves or others c. following organisational procedures in the event of fire and the evacuation of premises d. 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:
   a. their working environment
   b. the equipment that they use
   c. materials and substances (where appropriate) that they use
   d. 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:
   a. lifting alone
   b. with assistance of others
   c. with mechanical assistance

1.10 apply safe working practices and procedures to include:
   a. maintaining a tidy workplace, with exits and gangways free from obstruction
   b. using equipment safely and only for the purpose intended
   c. observing organisational safety rules, signs and hazard warnings
   d. 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 nine 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:	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).
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
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:

a. check the currency and validity of the data and documentation used
b. exercise care and control over the documents at all times
c. correctly extract all necessary data in order to carry out the required tasks
d. seek out additional information where there are gaps or deficiencies in the information obtained
e. deal with or report any problems found with the data and documentation
f. make valid decisions based on the evaluation of the engineering information extracted from the documents
g. return all documents to the approved location on completion of the work
h. 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:

a. materials or components required
b. dimensions
c. tolerances
d. build quality
e. installation requirements
f. customer requirements
g. time scales
h. financial information
i. operating parameters
j. surface texture requirements
k. location/orientation of parts
l. process or treatments required
m. dismantling/assembly sequence
n. inspection/testing requirements
o. number/volumes required
p. repair/service methods

q. method of manufacture
r. weld type and size
s. operations required
t. connections to be made
u. surface finish required
v. shape or profiles
w. fault finding procedures
x. safety/risk factors
y. environmental controls
z. specific data (such as component data, maintenance data, electrical data, fluid data)
aa. resources (such as tools, equipment, personnel)
bb. utility supply details (such as electricity, water, gas, air)
cc. location of services, including standby and emergency backup systems
dd. circuit characteristics (such as pressure, flow, current, voltage, speed)
ee. protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)
ff. 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:

a. drawings (such as component drawings, assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings)
b. diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit diagrams)
c. manufacturers manuals/drawings
d. approved sketches
e. technical illustrations
f. photographic representations
g. visual display screen information
h. technical sales/marketing documentation
i. contractual documentation
j. other specific drawings/documents

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

a. instructions (such as job instructions, drawing instructions, manufacturers instructions)
b. specifications (such as material, finish, process, contractual, calibration)
c. reference materials (such as manuals, tables, charts, guides, notes)
d. schedules
e. operation sheets
f. service/test information
g. planning documentation
h. quality control documents
i. company specific technical instructions
j. national, international and organisational standards

k. health and safety standards relating to the activity (such as COSHH)
l. 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 wiring diagrams, block and schematic diagrams

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 303 Working efficiently and effectively in engineering

UAN:	**K/601/5055**
Level:	3
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 3).
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, 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 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. The learner will also be expected to review

objectives and targets for their personal development and make recommendations 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 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 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 contribute to improvements, 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:

- a. the work area is free from hazards and is suitably prepared for the activities to be undertaken
- b. any required safety procedures are implemented
- c. any necessary personal protection equipment is obtained and is in a usable condition
- d. tools and equipment required are obtained and checked that they are in a safe and useable condition
- e. all necessary drawings, specifications and associated documentation is obtained
- f. job instructions are obtained and understood
- g. the correct materials or components are obtained
- h. storage arrangements for work are appropriate
- i. 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 that 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:

- a. completing all necessary documentation accurately and legibly
- b. returning tools and equipment
- c. returning drawings and work instructions
- d. identifying, where appropriate, any unusable tools, equipment or components
- e. arranging for 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:

- a. materials
- b. tools and equipment
- c. drawings
- d. job specification
- e. quality
- f. people
- g. timescales
- h. safety
- i. activities or procedures

1.10 contribute to and communicate opportunities for improvement to working practices and procedures

1.11 make recommendations for improving to two of the following:
   a. working practices
   b. working methods
   c. quality
   d. safety
   e. tools and equipment
   f. supplier relationships
   g. internal communication
   h. customer service
   i. training and development
   j. teamwork
   k. other

1.12 maintain effective working relationships with colleagues to include two of the following:
   a. colleagues within own working group
   b. colleagues outside normal working group
   c. line management
   d. external contacts

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

1.14 review personal development objectives and targets to include one of the following:
   a. dual or multi-skilling
   b. training on new equipment / technology
   c. increased responsibility
   d. understanding of company working practices, procedures, plans and policies
   e. 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 area 2.2 describe the correct use of any equipment used 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 materials required 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 required to confirm that the activity has been completed 2.12 explain what materials, equipment and tools can be reused 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 making recommendations for improving working practices 2.16 describe the procedure and format for making suggestions for improvements 2.17 describe the benefits to organisations if improvements can be identified 2.18 describe the importance of maintaining effective working relationships within the workplace 2.19 describe the procedures to deal with and report any problems that can affect working relationships 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 responsibility and to whom they should report if they have any problems that they cannot resolve.	

Unit 235 Cutting materials using saws and abrasive discs

UAN:	**L/504/9219**
Level:	2
Credit value:	13
GLH:	42
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 34: Cutting and Shaping Materials using Gas Cutting Machines (Suite 2)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
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: a. machine saw b. band saw c. hand held portable abrasive disc d. radiac abrasive disc 1.3 ensure that the equipment is fit for purpose and used safely by carrying out all of the following: a. selecting the appropriate equipment/machine for the operation being performed b. checking that machine guards and safety devices are in position and function correctly c. checking that cutting discs/blades are in a serviceable condition (sharp, and free from damage or chips) d. isolating the equipment from its power supply whilst changing blades or discs e. 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: a. straight sawing b. abrasive disc cutting c. contour shaping using saws 1.7 cut and shape components which contain all of the following features: a. straight parallel cuts b. square cuts c. curved contours

d. angled/mitred cuts

1.8 cut and shape three of the following forms of material:
   a. flat plate
   b. solid bar (such as square, round, hexagonal)
   c. rolled sections (angle, channel, RSJ)
   d. pipe/tube
   e. rail section
   f. 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:
   a. material dimensional accuracy is within specification tolerances
   b. cuts are square, clean and free from excessive burrs
   c. 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 explain the personal protective clothing and equipment (PPE) to be worn when carrying out the fabrication activities (such as leather gloves, eye/ear protection, safety helmets) 2.3 explain the safe working practices and procedures to be observed when working with the machines (including emergency shutdown procedures) 2.4 describe 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 describe how to obtain the necessary drawings, specifications and work instructions 2.7 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken) 2.8 describe how to interpret marking out conventions (such as cutting

	lines, centre lines)
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	describe 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	describe 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, tested and usable condition)
2.15	describe the use of safety screens to protect other uses from flying sparks whilst using abrasive cutting discs
2.16	describe the importance of ensuring that machine guards are correctly fitted and positioned before using the equipment
2.17	describe how to set and adjust power saws for the various operations being performed
2.18	describe 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 problems that can occur 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 322 Marking out components for metalwork

UAN:	**F/504/9184**
Level:	3
Credit value:	21
GLH:	77
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 22: Marking Out Components for Metalwork (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to mark out sheet and plate work (including simple templates), and rolled sections 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, shaping and forming sheet materials, plate and sections as is appropriate to the application and will include marking out workpiece datum's, centre lines, angles and curved details, cutting and bending details including bending allowances and hole centring and outlining details. Materials to be marked out may include ferrous and non-ferrous. Certain materials will require the learner to take the grain flow or rolling direction 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 themselves, 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 the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying marking out procedures. The learner will understand the marking out process, and its application, and will know about the materials as well as the care and use of tools 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 metalwork
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 six of the following tools and instruments: a. scriber b. centre punch c. rule and tape d. straight edge e. square f. protractor g. dividers or trammels h. chalk, bluing or paint i. laser j. etching 1.5 prepare suitable datum's 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: a. hot rolled mild steel b. cold rolled mild steel c. coated mild steel (such as primed, tinned or galvanised)

d. stainless steel
e. aluminium
f. brass
g. copper
h. lead
i. titanium
j. non-metallic materials

1.8 mark out sheet or plate for three of the following forms/shapes of component:
a. flat covers and plates
b. square and radial bends
c. square/rectangular/box sections
d. cylindrical sections (such as trunking, pipes, tanks)
e. frames or structures
f. fish plates, gussets
g. brackets
h. structural support pads, bed plates
i. columns, beams or struts
j. simple seatings (such as boiler saddles, tank cradles)

1.9 mark out material to include five of the following features:
a. datum and centre lines
b. square/rectangular profiles
c. angles
d. circles
e. curved profiles
f. cutting and bending detail (including allowances)
g. hole centring and outlining (circular and linear)

1.10 check that the marking out complies with the specification

1.11 produce marked out component which meet all of the following quality and accuracy standards:
a. company/customer standards and codes of practice
b. dimensionally accurate (to drawing or specification)
c. clearly defined for required processes
d. uses recognised marking out conventions

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 metalwork
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 (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations) 2.2 describe the personal protective clothing and equipment that needs to be worn when carrying out the fabrication activities (such as leather gloves, eye/ear protection, safety helmets) 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 and explain how they can be minimised (such as working in a fabrication environment, lifting and handling sheet/fabricated components, slivers/burrs on sheet materials, using marking out mediums, using laser marking out equipment)

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 British, European or relevant international standards in relation to work undertaken)

2.7 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.8 explain how you can produce a three dimensional shape from the two dimensional material

2.9 describe the preparations that need to be carried out on the material prior to marking out to enhance clarity and accuracy, and safety

2.10 explain the principles of marking out, developing basic shapes (flat, rectangular and cylindrical) from flat sheet, plate or rolled section materials

2.11 describe the effective use and care of tools/instruments

2.12 explain the use of marking out conventions (such as datum edges/lines, centre lines)

2.13 explain the material characteristics and process considerations that need to be taken into account when marking out sheet, plate or rolled section materials

2.14 explain how to calculate and mark out true lengths, bend allowances and circumferences

2.15 explain the geometrical construction methods used for straight and radius bends, curved or circumference sections, pyramid or cone sections

2.16 explain ways of laying out the shapes/patterns to maximise the use of plate or sheet material

2.17 explain how to set and adjust the tools, such as squares and protractors

2.18 describe the methods of marking out large or long shapes

2.19 explain how to mark out and transfer information from templates

2.20 explain how to transfer information to the underside of the sheet or plate

2.21 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

2.22 explain the need for clear and dimensional accuracy in marking out to specifications/drawings

2.23 describe the sort of problems that can occur in marking out fabrication components, and explain how these can be avoided

2.24 describe the extent of their own responsibility 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 327 Developing and marking out templates for metalwork

UAN:	**D/504/9189**
Level:	3
Credit value:	28
GLH:	91
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 27: Developing and Marking Out Templates for Metalwork (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for developing and marking out templates prior to cutting and/or shaping the material in accordance with approved procedures. The learner will be required to select the appropriate materials and equipment to use based on the information presented to them and the accuracy required to be achieved. The templates produced may be used for marking out, setting of fabrications or pipe arrangements or preparing (setting) heavy plate for rolling. The learner's responsibilities will require them to comply with organisational policy and procedures for the marking out and template making activities, seeking out relevant information and reporting any problems with the equipment, materials or template making 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 the quality and accuracy of the work that they produce. The learner's knowledge will provide a good understanding of their work, and provide an informed approach to template making. The learner will understand the marking out and

template making process and its application, and will know about the equipment, materials and processes to be carried out in sufficient depth to provide a sound basis for carrying out the activities, correcting faults and producing the templates to the required specification.

The learner will understand the safety precautions required when carrying out the template making 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. develop and mark out templates for metalwork
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 use all of the following tools and instruments to mark out directly from drawings onto sheetmetal: a. scriber b. centre punch c. rule or tape d. straight edge e. square f. protractor g. dividers or trammels h. chalk, bluing or paint i. laser (where applicable) 1.5 prepare suitable datum's and marking out surfaces 1.6 mark out using appropriate methods 1.7 mark out plate or pipe setting for two of the following: a. angular setting b. large radius section c. plate setting d. burner template 1.8 mark out templates for six of the following: a. radiused and mitred corners b. concentric cones c. offset cones d. truncated cones e. square/rectangular to round f. fishtail

g. segmented bends (lobsterback)
h. ball corner or spherical section
i. fish plates
j. bed plates
k. gusset plates
l. structural components
m. simple seating (tank cradles)
n. box edges

1.9 mark out material to include all of the following features:
a. datums and centre-lines
b. square and rectangular profiles
c. angles
d. circles and curved profiles
e. cutting detail and allowances
f. bend/fold allowances
g. hole centres and outlining (linear)
h. hole centres and outlining (on pitch circles)

1.10 check that the marking out complies with the specification

1.11 develop templates which meet all the following quality and accuracy standards:
a. template profile complies with drawing or job requirements
b. dimensional accuracy meets drawing/specification
c. suitably marked or labelled to identify purpose
d. marking out uses recognised conventions

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 develop and mark out templates for metalwork
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when working in a fabrication environment with sheet or plate materials (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations) 2.2 describe the personal protective clothing and equipment that needs to be worn when carrying out the fabrication activities (such as leather gloves, eye protection, safety helmets) 2.3 explain the correct methods of moving or lifting sheet or plate materials 2.4 describe the hazards associated with fabrication work and explain how they can be minimised (such as handling sheet/fabricated components; using dangerous or badly maintained tools and equipment) 2.5 explain how to obtain the necessary drawings, template specifications and job instructions 2.6 explain how to use and extract information from engineering drawings and related specifications (to include symbols and

conventions to appropriate British, European or relevant international standards in relation to work undertaken)

2.7 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.8 explain the principles and techniques for marking out templates

2.9 explain the geometrical methods used for developing of complex shapes (such as square to round, lobsterback sections) from sheet metal

2.10 explain how to produce a three dimensional shape from the two dimensional material

2.11 explain the use of marking out conventions (such as datum edges/lines, centre lines)

2.12 describe the preparations that need to be carried out on the material prior to marking out to enhance clarity and accuracy, and safety

2.13 explain the component material characteristics and process considerations that need to be taken into account when marking out templates

2.14 explain why you need allowances for joint and weld preparations for different materials and thicknesses

2.15 explain how to calculate true lengths, bend allowances and circumferences

2.16 describe the effective use and care of tools/instruments

2.17 explain how to mark out and preserve the template for maximum clarity, accuracy and ease of transfer

2.18 describe ways of laying out the shapes/patterns to maximise the use of plate or sheet material

2.19 explain how to setup and adjust the tools, such as squares and protractors

2.20 explain how to transfer information to the underside of the sheet or plate

2.21 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

2.22 explain the need for clear and dimensional accuracy in marking out to specifications/drawings

2.23 describe the problems that can occur in marking out templates and explain how these can be avoided

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

Unit 328 Joining fabricated components using mechanical fasteners

UAN:	**R/504/9190**
Level:	3
Credit value:	21
GLH:	77
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 28: Joining Fabricated Components using Mechanical Fasteners (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
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 is 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 seek out the relevant information and 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 with minimum supervision, taking personal responsibility for their actions and the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to the joining activities carried out. The learner will understand 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 using 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. join fabricated 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: a. correctly prepare the faces of the materials to be joined b. select the appropriate/specified fixings c. correctly align the materials and faces to be joined d. assemble the components in the correct order or manner e. 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: a. riveting using solid rivets b. riveting using pop/blind rivets c. self-tapping screws d. use of proprietary fasteners

e. crimping
f. assembling using bolt fittings
g. using screw fittings to tapped components
h. nuts and (spot welded) screw studs
i. locking methods and devices
j. clinching

1.7 produce assemblies which include six of the following:
a. flat and flanged joints on flat or curved surfaces
b. square/rectangular trunking
c. circular trunking
d. access flanges and cover plates
e. tanks and tank covers
f. joints with gasket or sealant
g. pipes
h. structural components
i. long or critical alignments
j. permanent and temporary assemblies

1.8 join the components in three of the following joining positions, access and environmental conditions:
a. horizontal
b. vertical
c. overhead
d. in workshop conditions
e. 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 is applicable to the application:
a. joints are accurately assembled and aligned in accordance with the specifications
b. joints are secure and firm
c. bolted and screwed joints are tightened to the correct torque
d. riveted joints are free from excessive material deformation and hammer marks
e. pitch of holes meet the specification
f. 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 join fabricated 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 (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations) 2.2 describe the personal protective clothing and equipment that needs to be worn when carrying out the joining activities (such as leather gloves, eye protection, safety helmets) 2.3 describe the hazards associated with the joining operations and explain how they can be minimised (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) 2.4 explain how to obtain the necessary drawings and joining procedure specifications 2.5 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken) 2.6 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.7 explain the use of manufacturers' specifications for the types of fasteners used 2.8 explain the advantages and disadvantages of the different forms and methods of mechanical join 2.9 describe the various joining processes that are used and the tools and equipment that is required 2.10 describe the preparations that need to be carried out on the materials/components prior to joining them (such as, materials to be degreased, dry and clean, with hole and flanges de-burred) 2.11 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) 2.12 explain how to produce a secure joint using blind rivets and the type of riveting tools that are available 2.13 explain how to produce a good solid riveted joint and the use of the various riveting tools 2.14 explain how to determine the length of the rivets required to give a properly formed rivet head 2.15 describe the range of bolts and screwed fasteners that are to be used; explain 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 2.16 describe the various types of proprietary fasteners that are used on fabricated assemblies (such as anchor nuts, clinch nuts, welded studs)

2.17	explain the materials used and their joining characteristics, electrochemical reaction between dissimilar metals and means of reducing the effects, use of gasket material
2.18	describe the checks that need 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)
2.19	describe the equipment setting, operating and care procedures; explain why equipment and tools need to be correctly set up and in good condition
2.20	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
2.21	describe the quality control and test procedures for detection of defects in joints, visual, feel and measurement checks
2.22	describe the problems that can occur with the joining operations and how these can be avoided
2.23	describe the extent of their own responsibility 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 331 Producing fillet welded joints using a manual welding process

UAN:	**Y/504/9191**
Level:	3
Credit value:	76
GLH:	252
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 31: Producing Fillet Welded Joints using a Manual Welding Process (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
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 oxy/fuel 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 Part 1 and EN 9696 Part 1 (for

aluminium).

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, 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, 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: a. Manual Metal Arc b. MIG/MAG c. TIG d. Plasma Arc e. Cored wire f. Oxy/fuel Gas welding 1.7 weld joints according to approved welding procedures in good

access situations in two of the following BS EN ISO 6947 positions:

a. flat (PA)
b. horizontal (PC)
c. horizontal vertical (PB)
d. vertical upwards (PF)
e. vertical downwards (PG)
f. overhead (PE or PD)

1.8 produce fillet welded joints in two of the following forms of material:

a. plate
b. sections
c. pipe/tube
d. sheet
e. other specific form

1.9 use consumables as specified in the welding procedure specification covering either:

two types of electrode from:

a. rutile
b. basic
c. cellulosic
d. nickel alloy
e. stainless steel
f. other electrode type

or

two types of filler wire from different material groups

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

a. achieve a minimum weld quality requirements applicable to fillet welds equivalent to those given in the relevant European/International Standards (such as BS EN ISO 5187 and EN30042/ISO 10042) as required by the application standard or specification
b. 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 (PPE), 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 and explain how they can be minimised (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) 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 the information required from the drawings and welding procedure specifications (interpretation of welding symbols, scope, content and application of the welding procedure specification) to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken 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 the methods used 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 describe 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 responsibility and explain whom they should report to if they have problems that they cannot resolve

Unit 332 Cutting plate and sections using shearing machines

UAN:	**D/504/9192**
Level:	3
Credit value:	28
GLH:	91
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 32: Cutting Plate and Sections using Shearing Machines (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
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 and thickness and the accuracy required to be achieved. Materials to be cut and shaped may include ferrous and non-ferrous 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 machines back stop 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, and 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 with minimum supervision taking personal responsibility for their own actions and the quality and accuracy of the work that they

produce.

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying metal shearing procedures. The learner will understand 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: a. the appropriate equipment/machine is selected for the operation being performed b. the machine guards and safety devices are in position and function correctly c. cutting blades are in a serviceable condition (sharp, free from damage or chips) d. machine settings are suitable for the material thickness and operations to be performed 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: a. guillotines b. 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: a. to markings b. using machine back-stop for multiple cutting 1.7 perform operations that produce straight and accurate cuts which includes all of the following: a. parallel cuts b. square cuts

c. angular cuts

1.8 cut plate, sections or bars for one appropriate material and for two different thicknesses:
   a. mild steel
   b. stainless steel
   c. aluminium
   d. brass or copper
   e. tin plate
   f. other specific materials

1.9 produce cut components which meet all of the following quality and accuracy standards:
   a. dimensional accuracy is within the tolerances specified on the drawing/specification
   b. cut components are free from excessive distortion
   c. cut edges are neat and free from false tool cuts and shearing slivers
   d. angled cuts are within specification 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 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 (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations) 2.2 describe the personal protective clothing and equipment that needs to be worn when carrying out the fabrication activities (such as leather gloves, eye/ear protection, safety helmets) 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 and explain how they can be minimised (such as using dangerous or badly maintained tools and equipment; lifting and handling plate; operating machinery) 2.6 explain how to obtain the necessary drawings and specifications 2.7 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken) 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.9	explain how to interpret marking out conventions (such as cutting lines, centre lines)
2.10	describe the various shearing machine cutting methods and techniques (such as cutting to marking out; using machine back-stops; setting plate at an angle to the machine slides)
2.11	describe the material handling and preparation methods (such as degreasing, de-burring, straightening)
2.12	explain the material cutting characteristics and process considerations that need to be taken into account when shearing plate material
2.13	explain the method of setting and adjusting guillotine blades for the material thickness
2.14	describe the tool and equipment care and control procedures and explain how to recognise when the cutting blades require changing
2.15	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
2.16	explain the safety mechanisms and devices that are on the machine and why they must always be used (machine guards, interlocks, safety operating devices
2.17	describe the problems that can occur when shearing materials and explain how these can be avoided
2.18	describe the inspection techniques that can be applied to check shape and dimensional accuracy are to specification and within acceptable limits
2.19	describe the extent of their own responsibility and explain whom they should report to if they have problems that they cannot resolve
2.20	explain the reporting lines and procedures, line supervision and technical experts

Unit 333 Cutting and shaping materials using portable thermal cutting equipment

UAN:	**H/504/9193**
Level:	3
Credit value:	35
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 33: Cutting and Shaping Materials using Portable Thermal Cutting Equipment (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
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 oxy/fuel gas cutting equipment, plasma cutting equipment and simple portable machines running on tracks. The learner will be required to assemble and set 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 required 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, vertical cuts, overhead cuts, external curved contours, round and square holes and demolition work as is appropriate. This will call for care in selecting the right 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, seeking out relevant information for the thermal cutting activities undertaken and to report any problems with the equipment,

materials, consumables or cutting activities that they cannot personally resolve themselves, or are outside their personal responsibilities, to the relevant authority. The learner will be expected to work with minimum supervision, taking personal responsibility for their own actions and the quality and accuracy of the work that they produce.

The learner's underpinning knowledge will provide a good understanding of their work, and provide an informed approach to applying thermal-cutting procedures. The learner will understand the processes, and will know about the equipment and its application, and 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 and shape materials using portable 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 two of the following thermal cutting methods: a. hand held oxy-fuel gas-cutting equipment b. hand held plasma gas-cutting equipment c. simple portable track driven cutting equipment (electrical or mechanical) 1.3 confirm that the equipment is safe and fit for purpose by carrying out all of the following checks: a. the equipment selected is suitable for the operations to be performed b. regulators, hoses and valves are securely connected and free from leaks and damage c. the correct gas nozzle is fitted to the cutting torch d. that a flash back arrestor is fitted to gas equipment e. appropriate gas pressures are set

f. the correct procedure is used for lighting, adjusting and extinguishing the cutting flame
g. hoses are safely routed and protected at all times
h. gas cylinders are handled and stored safely and correctly

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 perform thermal cutting operations to produce six of the following features:
a. down-hand straight cuts freehand
b. straight cuts track guided
c. vertical cuts
d. overhead cuts
e. square/rectangular shapes
f. irregular shapes
g. angled cuts
h. external curved contours
i. round holes
j. square holes
k. rough cutting (demolition)
l. bevelled edge - weld preparations

1.7 produce thermal cuts in four of the following forms of material (metal of 3mm and above and two different thickness):
a. plate
b. bar
c. rolled sections
d. pipe/tube
e. fabricated sections
f. extrusions

1.8 produce cut profiles for one type of material from the following:
a. mild steel
b. stainless steel
c. special steels
d. other appropriate material

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

1.10 produce thermally cut components which meet all of the following quality and accuracy standards:
a. dimensional accuracy is within the tolerances specified on the drawing/specification or within +/- 1.5mm
b. angled cuts are within specification requirements (perpendicular/angularity)
c. cuts are clean and smooth with minimal drag lines

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 and shape materials using portable 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 (PPE), 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 fabrications and thermal cutting equipment (such as leather aprons and gloves, eye/ear protection, safety helmets) 2.3 explain the correct methods of moving or lifting plate materials and components 2.4 describe the hazards associated with thermal cutting and how they can be minimised (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal, elevated working, enclosed spaces) 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 shut down procedures 2.6 explain how to obtain the necessary drawings and thermal cutting specifications 2.7 explain how to extract information from the engineering drawings and related specifications to include symbols and conventions (to appropriate BS or ISO standards in relation to work undertaken) 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.9 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) 2.10 describe the various types of thermal cutting equipment available and typical applications 2.11 describe the accessories that can be used with hand held thermal cutting equipment to aid cutting operations (such as guides, trammels, templates) and arrangements for attaching cutting aids to the equipment 2.12 explain the gases used in thermal cutting, gas identification and colour codes, their particular characteristics and safety procedures 2.13 explain how to set up the thermal cutting equipment (connection of hoses, regulators and flash back arrestors, selection of cutting torch and nozzle size in relationship to material thickness and operations performed) 2.14 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)

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

2.16 explain how to setup the operating conditions; flame control and the effects of mixtures and pressures associated with thermal cutting

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

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

2.19 explain the material thermal cutting characteristics and material preparation requirements

2.20 explain the terminology used in thermal cutting in relation to the operations being performed

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

2.23 explain the causes of cutting defects, how to recognise them and methods of correction and prevention

2.24 describe the quality requirements of the type of work being undertaken

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

Unit 335 Bending and forming plate using press brakes or bending machines

UAN:	**M/504/9195**
Level:	3
Credit value:	35
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 35: Bending and Forming Plate using Press Brakes or Bending Machines (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
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 select the appropriate bending and forming equipment and set it up for the operations being performed. This will involve setting up appropriate backstops or plate positioning devices, fitting of appropriate bending tools/formers taking account of material thickness and the accuracy required to be achieved. 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. Materials to be bent and formed may include ferrous and non-ferrous, and tasks will include producing bends of various angles, producing box and tray sections, 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, seeking out relevant information 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 with minimum supervision, taking personal responsibility for their own actions and the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying the power pressing procedures required. The learner will understand the processes, and will know about the equipment and its application, the tooling 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 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 press brakes or bending 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: a. press brakes b. powered bending machine c. power press 1.3 confirm that the equipment is safe to use and fit for purpose by carrying out all of the following checks: a. the appropriate machine is selected for the operation being performed b. the machine guards and safety devices are in position and function correctly c. forming tools are appropriate and in a serviceable condition (secure, correct shape, free from damage) d. machine settings are suitable for the material thickness and operations to be performed

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 :
  a. bends at 90 degrees
  b. bends of various angles using various bend radii
  c. set plate ends
  d. box square and rectangular sections
  e. curved plates
1.7 bend and form metal plate of 3mm or more thickness for one appropriate material and two thicknesses:
  a. mild-steel
  b. stainless steel
  c. aluminium
  d. 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:
  a. bend position and dimensional accuracy is within the specification tolerances
  b. the form or sharpness of the bend conforms to best practice and or specification without deformation or cracking
  c. 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 press brakes or bending 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 (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations)
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, and explain how they can be minimised (such as handling heavy sheet materials and components; operating moving equipment; using faulty or badly maintained tools and equipment)
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 use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken)
2.8	explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
2.9	explain the marking out conventions applicable to the bending process (such as centre lines, bending lines)
2.10	describe the various types of power operated bending machines that are used and typical applications
2.11	explain how to prepare and set-up the machine for a range of different bends (angled bends; box sections; plate edge setting; curved 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 machines tool holding device
2.13	explain the ways of limiting distortion, marking and creases in the finished workpiece
2.14	describe the preparations that need 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 explain 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	explain the accuracy and limitations of the processes
2.22	describe the extent of their own responsibility and explain whom they should report to if they have problems that they cannot resolve

Unit 336 Forming platework using power rolling machines

UAN:	**T/504/9196**
Level:	3
Credit value:	35
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 36: Forming Platework using Power Rolling Machines (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
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 select the most appropriate type and size of power rolling machine based on the operations to be performed and the thickness and size of the material to be rolled. Setting up the rolls will involve setting and adjusting the gap between feed and forming rolls to suit plate thickness, positioning side roller and adjusting to suit 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 or direct the rolling operations for their effective use to form the material to the required profile without flats or deformities. The learner will also need ensure that all the required safety devices are operating correctly and that the machine guards are in place and correctly adjusted. Materials to be rolled may include ferrous and non-ferrous and will include operations such as rolling cylinders and cones, producing curved sections, counter curved sections, pipe sections and straightening plate. This will call for care in selecting the right machines

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 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 with minimum supervision, taking personal responsibility for their own actions and the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying the power rolling procedures required. The learner will understand the process and its application, and will know about the equipment and materials in adequate depth to provide a sound basis for setting up the equipment, correcting faults and 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: a. powered rolls hand adjusted b. powered rolls console adjusted c. 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: a. the rolls are appropriate for the material used and operations being performed b. the machine guards and safety devices are in position and

operating correctly
   c. rolls are appropriate for the operation and in a serviceable condition (suitable diameter; free from damage)
   d. roll settings are suitable for the material thickness and operations to be performed
   e. 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 five of the following:
   a. cylinders
   b. cones
   c. segments of a cylindrical tank
   d. curved section or sector of an otherwise flat plate
   e. counter curved sections
   f. pipe sections
   g. flattening or straightening plate

1.7 carry out rolling operations on one type of material from the following:
   a. carbon steel
   b. stainless steel
   c. aluminium
   d. 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:
   a. dimensional accuracy is within the specification tolerances
   b. the rolled section conforms to best practice and or specification without deformation or cracking
   c. 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 (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations) 2.2 explain what checks need to be carried out to ensure that the power rolls are safe and in a fit condition to use 2.3 describe the personal protective clothing and equipment that

needs to be worn when working with heavy platework (such as gloves, eye/ear protection, safety helmets)

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 and explain how they can be minimised, such as handling sheet/fabricated components, using hot metal techniques, using dangerous or badly maintained tools and equipment, moving parts of power rolling machines

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

2.7 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken)

2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.9 explain the marking out conventions used in platework and how to recognise the bending, forming and cutting lines

2.10 explain the basic principle of operation of the power rolling machine used and the type of work it can perform

2.11 explain how to select an appropriate machine for the operations to be performed (roll size; power of machine)

2.12 explain how to set up the machine to produce the required form (cylinders, cones, curved sections, straightening plates)

2.13 describe the techniques of rolling (including pre-setting plate edges, adjusting pressure throughout the rolling operations, checking component for parallelism or form throughout the operations)

2.14 explain how to release the rolls and remove the workpiece when rolling cylindrical and conical sections

2.15 explain the ways of limiting distortion, marking, creases and flats in curved sections

2.16 explain how the materials need to be prepared prior to rolling, and the effects of raw material scale or burrs on the finished article

2.17 explain the material characteristics with regard to forming using rolling machines

2.18 describe the care and maintenance procedures that need to be observed to ensure the machines are in a serviceable condition

2.19 describe the problems that can occur with the rolling activities, and how they can be avoided

2.20 describe the organisational quality control procedures and how to recognise rolling defects

2.21 describe the inspection checks that need to be carried out and the tools and equipment that are used

2.22 describe the accuracy that can be achieved by rolling and explain the limitations of the rolling processes

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

Unit 337 Producing and finishing holes using drilling machines

UAN:	**A/504/9197**
Level:	3
Credit value:	14
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 37: Producing and Finishing Holes using Drilling Machines (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce holes using drilling machines in sheet, plate, rolled section or pipe 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 workpiece 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 accurately position the drill bits 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, counter-bored 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 with minimum supervision, taking personal

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

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying the drilling and finishing procedures. The learner will understand 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 and finish 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: a. hand held drilling machine b. pillar/bench drill c. radial arm drill d. other types of clamped drill (such as magnetic, vacuum) 1.3 use two of the following workholding devices: a. jigs/fixtures b. machine vice c. clamps d. other types of clamps (such as magnetic, vacuum) 1.4 ensure that the equipment is fit for purpose and used safely by carrying out all of the following: a. selecting the appropriate drilling equipment/machine for the operation being performed b. checking the machine guards and safety devices are in position and function correctly c. checking drill bits and cutting tools are in a serviceable condition (free from damage or chips; sharp)

d. isolating the equipment from its power supply whilst changing drill bits
e. securely clamping/restraining the components during the drilling operations
f. 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 five of the following drilling and finishing operations:
a. drilling through holes
b. drilling holes to a depth
c. counter-boring holes
d. countersinking holes
e. reaming holes
f. tapered reaming
g. centre drilling
h. spot facing
i. trepanning holes
j. tapping holes
k. jig or template drilling
l. component alignment drilling

1.8 produce drilled holes in three of the following material types:
a. ferrous sheet metal
b. stainless steel sheet metal
c. non-ferrous sheet metal
d. ferrous plate or components
e. stainless steel plate or components
f. non-ferrous plate or components
g. non-metallic materials
h. composite materials

1.9 produce components to the required quality and within the specified dimensional accuracy which meet all of the following as is applicable to the process:
a. dimensional and positional accuracy is within specification tolerances
b. drilled holes are correctly formed and free from excessive tool marks
c. reamed holes are of the correct fit and have a smooth surface finish free from tool marks
d. tapped holes are of the correct type, threads are correctly formed and have a good fit
e. counter-bores, 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 and finish 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 fabricating (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations) 2.2 describe the personal protective clothing and equipment that needs to be worn when carrying out the fabrication activities (such as leather gloves, eye/ear protection, safety helmets) 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 and explain how they can be minimised (such as using dangerous or badly maintained tools and equipment; insecure or poorly clamped workpieces; airborne metal particles; sharp edges and splinters) 2.6 explain how to obtain the necessary drawings, specifications and work instructions 2.7 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken) 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.9 explain how to interpret marking out conventions (such as cutting lines, centre lines) 2.10 describe the various types and application of drilling machines (including portable power tools, bench and pedestal machines and radial arm machines) 2.11 describe the range of drilling and hole finishing tools available (including twist drills, reamers, counter-bore tools, countersink tools, spot facing tools, taps) and how to check their serviceability 2.12 explain the methods of holding and securing the drills and finishing tools into the machine spindle (chucks, taper shank sleeves, collet chucks) 2.13 explain the methods of holding and securing workpieces for drilling (including jigs and fixtures, machine vices, clamps and restraining devices) 2.14 describe the methods used to align the drill with the workpiece and the use of centre drills and pilot drills 2.15 explain how to check that the drill hole is in the correct position before drilling to the full diameter, and 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, reaming and tapping of holes 2.18 explain how to set and adjust the tools and equipment such as the

	use of depth stops
2.19	explain the material characteristics and process considerations that need 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 problems that can occur with drilling operations, and explain how these can be avoided
2.23	describe the inspection techniques that can be applied to check the dimensional accuracy and finish is to specification and within acceptable limits
2.24	describe the extent of their own responsibility 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 338 Producing platework assemblies

UAN:	**F/504/9198**
Level:	3
Credit value:	35
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 38: Producing Platework Assemblies (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce holes using drilling machines in sheet, plate, rolled section or pipe 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 workpiece 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 accurately position the drill bits 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, counter-bored 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 with minimum supervision, taking personal responsibility for their own actions and the

quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying the drilling and finishing procedures. The learner will understand 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 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: a. correctly prepare and set-up the components and faces to be joined b. use the correct datum faces c. use the specified or appropriate fixing method d. correctly align the components and faces to be joined e. assemble/fabricate the platework components in the correct order or manner f. 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: a. plates or covers b. pre-fabricated square/rectangular components c. pre-fabricated cylindrical/conical components

d. brackets
e. flanges
f. pipes
g. 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:
a. temporary tack welding
b. riveting (hot or cold)
c. flanged and mechanically fastened (nuts and bolts)
d. adhesive bonding

1.8 secure the components using the specified connectors and securing devices

1.9 produce five of the following platework assemblies:
a. frames
b. tanks
c. covers and side plates
d. square, rectangular and box sections
e. cylindrical
f. conical
g. reduction pieces
h. transformers
i. segmented bends
j. steel and composite material assemblies
k. 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:
a. all components are correctly assembled and aligned in accordance with the specification
b. overall dimensions are within specification tolerances
c. assemblies meet appropriate geometric tolerances (square, straight, angles free from twists)
d. where appropriate, pitch of erection holes meet specification requirements
e. 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 (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations)

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

2.3 explain the safe working practices and procedures needed 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 and explain how they can be minimised (such using dangerous or badly maintained tools and equipment; lifting and handling long and heavy components; cuts, slips trips and falls)

2.6 explain how to obtain the necessary drawings and joining specifications

2.7 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken)

2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.9 explain how to interpret marking out conventions (such as cutting lines, centre lines)

2.10 describe the preparations that need to be carried out on the components prior to assembling them

2.11 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)

2.12 explain how to set up and align the various components and the tools and equipment that is used

2.13 explain the methods of temporarily holding the joints together to aid the assembly activities (clamps, rivet clamps, jacks and wedges)

2.14 explain the use and care of tools and equipment, and control procedures

2.15 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

2.16 describe the problems that can occur when producing platework assemblies, and explain how these can be avoided

2.17 describe the inspection techniques that can be applied to check shape (including straightness) and dimensional accuracy is to specification and within acceptable limits

2.18 describe the extent of their own responsibility 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 339 Slinging, lifting and moving materials and components

UAN:	**J/504/9199**
Level:	3
Credit value:	14
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 39: Slinging, Lifting and Moving Materials and Components (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competencies 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 (SWL) or working load limit (WLL). They 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 be able 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 the safety and integrity of the materials being moved.

The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying slinging, signalling and lifting procedures. The learner will understand 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 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 in a safe and usable condition by checking all of the following: a. equipment is certified and is compliant, within current test dates b. all lifting equipment registers are up to date c. all slings are free from obvious defects d. the lifting equipment selected is suitable and has a sufficient SWL/WLL for the application e. the identification number and SWL/WLL are clearly marked on the equipment selected f. 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 is applicable: a. check against documentation b. calculation from drawings c. by estimation d. by converting metric-imperial 1.4 calculate loads in three of the following sheave block combinations: a. single

b. two singles
c. a double and single
d. two doubles

1.5 use two of the following lifting and moving methods and technique:
a. crane
b. winch
c. powered lifting equipment
d. lifting appliances
e. pulling appliances
f. multi sheaved block combinations
g. hand operated lifting equipment
h. jacks, skates and trolleys

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

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

1.8 use two of the following slinging methods:
a. single leg slings
b. two-leg slings
c. three-and-four leg slings

1.9 confirm that the load is secure before moving

1.10 move the load over the selected, suitable route

1.11 move two of the following types of loads:
a. sheet materials
b. pipes, bars, joists (single and in bundles)
c. fragile
d. hot/radiant
e. components with evenly distributed weight
f. components with unevenly distributed weight
g. awkward shaped
h. corrosive/chemical

1.12 move loads safely and correctly that are re-positioned in two of the following positions:
a. to differing elevations
b. as part of an assembly
c. through complex rigging operations
d. along the same elevation
e. turn a load

1.13 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 (PPE), protecting other workers during the lifting operations; accident procedure; statutory regulations, risk

assessment procedures and COSHH regulations)

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 and lifting equipment regulations (loler) also BS 7121

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 that is to be used for the lifting operations (such as hand and power operated cranes, winches pulling equipment)

2.6 describe the lifting equipment accessories that are 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 problems that they should look for

2.8 explain how to carry out in-service inspections of the equipment and explain 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 describe 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 calculate loads on winches/lead ropes on multi-sheaved rigs

2.12 explain how to identify the included angle when using multi-leg slings

2.13 explain how to check that the lifting equipment is capable of lifting the load to be moved

2.14 explain how to determine the centre of gravity of the load and determine suitable slinging and lifting points

2.15 explain how to plan and prepare a route for moving loads and the areas that they will need to take into account

2.16 explain the specific requirements in their organisation for the use of lifting equipment and lifting operations

2.17 explain the signalling techniques used to communicate with crane drivers to include both hand signals and verbal commands

2.18 explain how lifting equipment should be stored, handled and maintained

2.19 explain the problems that can occur when moving loads and how these can be avoided

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

Unit 366 Operating CNC fabrication equipment

UAN:	**D/504/9211**
Level:	3
Credit value:	40
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 66: Operating CNC Fabrication Equipment (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to operate computer numerically controlled (CNC) fabrication machines, such as shearing machines, gas, laser, plasma or water jet cutting, punching, bending and forming machines, in accordance with approved procedures. The learner will be expected to take charge of the prepared machine and to 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 operating program, dealing with any error messages, and executing the program activities safely and correctly. The learner will be required to monitor the cutting or forming operations continuously, making any necessary adjustments to machine parameters in line with the learner's 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 CNC activities undertaken, and to report any problems with the equipment, tooling, program, 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 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 underpinning knowledge will be sufficient to provide a good understanding of their work, and will enable them to adopt an informed approach to applying CNC fabrication procedures. They will have an understanding of the CNC machining process used, and its application, and will know about the machine, tooling, materials, machining activities and consumables, in adequate depth to provide a sound background to machine 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 with its associated tools and equipment. They 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. operate CNC fabrication 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 ensure that the machine is ready for operation, by carrying out all of the following: a. checking that the correct operating program is loaded and is at the correct start point b. ensuring that machine guards are in place and correctly adjusted c. positioning and securing material/components without damage and distortion d. checking that cutting tools/tooling are in a suitable condition e. setting plate/section datum's and positioning the machine f. update the program tool data, as applicable g. ensuring that start-up procedures are observed h. adjusting machine settings as required to maintain accuracy 1.3 confirm that the equipment is set up and ready for operation

1.4 follow the defined procedures for starting and running the operating system

1.5 operate one of the following CNC fabrication machines:
- a. shearing machine
- b. punching machine
- c. forming machine
- d. bending machine
- e. plasma cutting
- f. laser cutting
- g. gas cutting
- h. water jet cutting

1.6 position and secure the workpiece, using two of the following holding methods/device:
- a. jigs and fixtures
- b. clamps and stops
- c. pneumatic clamps
- d. other workholding devices

1.7 produce components which combine several different operations, which cover five of the following:
- a. straight cuts
- b. square/rectangular profiles
- c. curved profiles
- d. internal profiles
- e. angular profiles
- f. holes linearly pitched
- g. holes radially pitched
- h. louvers
- i. swages
- j. bends at 90 degrees
- k. bends of various angles
- l. multi-bend platework
- m. curved plates
- n. slots and apertures
- o. circles/ellipses
- p. other specific features

1.8 produce components using one of the following types of material:
- a. ferrous
- b. non-ferrous
- c. stainless steel
- d. special alloys
- e. other appropriate material

1.9 carry out the necessary checks during production for accuracy of four of the following:
- a. linear dimensions
- b. vertical dimensions
- c. position of features
- d. accuracy of hole/slot dimensions
- e. accuracy of profiles
- f. flatness/freedom from excessive distortion
- g. accuracy of louvers and swages

1.10 produce components which meet all of the following standards:

a. dimensional accuracy is within the tolerances
b. components conforms to the required shape/geometry or profile
c. components are free from deformity, burrs and sharp edges

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

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

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

Learning outcome
The learner will: 2. know how to operate CNC fabrication equipment
Assessment criteria
The learner can: 2.1 describe the specific safety precautions to be taken when operating CNC fabrication machines and equipment 2.2 describe the safety mechanisms on the machine, and the procedures for checking that they are operating correctly 2.3 describe the hazards associated with working on CNC cutting and forming machines (such as moving machinery, automatic machine operation, handling of tooling/cutting media, lifting and handling workholding devices, handling materials) and how they can be minimised 2.4 explain how to start and stop the machine in both normal and emergency situations 2.5 describe the importance of wearing the appropriate protective clothing and equipment (PPE), and of keeping the work area clean and tidy 2.6 describe the application of the CNC machine, and the range of operations it can perform 2.7 explain where to obtain component drawings, specifications and/or job instructions required for the components being machined 2.8 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken) 2.9 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.10 explain how to interpret the visual display and the various messages displayed 2.11 describe the function of error messages, and what to do when an error message is displayed 2.12 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program 2.13 explain the operation of the various hand and automatic modes of machine control (such as program operating and control buttons) 2.14 explain how to operate the machine using manual operation, single block run, full program run and feed/speed override controls

2.15	explain how to make adjustments to the program operating parameters
2.16	explain how to set and secure the workpiece to the machine; the effects of clamping the workpiece; and how material shaping/removal can cause warping/distortion of the finished workpiece
2.17	describe the problems that can occur with the cutting/forming activities, and how to prevent them
2.18	describe the quality control procedures used, inspection checks that need to be carried out and the equipment to be used
2.19	describe the extent of your own responsibility and whom you should report to if you have problems you cannot resolve

Appendix 1 Relationships to other qualifications

Links to other qualifications

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

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

This qualification has connections to the:

- Level 3 NVQ Diploma in Fabrication and Welding (1781-30-36)
- Level 2 NVQ Diploma in Fabrication and Welding (1782-20)
- Level 3 NVQ Extended Diploma in Fabrication and Welding (1782-60)

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 (from September 2010).

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
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for GOLA/e-volve assessments.

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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, GOLA/e-volve, 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

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).

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City & Guilds
1 Giltspur Street
London EC1A 9DD
T +44 (0)844 543 0000
F +44 (0)20 7294 2413
www.cityandguilds.com