ETCAL Level 2 NVQ Diploma in Fabrication and Welding Engineering 601/1820/9
Assessment

Diploma - Assessment Principles

Introduction

ETA qualifications are developed in conjunction with the industries and employers they service. They are designed to add value and deliver multidimensional outputs that provide impact for both learners and employers.

It is therefore important that the assessment requirements of ETA qualifications are robust whilst not containing unnecessary and over-burdensome challenges that detract from the intended outcomes and impact. These assessment principles are prepared with that in mind and are applicable to this qualification:

Level 2 NVQ Diploma in Fabrication and Welding Engineering

Principles

There are four key principles to underpin assessment delivery:

1. Assessment should contribute to developing a learner's knowledge and/or skills and provide relevant and current development as the related industry requires.

2. Systems for capturing evidence of competence should be integrated and efficient. Assessment practices for both competence-based and knowledge-based aspects of qualifications should, where possible, be integrated with industry driven standards and requirements.

3. Assessment methods must be appropriate for the level and nature of the qualification units to be assessed. Methods of assessing achievement against learning outcomes and assessment principles must be accommodating and flexible, whilst remaining appropriate for both the level being assessed and industry expectations of learners at that level.

4. Evidence of knowledge and understanding must be recorded and be clearly attributable to the learner. This can be delivered using task based activity with questions and answer sessions, supported by assessor observation.

The choice and application of assessment methods must be consistent with these principles and will generally include:

- Direct Observation
- Written evidence (portfolio/workbook)
- Centre set assignment
- Centre set coursework
- Oral examination
- Professional/open discussion

Delivery Team Requirements

Tutors / Assessors

- Tutors / Assessors should have a detailed knowledge of, and be competent in, the occupational requirements of the units
- Tutors / Assessors should hold or be working towards the related professional qualifications for delivery and assessment as required
- This competence will have been acquired either in direct employment in the occupational role to which the unit relates, or in employment as a manager, supervisor or in-house trainer of employees carrying out the role
- It is unlikely that occupational competence will have been achieved in less than twelve months of employment but individuals with less experience could be considered as assessors if sufficiently occupationally competent

Internal Quality Assurers (IQAs)

- IQAs must have a thorough understanding of the structure, content and occupational requirements of the units that they are internally quality assuring. This understanding will have been acquired while either working directly within or delivering within the relevant occupational area in either an operational or a support function
- The level of understanding must be sufficient to allow the IQA to judge whether the assessor has fully assessed learners against all the principles within the unit
- It is unlikely that a person could have gained this level of understanding in less than twelve months of being employed but individuals with less experience could be considered as IQAs if they have the required level of experience, knowledge and understanding.

Technical / Expert Witness

Expert witnesses can be drawn from a wide range of people who can observe, 'measure and examine performance against the industry and qualification principles. These can include line managers and experienced individuals within a related sector-based organisation. The Technical Expert Witnesses should have proven practical experience and knowledge relating to the content of the principles being assessed.

It is unlikely that someone could become an expert in their entire job role in less than twelve months of being employed in their industry. They could, however, very quickly become an expert in the content of a single unit if this was the focus of their job role. The assessor should make a

judgement as to the level of expertise held by a potential Technical Expert Witness and, where necessary, this should be confirmed with the awarding organisation.

Assessment Materials

ETC Awards Ltd. (ETA) Assessment Materials are protected by copyright and are supplied only to Approved Centres for use solely for the purpose of the assessment of ETA learners.

Instructions for Conducting Assessment

the Approved Centre must either:

- secure approval of in-house assessment material by ETA's External Quality Assurance team prior to use
- use ETA Assessment Materials
- we recognise that reasonable adjustments may be considered at the time of assessment, please refer to the ETA Reasonable adjustments and considerations policy

All approved centres must then handle and store securely all Assessment Materials in accordance with the following:

- Assessment Material must be accessible to learners only during their programme
- The Approved Centre must not make public in any format the contents of any materials either in part or in full.
- Materials must be securely handled and under no circumstances shared with third party organisations or individuals
- The Approved Centre must seek permission from ETA through the External Quality Assurance team if they want to convert Material for alternative storage, retrieval and delivery in electronic formats.

All centre based assessment material must be agreed with ETA prior to use and will be subject to robust monitored during sampling and verification activity.

Mandatory Units

Complying with Statutory Regulations and Organisational Safety Requirements 7
Using and Interpreting Engineering Data and Documentation 13
Carrying Out Engineering Activities Efficiently and Effectively 19

Optional Units

Joining Materials by the Manual Metal Arc Welding Process 26
Joining Materials by Manual MIG/MAG and other Continuous Wire Welding Processes 32
Joining materials by Manual TIG and Plasma-arc Welding Processes 38
Joining Materials by the Manual Gas Welding Process 44
Producing Fillet Welded Joints using a Manual Welding Process 50
Welding Materials with Mechanised Arc Welding Equipment 56
Welding Materials using Resistance Spot, Seam and Projection Welding Machines 62
Welding Materials using Laser Welding Machines 68
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Joining Rails using the Aluminothermic Welding Process 87
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Joining Materials using Plastics Welding Machines 122
Marking Out Components for Fabrication 128
Cutting Sheet Metal to Shape using Hand and Machine Tools 134
Forming Sheet Metal using Hand and Machine tools 140
Producing Sheet Metal Assemblies 146

Heat Treating Materials for Fabrication Activities 152
Cutting and Shaping Materials using CNC Laser Profiling Machines 158
Cutting and Shaping using CNC Plasma or Gas Cutting Machines 164
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Slinging, Lifting and Moving Materials and Components 189
Cutting Plate and Sections using Shearing Machines 195
Cutting Materials using Hand Operated Thermal Cutting Equipment 201
Cutting and Shaping Materials using Gas Cutting Machines 208
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Bending and Forming Plate using Power Operated Machines 219
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Forming of Structural Sections using Machines 244
Producing Structural Steel Ancillary Components 250
Assembling Structural Steelwork 255
Forming Pipework by Machine Bending 261
Produce Socket and Flange Fillet Welded Joints in Pipe using A Manual Welding Process 267
Cutting and Shaping Materials using CNC Water Jet Cutting Machines 273

Level 2 Unit – Complying with Statutory Regulations and Organisational Safety Requirements

Unit 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.

Unit introduction

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.

Assessment

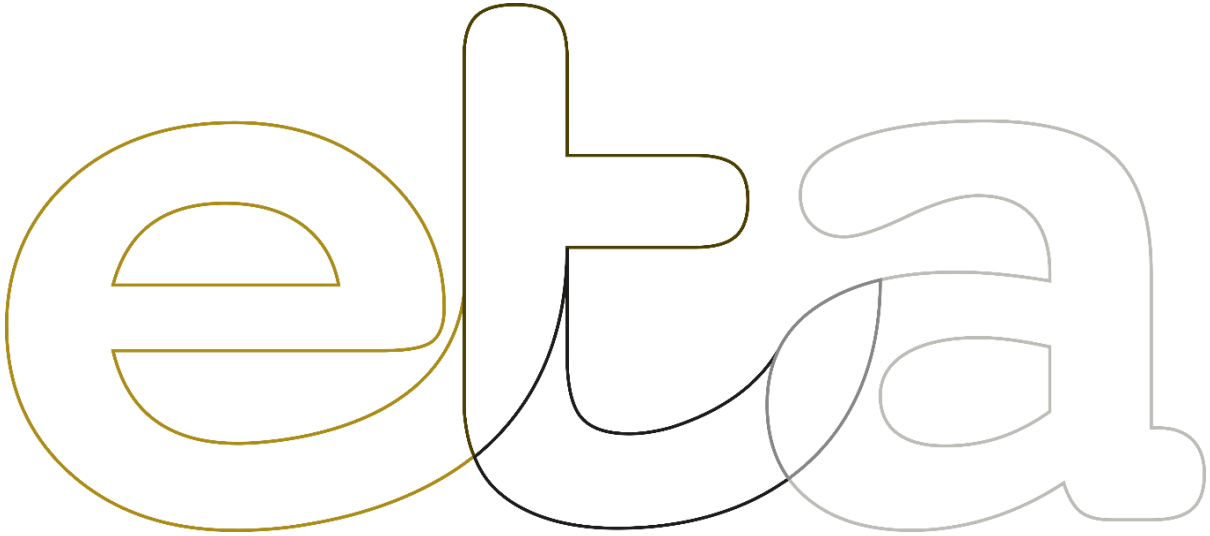
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		A/601/5013
Qualification Framework		RQF
Title		Complying with statutory regulations and organisational safety requirements
Unit Level		Level 2
Guided Learning Hours		35
Unit Credit Value		5
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Complying with statutory regulations and organisational safety requirements	1.1	Comply with their duties and obligations as defined in the Health and Safety at Work Act	
		1.2	Demonstrate their understanding of their duties and obligations to health and safety by: • applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act • identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as: • eye protection and personal protective equipment (PPE) • COSHH regulations • Risk assessments • identifying the warning signs and labels of the main groups of hazardous or dangerous substances • complying with the appropriate statutory regulations at all times	
		1.3	Present themselves in the workplace suitably prepared for the activities to be undertaken	
		1.4	Follow organisational accident and emergency procedures	
		1.5	Comply with emergency requirements, to include: • identifying the appropriate qualified first aiders and the location of first aid facilities • identifying the procedures to be followed in the event of injury to themselves or others	

			• following organisational procedures in the event of fire and the evacuation of premises • identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment	
		1.6	Recognise and control hazards in the workplace	
		1.7	Identify the hazards and risks that are associated with the following: • their working environment • the equipment that they use • materials and substances (where appropriate) that they use • working practices that do not follow laid down procedures	
		1.8	Use correct manual lifting and carrying techniques	
		1.9	Demonstrate one of the following methods of manual lifting and carrying: • lifting alone • with assistance of others • with mechanical assistance	
		1.10	Apply safe working practices and procedures to include: • maintaining a tidy workplace, with exits and gangways free from obstruction • using equipment safely and only for the purpose intended • observing organisational safety rules, signs and hazard warnings • taking measures to protect others from any harm resulting from the work that they are carrying out	
2.	Know how to comply with statutory regulations and organisational safety requirements	2.01	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)	
		2.02	Describe the specific regulations and safe working practices and procedures that apply to their work activities	
		2.03	Describe the warning signs for the seven main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations	
		2.04	Explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed	
		2.05	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)	
		2.06	Describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace	
		2.07	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)	
		2.08	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)	
		2.09	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	
		1.14	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	



Level 2 Unit – Using and Interpreting Engineering Data and Documentation

Unit 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.

Unit introduction

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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

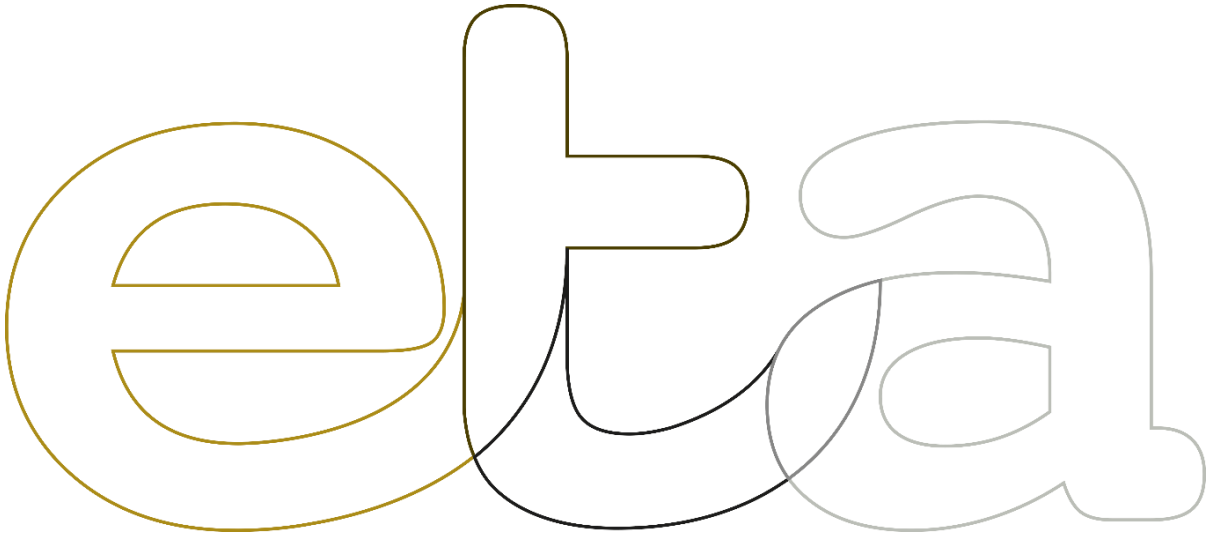
Unit Reference Number		Y/601/5012
Qualification Framework		RQF
Title		Using and interpreting engineering data and documentation
Unit Level		Level 2
Guided Learning Hours		25
Unit Credit Value		5
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Using and interpreting engineering data and documentation	1.1	Use the approved source to obtain the required data and documentation	
		1.2	Use the data and documentation and carry out **all** of the following: • check the currency and validity of the data and documentation used • exercise care and control over the documents at all times • correctly extract all necessary data in order to carry out the required tasks • seek out additional information where there are gaps or deficiencies in the information obtained • deal with or report any problems found with the data and documentation • make valid decisions based on the evaluation of the engineering information extracted from the documents • return all documents to the approved location on completion of the work • complete all necessary work-related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation	
		1.3	Correctly identify, interpret and extract the required information	
		1.4	Extract information that includes **three** of the following: • materials or components required • dimensions • tolerances • build quality • installation requirements • customer requirements • time scales	

			• financial information • operating parameters • surface texture requirements • location/orientation of parts • process or treatments required • dismantling/assembly sequence • inspection/testing requirements • number/volumes required • repair/service methods • method of manufacture • weld type and size • operations required • connections to be made • surface finish required • shape or profiles • fault finding procedures • safety/risk factors • environmental controls • specific data (such as component data, maintenance data, electrical data, fluid data) • resources (such as tools, equipment, personnel) • utility supply details (such as electricity, water, gas, air) • location of services, including standby and emergency backup systems • circuit characteristics (such as pressure, flow, current, voltage, speed) • protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment) • other specific related information	
		1.05	Use the information obtained to ensure that work output meets the specification	
		1.06	Use information extracted from documents to include **one** from the following: • drawings (such as component drawings, assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings) • diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit diagrams) • manufacturers manuals/drawings • approved sketches • technical illustrations • photographic representations • visual display screen information	

			• technical sales/marketing documentation • contractual documentation • other specific drawings/documents	
		1.07	Use information extracted from related documentation, to include **two** from the following: • instructions (such as job instructions, drawing instructions, manufacturers instructions) • specifications (such as material, finish, process, contractual, calibration) • reference materials (such as manuals, tables, charts, guides, notes) • schedules • operation sheets • service/test information • planning documentation • quality control documents • company specific technical instructions • national, international and organisational standards • health and safety standards relating to the activity (such as COSHH) • other specific related documentation	
		1.08	Deal promptly and effectively with any problems within their control and report those which cannot be solved	
		1.09	Report any inaccuracies or discrepancies in documentation and specifications	
2.0	Know how to use and interpret engineering data and documentation	2.01	Know how to use and interpret engineering data and documentation	
		2.02	Explain how documents are obtained, and how to check that they are current and valid	
		2.03	Explain the basic principles of confidentiality (including what information should be available and to whom)	
		2.04	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)	
		2.05	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	
		2.06	Describe the importance of differentiating fact from opinion when reviewing data and documentation	
		2.07	Describe the importance of analysing all available data and documentation before decisions are made	
		2.08	Describe the different ways of storing and organising data and documentation to ensure	

			easy access	
		2.09	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	
		1.14	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	



Level 2 Unit – Carrying out engineering activities efficiently and effectively

Unit 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.

Unit introduction

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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		Y/601/5052
Qualification Framework		RQF
Title		Carrying out engineering activities efficiently and effectively
Unit Level		Level 2
Guided Learning Hours		25
Unit Credit Value		5
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Carrying out engineering activities efficiently and effectively	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Prepare the work area to carry out the engineering activity	
		1.3	Prepare to carry out the engineering activity, taking into consideration **all** of the following, as applicable to the work to be undertaken: • the work area is free from hazards and suitably prepared for the activities to be undertaken • any required safety procedures are implemented • any necessary personal protection equipment is obtained and is in a usable condition • tools and equipment required are obtained and checked that they are in a safe and useable condition • all necessary drawings, specifications and associated documentation is obtained • job instructions are obtained and understood • the correct materials or components are obtained • storage arrangements for work are appropriate • appropriate authorisation to carry out the work is obtained	
		1.4	Check that there are sufficient supplies of materials and/or consumables and that they meet work requirements	
		1.5	Ensure completed products or resources are stored in the appropriate location on completion of the activities	

		1.6	Complete work activities, to include **all** of the following: • returning tools and equipment • returning drawings and work instructions • completing all necessary documentation accurately and legibly • identifying, where appropriate, any unusable tools, equipment and components • arranging for the safe disposal of waste materials	
		1.7	Tidy up the work area on completion of the engineering activity	
		1.8	Deal promptly and effectively with problems within their control and report those that cannot be resolved	
		1.9	Deal with problems affecting the engineering process, to include **two** of the following: • materials • tools and equipment • drawings • job specification • quality • people • timescales • safety • activities or procedures	
		1.10	Contribute to organisational procedures for identifying opportunities for improvement to **one** of the following: • working practices • working methods • quality • safety • tools and equipment • supplier relationships • internal communication • customer service • training and development • teamwork • other	

		1.11	Maintain effective working relationships with colleagues to include **two** of the following: • colleagues within their own working group • people outside their normal working group • line management • external contacts	
		1.12	Review personal training and development as appropriate to the job role	
		1.13	Review personal development objectives and targets to include **one** of the following: • dual or multi-skilling • training on new equipment/technology • increased responsibility • understanding of company working practices, procedures, plans and policies • other specific requirements	
2.	Know how to carry out engineering activities efficiently and effectively	2.01	Describe the safe working practices and procedures to be followed whilst preparing and tidying up their work environment	
		2.02	Describe the correct use of any equipment to protect the health and safety of themselves and their colleagues	
		2.03	Describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity	
		2.04	Describe the action that should be taken if documentation received is incomplete and/or incorrect	
		2.05	Describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity	
		2.06	Describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity	
		2.07	Describe the action that should be taken if tools and equipment are not in full working order	
		2.08	Describe the checks to be carried out to ensure that all required materials are correct and complete, prior to undertaking the activity	
		2.09	Describe the action that should be taken if materials do not meet the requirements of the activity	
		2.10	Explain whom to inform when the work activity has been completed	
		2.11	Describe the information and/or documentation that others will require to confirm that the activity has been completed	
		2.12	Explain what materials, equipment and tools can be re-used	
		2.13	Explain how any waste materials and/or products are transferred, stored and disposed of	
		2.14	Explain where tools and equipment should be stored and located	
		2.15	Describe the procedures for dealing with and reporting any problems that can affect working	

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

Level 2 Unit – Joining Materials by the Manual Metal Arc Welding Process

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to prepare and operate manual metal arc welding (MMA) equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the work holding equipment and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that all the leads/cables, electrode holder and workpiece earthing arrangements are securely connected and free from damage. In preparing to weld, the learner will need to set and adjust the welding conditions in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly and make any necessary adjustments to settings in line with their permitted authority, in order to produce the welded joints to the required specification.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		T/504/9232
Qualification Framework		RQF
Title		Joining Materials by the Manual Metal Arc Welding Process
Unit Level		Level 2
Guided Learning Hours		196
Unit Credit Value		54
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Materials by the Manual Metal Arc Welding Process	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	Set up, check, adjust and use manual metal arc welding and related equipment, to include either: • alternating current (AC) equipment • direct current (DC) equipment	
		1.6	Make the joints as specified using the appropriate thermal joining technique	
		1.7	Produce welded joints which incorporate both: • Fillet welds • Butt welds	
		1.8	Weld joints according to approved welding procedures, in good access situations in two of the following BS EN ISO 6947 positions: • Flat (PA) • Horizontal vertical (PB) • Horizontal (PC) • Vertical upwards (PF) • Vertical downwards (PG)	
		1.9	Use two types of electrode from the following, including two different sizes of each chosen type: • rutile • basic	

			• nickel alloy • cellulosic • stainless steel • other electrodes	
		1.10	Produce joints in one form of specified material from the following: • plate • section • pipe/tube • other forms	
		1.11	Produce joints of the required quality and of specified dimensional accuracy which: • achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (such as BS EN ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification • meet and verify the required dimensional accuracy within specified tolerances	
		1.12	Shut down the equipment to a safe condition on completion of joining activities	
		1.13	Deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures	
		1.14	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Join Materials by the Manual Metal Arc Welding Process	2.1	Explain the safe working practices and procedures to be observed when working with MMA welding equipment (general workshop and site safety; appropriate personal protective equipment (PPE); fire prevention; protecting other workers from stray arcs; safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with MMA welding (live electrical components; poor earthing; the electric arc; fumes and gases; spatter; hot slag and metal; grinding and mechanical metal/slag removal; elevated working; enclosed spaces; slips, trips and falls), and how they can be minimised	
		2.3	Describe the manual metal arc welding process (basic principles of fusion welding, AC and DC power sources, ancillary equipment; care of equipment; consumables; power ranges)	
		2.4	Describe the types of electrodes; correct control, storage and drying of electrodes	
		2.5	Describe the types of welded joints to be produced (fillet and butt welds, single and multi-run welds, joints in pipe, plate and sections, welding positions)	
		2.6	Describe how to set up and restrain the joint (the use of jigs and fixtures, manipulators and positioners, restraining devices, tack welding size and spacing in relationship to material thickness)	
		2.7	Describe the checks to be made prior to welding (confirming correct set-up of joint and cleanliness of materials; condition of electrical connections, power return and earthing	

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

Level 2 Unit – Joining Materials by the Semi-automatic MIG/MAG and Flux Cored Arc Processes

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to prepare and operate semi-automatic MIG, MAG or Flux cored-wire arc welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the work holding equipment and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that all the leads/cables, shielding gas system, hoses and wire feed mechanisms are securely connected and free from damage. In preparing to weld, the learner will need to set and adjust the welding conditions, in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly and make any necessary adjustments to settings, in line with their permitted authority, in order to produce the welded joints to the required specification.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/504/9234
Qualification Framework		RQF
Title		Joining Materials by the Semi-automatic MIG/MAG and Flux Cored Arc Processes
Unit Level		Level 2
Guided Learning Hours		196
Unit Credit Value		54
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Materials by the Semi-automatic MIG/MAG and Flux Cored Arc Processes	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	Set up, check, adjust and use welding and related equipment for one of the following welding processes: • MIG • MAG • Flux cored wire arc	
		1.6	Make the joints as specified using the appropriate thermal joining technique	
		1.7	Produce welded joints which incorporates both: • Fillet welds • Butt welds	
		1.8	Weld joints according to approved welding procedures, in good access situations, in two of the following BS EN ISO 6947 positions: • Flat (PA): • Horizontal vertical (PB) • Horizontal (PC) • Vertical upwards (PF) • Vertical downwards (PG)	
		1.9	Use consumables appropriate to the material and application, to include both of the following: • two wire types from different material groups • two different shielding gases (where applicable)	

		1.10	Produce joints in one form of specified material from the following: • plate • section • pipe/tube • sheet (<3mm) • other specific forms	
		1.11	Produce joints of the required quality and of specified dimensional accuracy which: • achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (such as BS EN ISO 5187 and EN 30042 / ISO 10042 or EN 9606) required by the application standard or specification • meet and verify the required dimensional accuracy within specified tolerance	
		1.12	Shut down the equipment to a safe condition on completion of joining activities	
		1.13	Deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures	
		1.14	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Join Materials by the Semi-automatic MIG/MAG and Flux Cored Arc Processes	2.1	Explain the safe working practices and procedures to be observed when working with MIG, MAG or Flux cored wire arc welding equipment (general workshop and site safety; appropriate personal protective equipment (PPE); fire prevention; protecting other workers from the effects of the welding arc; safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the correct handling and storage of gas cylinders (manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)	
		2.3	Describe the hazards associated with arc welding (live electrical components; poor earthing; the electric arc; fumes and gases; gas supply leaks; spatter, hot slag and metal; elevated working; enclosed spaces; slips, trips and falls), and explain how they can be minimised	
		2.4	Describe the semi-automatic MIG, MAG or Flux cored wire arc welding process (basic principles of fusion welding, power sources, ancillary equipment, power ranges, care of equipment)	
		2.5	Describe the consumables associated with MIG, MAG or Flux cored wire arc welding (types of wire and their application (solid and cored), types of shielding gas and their application, gas supply and control)	
		2.6	Describe the types of welded joints to be produced (fillet and butt welds, single and multi-run welds, joints in pipe, plate, sheet and sections; welding positions)	

		2.7	Describe how to set up and restrain the joint (the use of jigs and fixtures, manipulators and positioners, restraining devices, tack welding size and spacing in relationship to material thickness)	
		2.8	Describe how to prepare the welding equipment and checks that need to be made to ensure that it is safe and ready to use (electrical connections, power return and earthing arrangements; wire feed mechanisms, gas supply, setting welding parameters, correct joint set-up, cleanliness of materials used; calibration before use; routine care and maintenance of equipment)	
		2.9	Explain the techniques of operating the welding equipment to produce a range of joints in the various joint positions (fine tuning parameters, correct manipulation of the welding gun, safe closing down of the welding equipment)	
		2.10	Explain the importance of complying with job instructions and the welding procedure specification	
		2.11	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)	
		2.12	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	Describe the personal approval tests, and their applicability to their work	
		2.15	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.16	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Joining Materials by the Manual TIG and Plasma-arc Welding Processes

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to prepare and operate manual TIG or Plasma-arc welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the work holding 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 torch 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.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/504/9235
Qualification Framework		RQF
Title		Joining Materials by the Manual TIG and Plasma-arc Welding Processes
Unit Level		Level 2
Guided Learning Hours		196
Unit Credit Value		54
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Materials by the Manual TIG and Plasma-arc Welding Processes	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	Set up, check, adjust and use manual welding and related equipment for one of the following welding processes: • TIG • Plasma-arc	
		1.6	Make the joints as specified using the appropriate thermal joining technique	
		1.7	Produce welded joints which incorporate the following: • butt welds and • fillet welds OR • welds made autogenously (without filler wire)	
		1.8	Weld joints according to approved welding procedures, in good access situations, in two of the following BS EN ISO 6947positions: • Flat (PA): • Horizontal (PC) • Vertical upwards (PF) • Horizontal vertical (PB) • Vertical downwards (PG)	

		1.9	Use consumables appropriate to the material and application, to include both of the following: • one size of electrode • two types of filler wire from different material groups	
		1.10	Produce joints in one form of specified materials from the following: • plate • section • pipe/tube • sheet (<3mm) • other forms	
		1.11	Produce joints of the required quality and of specified dimensional accuracy which: • achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (such as BS EN ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification • meet and verify the required dimensional accuracy within specified tolerance	
		1.12	Shut down the equipment to a safe condition on completion of joining activities	
		1.13	Deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures	
		1.14	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Join Materials by the Manual TIG and Plasma-arc Welding Processes	2.1	Explain the safe working practices and procedures to be observed when working with TIG or Plasma-arc welding equipment (general workshop and site safety; appropriate personal protective equipment (PPE); fire prevention; protecting other workers from the effects of the electric arc; safety in enclosed/confined spaces; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with arc welding (live electrical components; poor earthing arrangements; the electric arc; fumes and gases; gas supply leaks; spatter; hot slag and metal; grinding and mechanical metal/slag removal; elevated working; enclosed spaces; slips, trips and falls), and how they can be minimised	
		2.3	Describe the correct handling and storage of gas cylinders (manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)	
		2.4	Describe the manual TIG or Plasma-arc welding process (basic principles of fusion welding; power sources ancillary equipment; power ranges; arc initiation system; care and maintenance of equipment)	

		2.5	Describe the consumables associated with TIG or Plasma-arc welding (types of filler wire, types of shielding gas, welding electrodes, gas supply and control, control and storage of consumables)	
		2.6	Describe the types of welded joints to be produced (fillet and butt welds, single and multi-run welds, joints in pipe plate, sheet and sections; welding positions)	
		2.7	Describe how to set up and restrain the joint (confirming correct set-up of joint; cleanliness of materials used; the use of jigs and fixtures, manipulators and positioners, restraining devices; tack welding size and spacing in relationship to material thickness)	
		2.8	Describe how to prepare the equipment, and checks that need to be made to ensure that it is safe to use (condition of electrical connections, power return and earthing arrangements, operating parameters)	
		2.9	Explain the techniques of operating the welding equipment to produce a range of joints in the various joint positions (fine tuning parameters, correct manipulation of torch, safe closing down of the welding equipment)	
		2.10	Explain the importance of complying with job instructions and the welding procedure specification	
		2.11	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)	
		2.12	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	Describe personal approval tests and their applicability to their work	
		2.15	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.16	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Joining Materials by the Manual Oxy/fuel Gas Welding Process

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to prepare and operate oxy/fuel gas-welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the work holding and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that the regulators, hoses, flashback arrestor and welding torch are securely connected and are free from leaks or damage. In preparing to weld, the learner will need to set and adjust the gas pressures/welding conditions, in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly and make any necessary adjustments to settings, in line with their permitted authority, in order to produce the welded joints to the required specification.

Unit introduction

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

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

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

Assessment

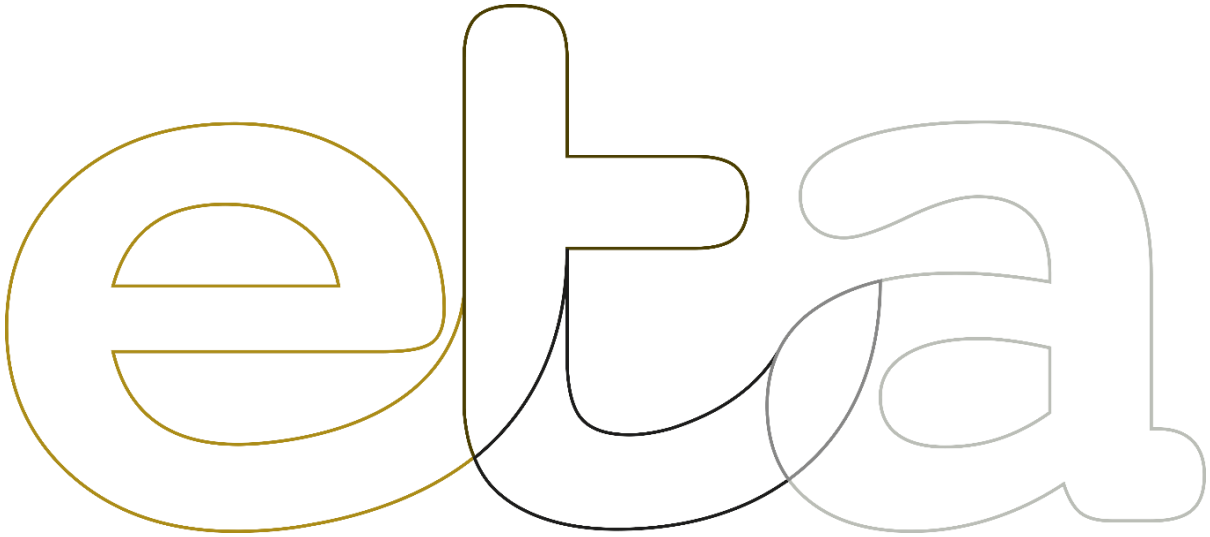
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		L/504/9236
Qualification Framework		RQF
Title		Joining Materials by the Manual Oxy/fuel Gas Welding Process
Unit Level		Level 2
Guided Learning Hours		175
Unit Credit Value		50
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Materials by the Manual Oxy/fuel Gas Welding Process	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and job instructions	
		1.3	Check that the joint preparation complies with the specification	
		1.4	Check that joining and related equipment and consumables are as specified and fit for purpose	
		1.5	Prepare the oxy/fuel gas welding equipment for use, to include all of the following: • checking regulators, hoses and valves are securely connected and free from leaks and damage • checking/fitting the correct gas nozzle to the torch • checking that a flashback arrestor is fitted • setting appropriate gas pressures • using the correct procedure for lighting, adjusting and extinguishing the welding flame • using appropriate and safe procedures for handling and storing of gas cylinders	
		1.6	• Make the joints as specified using the appropriate thermal joining technique	
		1.7	Produce welded joints which incorporate the following: • Butt welds and • Fillet welds OR • welds made autogenously (without filler wire)	
		1.8	Weld joints according to approved welding procedures, and in good access situations, in two of the following BS EN ISO 6947 positions:	

			• Flat (PA) • Horizontal (PC) • Horizontal vertical (PB) • Vertical upwards (PF) • Vertical downwards (PG)	
		1.9	Use a range of filler wire, to include both of the following: • two different sizes • two different filler wire properties/composition	
		1.10	Produce joints in one form of specified materials from the following: • plate • section • pipe/tube • sheet (<3mm) • other specific forms	
		1.11	Produce joints of the required quality and of specified dimensional accuracy which: • achieve a minimum weld quality equivalent to the level given in the relevant European International Standard (such as BS EN ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification • meet and verify the required dimensional accuracy within specified tolerance	
		1.12	Shut down the equipment to a safe condition on completion of joining activities	
		1.13	Deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures	
		1.14	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Join Materials by the Manual Oxy/fuel Gas Welding Process	2.1	Explain the safe working practices and procedures to be observed when working with oxy/fuel gas welding equipment (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; 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 oxy/fuel gas welding (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot slag and metal, grinding and mechanical slag removal, elevated working, enclosed spaces, slips trips and falls), and how they can be minimised	

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



Level 2 Unit – Producing Fillet Welded Joints using a Manual/Semi-Automatic Welding Process

Unit 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/semi-automatic welding process such as manual metal arc (MMA), MIG, MAG, TIG, flux- cored wire, inner shield or gas welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the work holding 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, EN 287 or EN 0906.

Unit introduction

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

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

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

Assessment

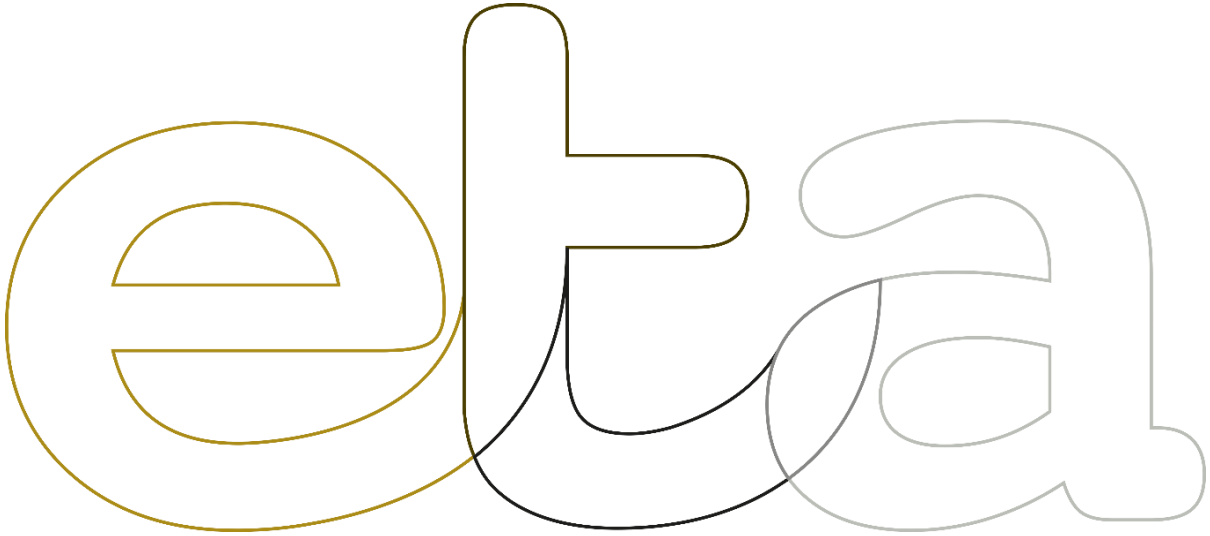
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		R/504/9237
Qualification Framework		RQF
Title		Producing Fillet Welded Joints using a Manual/Semi-Automatic Welding Process
Unit Level		Level 2
Guided Learning Hours		169
Unit Credit Value		44
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Fillet Welded Joints using a Manual/Semi-Automatic Welding Process	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and job instructions	
		1.3	Check that the joint preparation complies with the specification	
		1.4	Check that joining and related equipment and consumables are as specified and fit for purpose	
		1.5	Make the joints as specified using the appropriate thermal joining technique	
		1.6	Set up, check, adjust and use welding and related equipment for one of the following welding processes: • Manual Metal Arc • MIG/MAG • TIG • Plasma Arc • Flux Cored wire • 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: • Flat (PA) • Horizontal (PC) • Horizontal Vertical (PB) • Vertical Upwards (PF) • Vertical Downwards (PG) • Overhead (PE or PD)	

		1.8	Use consumables as specified in the welding procedure specification, covering either: Two types of electrode from: • rutile • basic • cellulosic • nickel alloy • stainless steel • other specific type OR • two types of filler wire from different material groups	
		1.9	Produce fillet welded joints in two of the following forms of material: • plate • sections • pipe/tube • sheet • other specific form	
		1.10	Produce joints of the required quality and of specified dimensional accuracy which: • achieve a minimum weld quality equivalent to the level given in the relevant European / International Standard (such as BS EN ISO 5187 and EN 30042 / ISO 10042) required by the application standard or specification • meet and verify 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	
2.	Know how to Produce Fillet Welded Joints using a Manual/Semi-Automatic Welding Process	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 (live electrical components, poor earthing, arc radiation, fumes and gases, gas supply leaks, spatter, hot	

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



Level 2 Unit – Welding Materials with Mechanised Arc Welding Equipment

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate one type of mechanised MIG/MAG, flux cored wire, submerged arc, TIG, or plasma arc welding installation, which has already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the equipment has been approved for production, and that sufficient supplies of all the required materials and consumables are present and correct, and ready for production operations to be performed.

The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

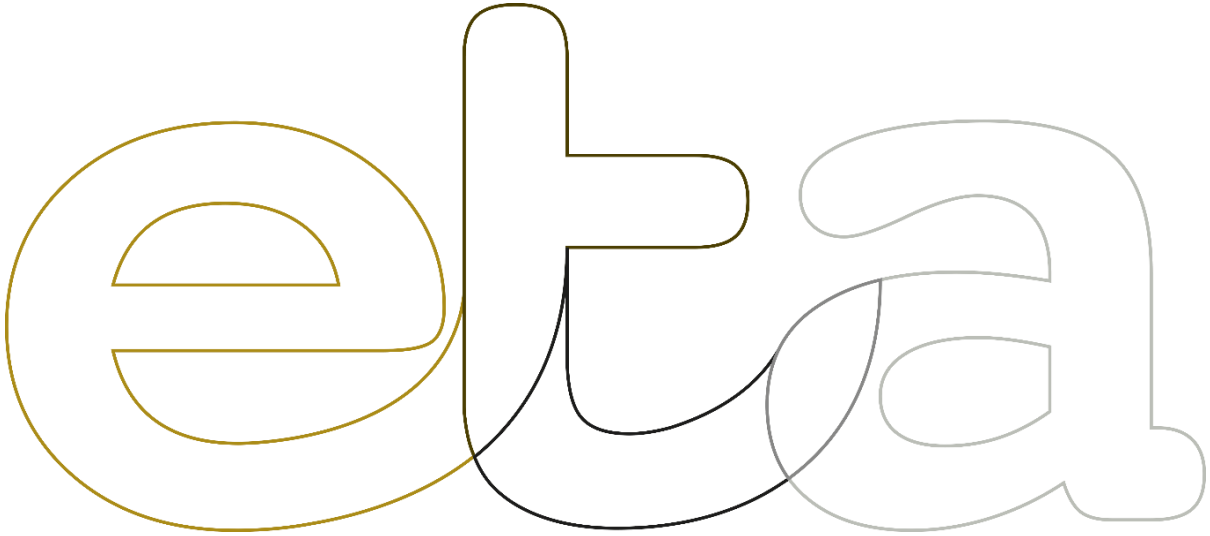
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/504/9212
Qualification Framework		RQF
Title		Welding Materials with Mechanised Arc Welding Equipment
Unit Level		Level 2
Guided Learning Hours		140
Unit Credit Value		37
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Welding Materials with Mechanised Arc Welding Equipment	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and work instructions	
		1.3	Operate one of the following mechanised arc welding processes in the specified materials, forms and positions: • MIG/MAG • cored wire • TIG • submerged arc • plasma arc	
		1.4	Confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.5	Check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • jigs and fixtures are in place and operate correctly • all machine functions operate correctly • all safety equipment is in place and functioning correctly	
		1.6	Check that the parent material, components, consumables and joint preparation comply with specifications	
		1.7	Produce welded components covering both of the following: • two different joint configurations • two different material groups	
		1.8	Carry out and monitor the machine operations in accordance with specifications and job	

			instructions	
		1.9	Monitor the process operation and machine functions, and make adjustments as required to parameters and mechanisms within their permitted authority and tolerances, to include adjusting all of the following: • electrical parameters • welding speed • flux dispensing and recovery mechanisms • safety devices • wire feed rate • gas shielding system • mechanical functions (handling, loading, work holding, transfer)	
		1.10	Achieve joints of the required quality and specified dimensional accuracy which: • achieve a weld quality equivalent to the relevant level of BS EN ISO 5817, as required by the application standard (for aluminium, EN 30042/ISO 10042 applies) • meet and verify the required dimensional accuracy within specified tolerances	
		1.11	Achieve the rate of output as specified	
		1.12	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.13	Shut down the equipment to a safe condition on conclusion of the joining activities	
2.	Know how to Weld Materials with Mechanised Arc Welding Equipment	2.1	Explain the safe working practices and procedures to be observed when operating mechanised arc welding installations (working with machinery; the use of personal protective equipment (PPE); protecting others from the effects of the electric arc; appropriate machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with arc welding machines (dangers from the electric arc; live electrical components; fumes and gases; hot metal; grinding and mechanical metal/slag removal; moving parts of machinery), and how they can be minimised	
		2.3	Describe the basic principles of mechanised and automated welding (types of installations; machine functions; control systems; safety features)	
		2.4	Describe the key components and features of the equipment used (power source; electrical parameters such as arc voltage, current, wire dispensing and feed mechanisms; flux dispensing and recovery; shielding gas supply; control and storage of consumables; how variations in the parameters influence weld features, quality and output)	
		2.5	Explain how to extract the necessary information from drawings and welding procedure specifications; welding symbols and abbreviations used (to include symbols and	

			conventions to appropriate British, European or relevant International standards in relation to work undertaken)	
		2.6	Explain the operation of the machine controls and their function; care of equipment	
		2.7	Describe how to care for the welding equipment used	
		2.8	Describe how to set up and align the workpiece, and the equipment to be used	
		2.9	Describe how to monitor the installation during the welding process; how to recognise problems and action to be taken	
		2.10	Describe the problems that can occur with the welding activities (distortion, material and weld defects)	
		2.11	Describe the self inspection of completed work, methods and equipment to be used	
		2.12	Describe the organisational quality systems (standards to be achieved; production records to be kept)	
		2.13	Describe the personal approval tests and their applicability to their work	
		2.14	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.15	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Welding Materials using Resistance Spot, Seam and Projection Welding Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate resistance spot, seam or projection welding installations, which have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production, and that sufficient supplies of all required materials and consumables are present and correct, and ready for production operations to be performed.

The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		K/504/9213
Qualification Framework		RQF
Title		Welding Materials using Resistance Spot, Seam and Projection Welding Machines
Unit Level		Level 2
Guided Learning Hours		129
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Welding Materials using Resistance Spot, Seam and Projection Welding Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and work instructions	
		1.3	Operate one of the following resistance welding installations: • spot welding • seam welding • projection welding	
		1.4	Confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.5	Check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • jigs and fixtures are in place and operate correctly • all machine functions operate correctly • all safety equipment is in place and functioning correctly	
		1.6	Check that the parent material, components, consumables and joint preparation comply with specifications	
		1.7	Produce welded components in the specified materials and forms that cover both of the following: • two different material thicknesses • two different joint configurations	
		1.8	Carry out and monitor the machine operations in accordance with specifications and job instructions	

		1.9	Monitor the process operation, electrode condition and machine function and make adjustments to required parameters and mechanisms, to include all of the following as appropriate to the machine type: • welding current • welding and squeeze times • electrode pressure cycle • welding speed (seam) • weld pitch (spot) • mechanical functions	
		1.10	Achieve joints of the required quality and specified dimensional accuracy which: • achieve a weld quality as specified in the application standard • spot and projection welds are correctly located • seam welds are of the correct dimensions • meet the required dimensional accuracy within specified tolerance	
		1.11	Achieve the rate of output as specified	
		1.12	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.13	Shut down the equipment to a safe condition on conclusion of the joining activities	
2.	Know how to Weld Materials using Resistance Spot, Seam and Projection Welding Machines	2.1	Explain the specific safety precautions to be taken when operating resistance welding installations (working with machinery; the use of appropriate personal protective equipment (PPE); machine guards; operation of machine safety devices; stopping the machine in an emergency; closing down the machine on completion of the welding activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with resistance welding machines (dangers from live internal electrical components, fumes, hot metal, expulsion of hot particles, moving parts of machines), and how they can be minimised	
		2.3	Describe the basic principles of resistance welding and the terminology used in welding	
		2.4	Describe the basic principles of mechanised and automated welding (types of installation; machine functions; control systems; safety features)	
		2.5	Describe the key components and features of the equipment used (power source; electrical parameters such as arc voltage, current, electrode pressure and welding time; systems for parameter control; how variation in the parameters influence weld features, quality and output)	
		2.6	Explain how to extract the information required from drawings and welding procedure specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)	

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

Level 2 Unit – Welding Materials using Laser Welding Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate laser welding installations that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production and that sufficient supplies of all required materials and consumables are present and correct, and ready for production operations to be performed.

The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

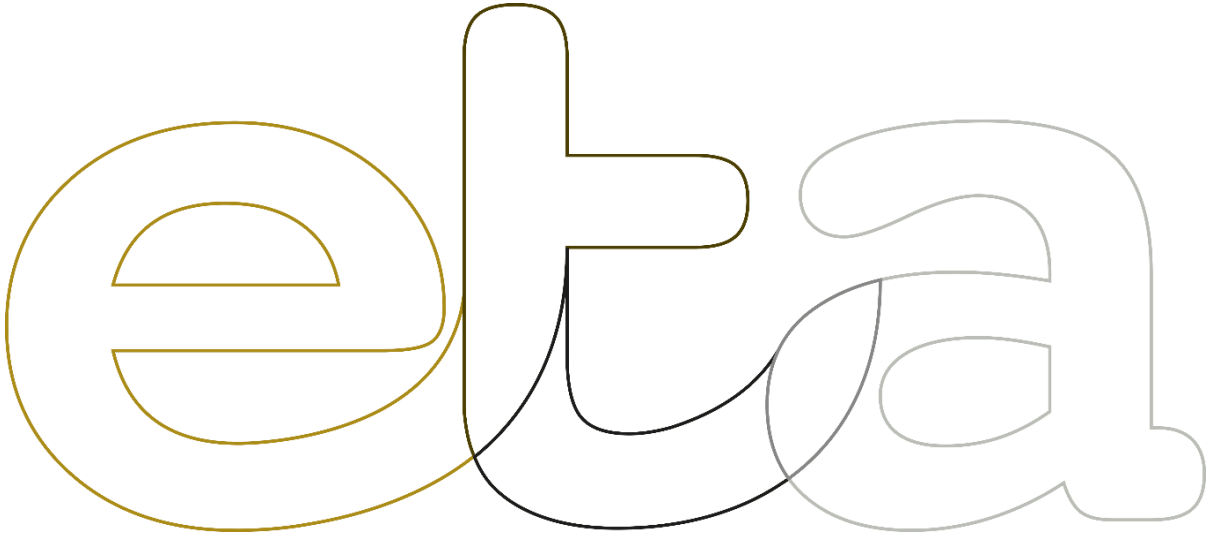
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		M/504/9214
Qualification Framework		RQF
Title		Welding Materials using Laser Welding Machines
Unit Level		Level 2
Guided Learning Hours		140
Unit Credit Value		37
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Welding Materials using Laser Welding Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and work instructions	
		1.3	Confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.4	Check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • all machine functions operate correctly • all safety equipment is in place and functioning correctly	
		1.5	Check that the parent material, components, consumables and joint preparation comply with specifications	
		1.6	Produce welded components covering both of the following: • two different components • two different material groups	
		1.7	Carry out and monitor the machine operations in accordance with specifications and job instructions	
		1.8	Monitor the process operation and machine function and make adjustments as required to parameters and mechanisms, to include all of the following, as appropriate to the machine type: • electrical parameters • welding speed • weld alignment and characteristics	

			• beam tracking • beam characteristics (focal spot) • gas shielding (where applicable) • mechanical mechanisms for work holding, traversing and transfer	
		1.9	Achieve joints of the required quality and specified dimensional accuracy which: • achieve a weld quality equivalent to the relevant level of BS EN/ISO 13919 standards or relevant international standard, as required by the application standard • meet the required dimensional accuracy within specified tolerances	
		1.10	Achieve the rate of output as specified	
		1.11	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.12	Shut down the equipment to a safe condition on conclusion of the joining activities	
2.	Know how to Weld Materials using Laser Welding Machines	2.1	Explain the safe working practices and procedures to be observed when operating laser welding installations (working with machinery; care when working with laser beams; the use of appropriate personal protective equipment (PPE); protecting other workers; machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with laser welding machines (dangers from the laser beam; live electrical components; fumes and gases; hot metal; moving parts of machinery), and how they can be minimised	
		2.3	Describe the basic principles of laser welding and the terminology used in welding	
		2.4	Describe the key components and features of the equipment (types of laser beam generators, beam characteristics, power ranges; beam guiding and focusing arrangements; power sources; materials and thickness capabilities; facilities for manipulating the components for welding; safety features; shielding gas supply and control)	
		2.5	Describe the basic principles of mechanised and automated welding (types of installations; machine functions; safety features)	
		2.6	Explain how to extract the information required from drawings and welding procedure specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)	
		2.7	Describe the operation of the machine; controls and their function; care of equipment	
		2.8	Describe how to set up and align the workpiece	
		2.9	Describe how to monitor the installation during the welding process; how to recognise problems, and action to be taken	
		2.10	Describe the problems that can occur with the welding activities, materials and weld defects	
		2.11	Explain the self inspection of completed work	

		2.12	Describe the organisational quality systems (standards to be achieved; production records to be kept)	
		2.13	Describe the personal approval tests and their applicability to their work	
		2.14	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.15	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Welding Materials using Electron Beam Welding Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate electron beam welding installations that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production and that sufficient supplies of all required materials and consumables are present and correct and are ready for production operations to be performed.

The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		T/504/9215
Qualification Framework		RQF
Title		Welding Materials using Electron Beam Welding Machines
Unit Level		Level 2
Guided Learning Hours		140
Unit Credit Value		37
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Welding Materials using Electron Beam Welding Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and work instructions	
		1.3	Confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.4	Check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • chamber pressures checked • all machine functions operate correctly • all safety equipment is in place and functioning correctly	
		1.5	Check that the parent material, components, consumables and joint preparation comply with specifications	
		1.6	Produce welded components covering both of the following: • two different components • two different material groups	
		1.7	Carry out and monitor the machine operations in accordance with specifications and job instructions	
		1.8	Monitor the process operation and machine function and make adjustments as required to parameters and mechanisms, to include all of the following, as appropriate to the machine type: • electrical parameters • welding speed • chamber pressure	

			• weld alignment and characteristics • beam tracking • mechanical functions	
		1.9	Achieve joints of the required quality and specified dimensional accuracy which: • achieve a weld quality equivalent to the relevant level of BS EN/ISO 13919 standards or relevant international standards, as required by the application standard • meet the required dimensional accuracy within specified tolerances	
		1.10	Achieve the rate of output as specified	
		1.11	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.12	Shut down the equipment to a safe condition on conclusion of the joining activities	
2.	Know how to Weld Materials using Electron Beam Welding Machines	2.1	Explain the safe working practices and procedures to be observed when operating electron beam welding installations (working with machinery; care in presence of high voltage; the use of appropriate personal protective equipment (PPE); protecting other workers; machine guards; operation of machine safety devices; x-ray dosimeters; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with electron beam welding machines (dangers from the mains and high voltage supplies; live electrical components; emission of x-rays, fumes and gases; hot metal; moving parts of machinery), and how they can be minimised	
		2.3	Describe the principles of electron-beam welding and the terminology used in welding	
		2.4	Describe the key components and features of the equipment (electron gun and control of beam power and characteristics; vacuum chamber and its construction; vacuum system and controls; in-chamber manipulating equipment; power sources and power range; material and thickness capabilities; safety features; facilities for loading chamber and work handling)	
		2.5	Explain how to extract the information required from drawings and welding procedure specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)	
		2.6	Describe the operation of the machine; controls and their function; care of equipment	
		2.7	Describe how to set up and align the workpiece	
		2.8	Describe how to monitor the installation during the welding process; how to recognise problems, and action to be taken	
		2.9	Describe the problems that can occur with the welding activities (materials and weld defects; beam instability, loss of alignment, increase in chamber pressure)	
		2.10	Explain the self inspection of completed work	
		2.11	Describe the organisational quality systems (standards to be achieved; production records to be kept)	

		2.12	Describe the personal approval tests and their applicability to their work	
		2.13	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.14	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Welding Materials using Friction Welding Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate friction welding installations that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production and that sufficient supplies of all required materials and consumables are present and correct and are ready for production operations to be performed.

The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation, using the in-process monitoring features of the welding machine, and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

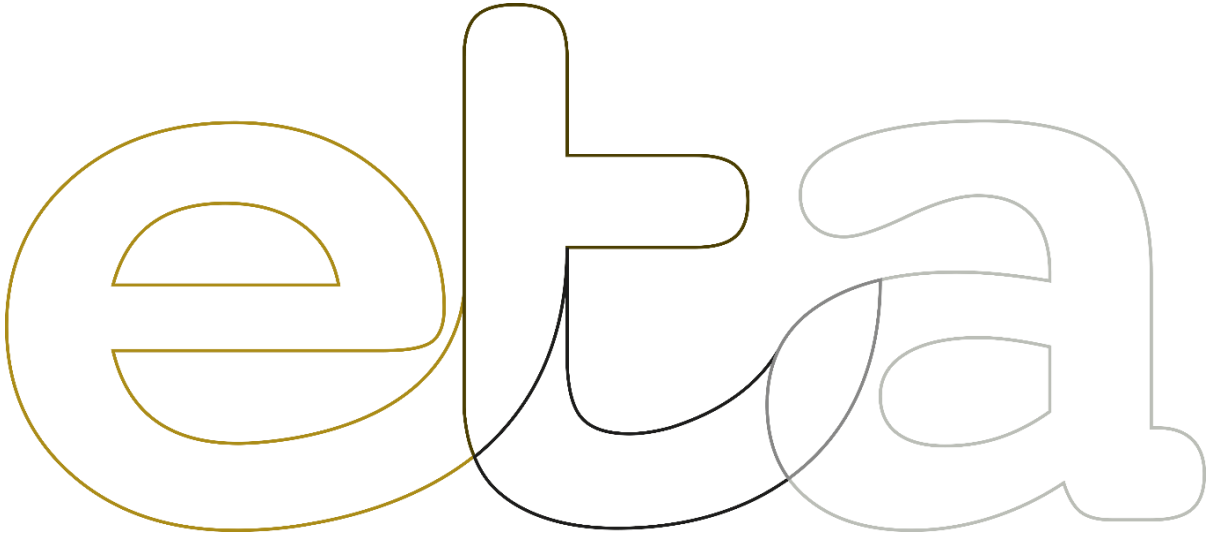
Unit Reference Number		A/504/9216
Qualification Framework		RQF
Title		Welding Materials using Friction Welding Machines
Unit Level		Level 2
Guided Learning Hours		129
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Welding Materials using Friction Welding Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the correct specification for the product or equipment being inspected	
		1.3	Carry out the inspection checks to one of the following quality and accuracy standards: • approved construction drawings • client specifications/detail drawings • applicable national and international standards	
		1.4	Use the correct equipment to carry out the inspection activities	
		1.5	Use six of the following types of inspection equipment: • rules and tapes • squares • spirit levels • dividers • gauges • protractors • plumb lines • callipers • Vernier instruments • torque instruments • rafter squares • templates and jigs • theodolites • laser equipment	
		1.6	Identify and confirm the inspection checks to be made and acceptance criteria to be used	

		1.7	Carry out all required inspections as specified	
		1.8	Carry out all of the following activities during the inspection process: • observe all the required safety procedures for the work area/activity • obtain and use the correct issue of drawings, job instructions and specifications • obtain and check the condition and calibration dates of tools, measuring instruments and equipment used • place and coordinate temporary survey stations, where required • perform the dimensional survey and determine out-of-tolerance values • apply adjustment of survey results for temperature correction (where applicable) • produce recommendations for control of final global dimensions, using intermediate data • report and investigate the possibility of gaining a concession for out-of-specification products • leave the work area in a safe and tidy condition on completion of the activities	
		1.9	Carry out the inspection of two of the following types of fabrications: • fabricated frames • structures • square/rectangular tanks • curved/profiled structures • trunking/ducting systems • pipe sections • cylindrical components • conical components • tubular structures • panels • transformers • reduction pieces • segmented bends • modular components • other specific fabrication	
		1.10	Carry out twelve of the following checks: • dimensional accuracy • squareness • angle • alignment • circularity or ovality • visual appearance • straightness • position/location	

			• freedom from distortion/damage • completeness • flatness • orientation • security of joints • weld size and profile • computation of best-fit centres • prediction of erection positions • development of cut lines • computation of allowances for weld gap tolerances and weld shrinkage for attainment of global tolerances practical allowances for expansion and contraction
		1.11	Identify any defects or variations from the specification
		1.12	Record the results of the inspection in the appropriate format
2.	Know how to Weld Materials using Friction Welding Machines	2.1	Describe the specific safety precautions to be taken when inspecting fabricated components (specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, relevant sections of COSHH
		2.2	Describe the persona protective clothing and equipment that should be worn (such as leather gloves, eye protection, ear protection, safety harness, etc.)
		2.3	Describe the hazards associated with inspecting fabricated products (such as working at height, handling fabricated structures, slips, trips and falls), and how they can be minimised
		2.4	Explain how and where to obtain the required drawings and related specifications, and how to check that they are current and complete
		2.5	Explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards), in relation to work undertaken
		2.6	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
		2.7	Describe the use of British, European and International standards in determining if components and products are fit for purpose
		2.8	Describe the general principles of quality assurance systems and procedures
		2.9	Describe the preparations to be undertaken before the product is inspected
		2.10	Describe the visual and dimensional inspection methods and techniques that are used for fabrications
		2.11	Describe the need to select and use set datum faces, and the effects of taking readings from different datums (such as accumulation of limits leading to errors)

		2.12	Describe the effects that the environment may have on the measurements taken (such as where precision measurements are concerned)	
		2.13	Describe the equipment that is used to carry out the various inspection checks (such as rules and tapes, precision Vernier instruments, levels and plumb lines, laser equipment and theodolite)	
		2.14	Describe the importance of ensuring that tools and equipment are set up correctly and are in a safe and useable condition	
		2.15	Describe the need to check that the equipment is approved for the inspection activities undertaken (including calibration checks and current certification dates)	



Level 2 Unit – Joining Rails using the Aluminothermic Welding Process

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist a Level 3 welder to prepare and operate an aluminothermic welding process, in accordance with instructions and/or approved procedures. In this context, ‘steel rail’ means materials and sections as used in the UK permanent way rail infrastructure.

The learner will be required to check that all the welding and ancillary equipment, such as saws, grinders and shearing tools, are available and in a usable condition. The learner will be expected to check that gases are available and that gas equipment, burners and hoses, are of the correct type, securely connected and free from leaks and damage. The learner will also need to ensure that appropriate crucibles, moulds and portions are available and in good condition. In preparing the weld they will need to identify the rail grade and profile, and to take account of any wear on the railhead. The learner must operate and handle the equipment safely and correctly and make any adjustments to equipment or settings, in line with their permitted authority, in order to produce and finish the welds to the required specification.

Unit introduction

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 the welding activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work in accordance with instructions from a Level 3 aluminothermic welder, taking personal responsibility for their own actions.

The learner’s knowledge will be sufficient to provide a sound basis for their work and will provide an understanding of how the aluminothermic 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 and 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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		Y/504/9238
Qualification Framework		RQF
Title		Joining Rails using the Aluminothermic Welding Process
Unit Level		Level 2
Guided Learning Hours		153
Unit Credit Value		52
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Rails using the Aluminothermic Welding Process	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	Assist in the preparation of rails for welding, in accordance with applicable specifications, to include all of the following: • confirming welding equipment, consumables and ancillary equipment is available and fit for purpose • identifying and measuring rail wear and condition • cutting the rail using the oxy-fuel process, a band saw or an abrasive disc • datum marking and aligning the rail • preheating the crucible and the joint area • joining the rails using safe and approved welding methods and procedures • reinstating the track to the required standard on completion of the welding activities • disposing of waste and surplus materials in accordance with approved procedures	
		1.6	Make the joints as specified using the appropriate thermal joining technique	
		1.7	Assist in the setting up, checking, adjustment and use of aluminothermic welding equipment for one of the following process variants, in accordance with the appropriate process manual: • Thermit • Railtech	

		1.8	Assist in the use of moulds and consumables appropriate to the material and application, to include all of the following: • two different rail profiles (unworn) • two different rail materials • join new rail to worn rail • join worn rail to worn rail	
		1.9	Assist in the welding of joints according to approved welding procedures in both of the following: • normal gap • wide gap	
		1.10	Assist in the production of welds which: • achieve a minimum weld quality required by the application standard or specification • meet the required dimensional accuracy within specified tolerance • have been finished to the required specification in terms of removal of risers and excess metal • are ground to the required standard	
		1.11	Produce joints of the required quality and of specified dimensional accuracy	
		1.12	Shut down the equipment to a safe condition on completion of joining activities	
		1.13	Deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures	
		1.14	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Join Rails using the Aluminothermic Welding Process	2.1	Explain the safe working practices and procedures to be observed when working with aluminothermic welding equipment (general site safety, appropriate personal protective equipment (PPE), fire prevention, protecting other workers, accident procedure; client requirements statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with aluminothermic welding (poor gas supply, leaks, hot metal, explosive gas mixtures, naked flames and exothermic reactions), and how they can be minimised	
		2.3	Describe the equipment and consumables used for aluminothermic welding	
		2.4	Describe the aluminothermic welding process and the use of process manuals	
		2.5	Describe the types of rail grades and profiles, and welded joints to be produced	
		2.6	Describe how to set up the joint (such as cutting, alignment, moulds, luting)	
		2.7	Describe how to set up of the welding equipment and checks that need to be made to ensure that it is safe and ready to use (gas supply, correct joint set-up, cleanliness of materials used)	

		2.8	Describe the techniques of operating the welding equipment, to produce a range of joints in accordance with the appropriate process manual	
		2.9	Explain the importance of complying with job instructions and the welding process specification	
		2.10	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)	
		2.11	Describe the problems that can occur with the welding activities, and explain how these can be overcome; effects of welding on rail materials and sources of weld defects; methods of prevention	
		2.12	Describe the organisational quality systems used and weld standards to be achieved; weld inspection and test procedures used (including visual and non-destructive tests)	
		2.13	Describe the personal approval tests and their applicability to their work	
		2.14	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.15	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Restore Rails to Operational Condition using an Arc Welding Process

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to restore rails to operational condition by resurfacing or repair, using either manual arc or self-shielded flux cored wire arc welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be expected to check the welding equipment to ensure that all the leads/cables, electrode holders 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 repairs to the required specification.

Unit introduction

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

The learner's knowledge will be sufficient to provide a sound basis for their work and will provide an informed approach to applying rail welding repair procedures and instructions. The learner will have an understanding of the manual arc or self-shielded flux cored arc welding process used, and its application, and will know about the equipment, materials and consumables, in adequate depth to provide a sound basis for setting up and operating the equipment, recognising and correcting faults and ensuring the work output is produced to the required specification.

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

Assessment

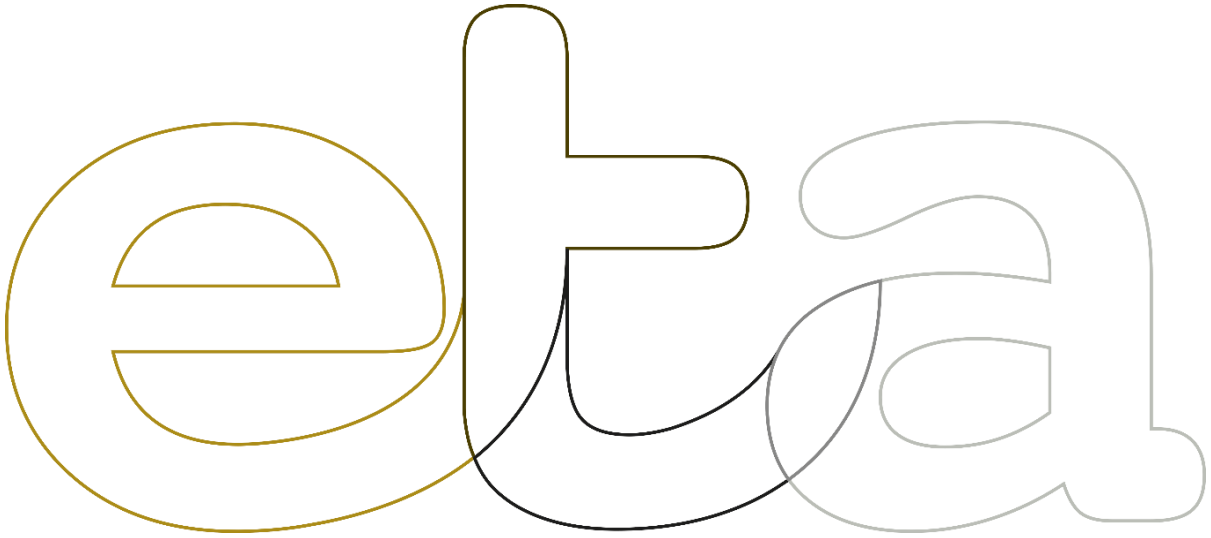
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		D/504/9239
Qualification Framework		RQF
Title		Restore Rails to Operational Condition using an Arc Welding Process
Unit Level		Level 2
Guided Learning Hours		132
Unit Credit Value		44
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Restore Rails to Operational Condition using an Arc Welding Process	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 repair activities: • determine or confirm the specific repair to be carried out • prepare the area of the rail to be repaired using grinding and penetrant testing • use safe and approved repair welding procedures at all times • finish the repair using approved methods and techniques • test the repaired area using the penetrant method • reinstate the track to the required standard on completion of the repair activities • dispose of waste and surplus materials in accordance with approved procedures	
		1.3	Use one of the following arc welding processes: • manual metal arc • self-shielded flux cored wire arc	
		1.4	Set up, check, adjust and use arc welding and related equipment, to include all of the following: • confirming welding equipment, consumables and ancillary equipment is available • checking that all leads/cables are secure and in a safe and usable condition • checking that the wire feed mechanism or electrode holder is securely connected and free from damage • ensuring that the correct type and size of wire or electrode is loaded to the wire feed mechanism or electrode holder • setting and adjusting the welding conditions in line with the instructions or welding procedure specification	

			• carrying out the repair welding activities safely and correctly, in line with the repair specification	
		1.5	Follow the relevant specifications for the component to be repaired	
		1.6	Use consumables appropriate to the rail material and application, to include both of the following: • two different wire or electrode types • two different wire or electrode sizes	
		1.7	Prepare the component for repair	
		1.8	Carry out the repairs within agreed timescale using approved materials, components, methods and procedures	
		1.9	Produce welded repairs in good access situations, to include both of the following: • normal grade rail • austenitic-manganese rail	
		1.10	Produce repairs which include both of the following: • resurfacing • repair	
		1.11	Produce welded components which: • achieve a minimum weld quality as required by the application standard or specification • meet the required dimensional accuracy within specified tolerances • are ground to the required standard	
		1.12	Ensure that the repaired component meets the specified operating conditions	
		1.13	Produce accurate and complete records of all the repair work carried out	
2.	Know how to Restore Rails to Operational Condition using an Arc Welding Process	2.1	Explain the safe working practices and procedures to be observed when working with manual metal arc or self-shielded flux cored wire arc welding equipment (general 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 hazards associated with arc welding (live electrical components, poor earthing, the electric arc, fumes and gases, spatter, hot metal), and how they can be minimised	
		2.3	Describe the arc welding process (basic principles of fusion welding, AC and DC power sources, ancillary equipment and power ranges, care of equipment)	
		2.4	Describe the consumables associated with manual metal arc or flux cored wire arc welding (types of wire/electrode and their application)	
		2.5	Describe the types of repairs to be produced (resurfacing and repair)	
		2.6	Describe how to identify the various steels used in rails, switches and crossings and how they will affect the welding repair procedure	
		2.7	Describe how to prepare the area of the rail to be repaired by grinding and penetrant testing	

		2.8	Describe 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, earthing arrangements; wire feed mechanisms, setting welding parameters, correct workpiece set-up, cleanliness of materials used)	
		2.9	Explain the importance of complying with job instructions and the welding procedure specification	
		2.10	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)	
		2.11	Describe the techniques used for completing and finishing the repaired rails (grinding off excess material, finish profiling and penetrant testing)	
		2.12	Describe the procedures for reinstating the track on completion of the repair activities	
		2.13	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)	
		2.14	Describe the techniques of operating the welding equipment to produce a range of repairs (fine tuning parameters, correct manipulation of the welding gun/electrode, safe closing down of the welding equipment)	
		2.15	Describe the organisational quality systems used and weld standards to be achieved	
		2.16	Describe the weld inspection and test procedures used (including destructive and non-destructive methods)	
		2.17	Describe the personal approval tests and their applicability to their work	
		2.18	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.19	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Welding Rails using Flash Welding Equipment

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate flash welding installations that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the installation has been approved for production, and that sufficient supplies of all required materials and consumables are present and correct, and ready for production operations to be performed.

The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		R/504/9240
Qualification Framework		RQF
Title		Welding Rails using Flash Welding Equipment
Unit Level		Level 2
Guided Learning Hours		132
Unit Credit Value		40
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Welding Rails using Flash Welding Equipment	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and work instructions	
		1.3	Confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.4	Check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the welding procedure specification • all machine functions operate correctly • all safety equipment is in place and functioning correctly	
		1.5	Check that the parent material, components, consumables and joint preparation comply with specifications	
		1.6	Carry out and monitor the machine operations in accordance with specifications and job instructions	
		1.7	Monitor the process operation and machine function and make adjustments as required to parameters and mechanisms, to include all of the following, as appropriate to machine type: • heat and forge cycle time • heat and forge loads (forces) • electrical conditions • weld and forge travel • weld appearance (correct extrusion)	
		1.8	Produce welded components covering both of the following: • two different rail sections • two different rail material groups	

		1.9	Achieve joints of the required quality and specified dimensional accuracy	
		1.10	Produce welded rails which: • achieve a weld quality as specified in the application standard or specification • meet the required dimensional accuracy within specified tolerances	
		1.11	Achieve the rate of output as specified	
		1.12	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.13	Shut down the equipment to a safe condition on conclusion of the joining activities	
2.	Know how to Weld Rails using Flash Welding Equipment	2.1	Explain the safe working practices and procedures to be observed when operating flash welding installations (working with machinery; the use of appropriate personal protective equipment (PPE); machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with flash welding machines (dangers from live electrical components; fumes; hot metal; moving parts of machinery), and how they can be minimised	
		2.3	Describe the principles of flash welding and the terminology used in welding	
		2.4	Describe the key components and features of the equipment (types of machines; constructional features, mechanical and electrical features, component holding devices, force generation and control systems, welding cycle control; feedback and recording)	
		2.5	Describe the mechanised and automated welding basics; types of installations; machine functions; safety features	
		2.6	Explain how to extract the information required from drawings and welding procedure specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)	
		2.7	Describe the operation of the machine; controls and their function; care of equipment	
		2.8	Describe how to set up and align the rails for the welding operation	
		2.9	Describe how to monitor the installation during the welding process; recognition of problems and action to be taken	
		2.10	Describe the problems that can occur with the welding activities, materials and weld defects	
		2.11	Describe the self inspection of completed work	
		2.12	Describe the organisational quality systems (standards to be achieved; feedback from machine; corrective actions; production records to be kept)	
		2.13	Describe the personal approval tests and their applicability to their work	
		2.14	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.15	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Joining Materials by Manual Torch Brazing and Soldering

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and use manual torch brazing and soldering equipment, in accordance with approved instructions or procedures. The learner will be required to check that all the hoses and equipment are correctly connected, free from leaks or damage, and are ready for use. The learner will be required to set and adjust the brazing conditions, in line with the specification. The learner will also need to select and use workholding and manipulating devices that are appropriate to the size and shape of materials and joint configuration being produced. The learner must operate the equipment safely and correctly and make any adjustments to settings, in order to produce the joints to the required specification.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		D/504/9242
Qualification Framework		RQF
Title		Joining Materials by Manual Torch Brazing and Soldering
Unit Level		Level 2
Guided Learning Hours		129
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Materials by Manual Torch Brazing and Soldering	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and job instructions	
		1.3	Check that the joint preparation complies with the specification	
		1.4	Check that joining and related equipment and consumables are as specified and fit for purpose	
		1.5	Make the joints as specified using the appropriate thermal joining technique	
		1.6	Set up, check, adjust and use one of the following processes and related equipment: • brazing • soldering	
		1.7	Use specified consumables appropriate to the parent metals, to include both of the following: • two different filler metals • appropriate fluxes	
		1.8	Produce brazed or soldered joints according to work procedures, and in good access situations, covering both of the following: • two different components or assemblies • two different parent metal groups	
		1.9	Produce joints of the required quality and of specified dimensional accuracy which: • achieve the specified joint quality equivalent to the level given in the relevant European/International standard (such as BS EN 13133, 13134 or 14276) required by the application standard or specification • meet the required dimensional accuracy within specified tolerance • are of good appearance, free from flux residues and excess filler metal	

		1.10	Shut down the equipment to a safe condition on completion of joining activities	
		1.11	Deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures	
		1.12	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Join Materials by Manual Torch Brazing and Soldering	2.1	Explain the safe working practices and procedures to be observed when working with gas brazing and soldering equipment (general workshop and site safety, appropriate personal protective equipment (PPE), fire and explosion prevention, fume extraction, protecting other workers, safety in enclosed/confined spaces, statutory regulations, risk assessment procedures and COSHH regulations)	
		2.2	Describe the hazards associated with torch brazing and soldering (naked flames, explosive gas mixes, oxygen enrichment, fumes and gasses, hot metal, enclosed spaces), and how they can be minimised	
		2.3	Describe the torch brazing and soldering process (basic principles of the process, wetting and capillary flow, role of fluxes, equipment type and its care)	
		2.4	Describe the types of filler metal and fluxes; forms of filler metal	
		2.5	Describe the types of joints to be produced	
		2.6	Describe how to set up and locate the joint (methods of cleaning joint faces; use of jigs and fixtures, restraining devices; self-locating joints; pre-placement of filler metal and flux)	
		2.7	Describe how to prepare to braze or solder (checks to confirm correct set-up and cleanliness; use of gauges, setting up the equipment, checking connections for leaks, checking operating parameters)	
		2.8	Explain the techniques of operating the equipment to produce a range of joints (selection of nozzle and flame adjustment, application of flux, correct manipulation of torch and filler wire, safe closing down of the equipment)	
		2.9	Explain the importance of complying with job instructions and the joining procedure specification	
		2.10	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)	
		2.11	Describe the problems that can occur with the joining activities and explain how these can be overcome (causes of distortion and methods of control; effects of heat on materials and sources of defects; methods of prevention)	
		2.12	Describe the methods of removing flux residues and cleaning the finished joint	
		2.13	Describe the organisational quality control systems and standards to be achieved; visual and non-destructive tests	
		2.14	Describe the personal approval tests and their applicability to their work	

		2.15	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.16	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Operating Brazing Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate torch, inductance, resistance or furnace brazing installations that have already been prepared for production, in accordance with approved instructions or procedures. The learner will be expected to check that the equipment has been approved for production, and that sufficient supplies of all the required materials and consumables are present and correct and are ready for production operations to be performed.

The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a joint quality and tolerances that meet the product specification. The learner must continuously monitor the operation of the installation, and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the brazed joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/504/9243
Qualification Framework		RQF
Title		Operating Brazing Machines
Unit Level		Level 2
Guided Learning Hours		129
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Operating Brazing Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and work instructions	
		1.3	Operate one of the following mechanised brazing processes in the specified materials, forms and positions: • torch • induction • furnace • resistance	
		1.4	Produced brazed assemblies covering both of the following: • two different joint configurations • two different material groups	
		1.5	Confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.6	Check all of the following before starting production: • the installation has been approved for production • supplies of components and consumables are adequate and correctly prepared • machine settings comply with instructions and the brazing procedure specification • all machine functions operate correctly • all safety equipment is in place and functioning correctly	
		1.7	Check that the parent material, components, consumables and joint preparation comply with specifications	
		1.8	Carry out and monitor the machine operations in accordance with specifications and job instructions	
		1.9	Monitor the process operation and machine functions, and make adjustments as required to	

			parameters and mechanisms within their permitted authority and tolerances, to include adjusting all of the following, as applicable to the machine type: • brazing temperature • brazing time • flux and filler metal dispensing • brazing atmosphere • flame condition • mechanical functions (handling, loading, workholding, transfer) • safety devices	
		1.10	Achieve joints of the required quality and specified dimensional accuracy	
		1.11	Produce brazed components or assemblies which: • achieve the specified joint quality equivalent to the level given in the relevant European/International standard (such as BS EN 13133, 13134 or 14276) required by the application standard or specification • meet the required dimensional accuracy within specified tolerances	
		1.12	Make sure the rate of output is as specified	
		1.13	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.14	Shut down the equipment to a safe condition on conclusion of the joining activities	
2.	Know how to Operate Brazing Machines	2.1	Explain the safe working practices and procedures to be observed when operating brazing installations (working with machinery; the use of appropriate personal protective equipment (PPE); machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with brazing machines (dangers from relevant equipment sources; fumes and gases; hot metal; moving parts of machinery), and how they can be minimised	
		2.3	Describe the principles of the relevant brazing process and the terminology used in brazing	
		2.4	Describe the key components and features of the equipment	
		2.5	Explain the mechanised and automated brazing basics (types of installations; machine functions; safety features)	
		2.6	Explain how to extract the information required from the drawings and brazing procedure specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)	
		2.7	Describe the operation of the machine controls and their function; care of equipment; control and storage of consumables	
		2.8	Describe how to set up and align the workpiece	

		2.9	Describe how to monitor the installation during the brazing process; recognition of problems, and action to be taken	
		2.10	Describe the problems that can occur with the brazing activities, materials, filler metals and joint defects	
		2.11	Describe self inspection of the completed work	
		2.12	Describe the organisational quality systems (standards to be achieved; production records to be kept)	
		2.13	Describe the personal approval tests and their applicability to their work	
		2.14	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.15	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Joining Plastics using Manual Welding Processes

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to prepare and operate manual plastics 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 gas supplies (if using an external gas supply) and electrical inputs are securely connected and free from damage. In the case of welding torches that have integral fans you will need to check that filers are free from debris. In preparing to weld, the learner will need to set and adjust the welding conditions, in line with the instructions or welding procedure specification, paying particular attention to the ambient conditions and the selected nozzle type. 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.

Unit introduction

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 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 sound basis for their work and will provide an understanding of how manual plastics welding processes work. The learner will know about the equipment, materials welding parameters 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 carrying out the welding 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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/504/9248
Qualification Framework		RQF
Title		Joining Plastics using Manual Welding Processes
Unit Level		Level 2
Guided Learning Hours		147
Unit Credit Value		44
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Plastics using Manual Welding Processes	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 and type	
		1.4	Check that joining and related equipment and welding rods 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 plastics welding and related equipment, to include two of the following: Note: one of the processes chosen must be hot gas or extrusion welding • hot gas • extrusion • socket fusion • heated wedge	
		1.7	Produce welded joints as appropriate to the process, to include one of the following: • fillet welds • butt welds • socket welds • lap welds	
		1.8	Use materials and welding rods as appropriate to the welding process used, to include both of the following: • two types of material from different material groups • two sizes or types of welding rods	
		1.9	Weld joints according to approved welding procedures, in good access situations, in two of	

			the following BS EN287 positions or two other positions, as appropriate to the process: • Flat • Horizontal • Vertical upwards • Vertical downwards • Overhead	
		1.10	Produce joints of the required quality and of specified dimensional accuracy which: • achieve a minimum weld quality equivalent with BS EN 13067, or as required by the application standard • meet the required dimensional accuracy within specified tolerances	
		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 agree procedures	
		1.13	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Join Plastics using Manual Welding Processes	2.1	Explain the safe working practices and procedures to be observed when working with manual plastics welding equipment (general workshop and site safety, appropriate personal protective equipment (PPE), fire prevention, protecting other workers, safety in enclosed/confined spaces; fume control; accident procedure; statutory regulations; risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with plastics welding (live electrical components, fumes and gases, hot material, elevated working temperature, enclosed spaces), and how they can be minimised	
		2.3	Describe the manual plastics welding processes (basic principles of hot gas, extrusion, injectiweld socket fusion and geomembrane welding; ancillary equipment; care of equipment; consumables; weld rod; power ranges)	
		2.4	Describe the types of weld rod and their correct storage	
		2.5	Describe the types of welded joints to be produced (fillet and butt welds; single and multi-run welds; joints in pipe, and, plate and profiles; welding positions)	
		2.6	Explain how to set up and restrain the joint (the use of jigs and fixtures, restraining devices, tack welding size and spacing in relationship to material thickness)	
		2.7	Describe the checks to be made prior to welding (confirming correct set-up and alignment of parts, cleanliness of materials, pre-weld scraping, condition and flow rate of gas/air, condition of and electrical connections, and operating parameters)	

		2.8	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 weld rod, correct procedure for closing down of the welding equipment)	
		2.9	Describe the importance of complying with the work instructions and the welding procedure specification	
		2.10	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)	
		2.11	Describe the problems that can occur with the welding activities and explain how these can be overcome (causes of distortion and methods of control; effects of welding on materials and sources of weld defects; methods of prevention and rectification)	
		2.12	Describe the organisational quality control systems used, and weld standards to be achieved	
		2.13	Describe the weld inspection and test procedures used (including destructive and non-destructive methods)	
		2.14	Describe the trial welds and certification and their applicability to their work	
		2.15	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.16	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Joining Materials using Plastics Welding Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to operate plastics welding machines that have already been prepared for production, in accordance with approved instructions or welding procedures. The learner will be expected to check that the machine has been approved for production, and that sufficient supplies of all required materials and consumables are present and correct and are ready for production operations to be performed.

The learner must operate the machine safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods, to check that the specified quality is being achieved. The learner must continuously monitor the operation of the machine and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance.

Unit introduction

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

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

The learner will understand the safety precautions required when carrying out the machine welding 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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/504/9249
Qualification Framework		RQF
Title		Joining Materials using Plastics Welding Machines
Unit Level		Level 2
Guided Learning Hours		129
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Materials using Plastics Welding Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant joining procedure and work instructions	
		1.3	Confirm that the welding machine is ready for operation to include checking all of the following: • the welding machine has been approved for production • supplies of components and materials are adequate and correctly prepared • welding machine settings comply with instructions and the welding procedure specification • all machine functions operate correctly • all safety equipment is in place and functioning correctly	
		1.4	Confirm that the welding machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.5	Produce welded components using two of the following types of equipment: • hot plate • electro-fusion • vibration • ultrasonic • laser • radio frequency • hot bar/impulse • spin • orbital • infrared	

		1.6	Produce welded components covering both of the following, as applicable to the process: • two different components • two different material groups	
		1.7	Check that the parent material, components and joint preparation comply with specifications	
		1.8	Carry out and monitor the machine operations in accordance with specifications and work instructions	
		1.9	Monitor the process operation and machine function and make adjustments to required parameters and mechanisms, to include all of the following, as appropriate to machine type: • time(s) • pressure(s) • speed • displacement • temperature/energy input	
		1.10	Achieve joints of the required quality and specified dimensional accuracy which: • achieve a weld quality equivalent with BS EN13067 or as required by the application standard • meet the required dimensional accuracy within specified tolerances	
		1.11	Make sure that the rate of output is as specified	
		1.12	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.13	Shut down the welding machine to a safe condition on conclusion of the joining activities	
2.	Know how to Join Materials using Plastics Welding Machines	2.1	Explain the safe working practices and procedures to be observed when operating a range of plastics welding machines (working with machinery; the use of appropriate personal protective equipment (PPE); machine guards; operation of machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with plastics welding machines (dangers from live electrical components; fumes; hot material; moving parts of machinery), and how they can be minimised	
		2.3	Describe the principles of plastics welding and the terminology used in welding	
		2.4	Describe the key components and features of the equipment (types of machines; constructional features, mechanical features, heat generation, force generation and control systems, welding cycle control; feedback and recording)	
		2.5	Explain the mechanised and automated welding basics (types of machines and their functions; safety features)	

		2.6	Explain how to extract the information required from the drawings and welding procedure specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)	
		2.7	Describe the operation of the machine; controls and their function; care of equipment	
		2.8	Describe how to set up and align the workpiece	
		2.9	Describe how to monitor the welding machine during the welding process; recognition of problems, and action to be taken	
		2.10	Describe the problems that can occur with the welding activities, materials and weld defects	
		2.11	Describe the visual inspection of completed weld	
		2.12	Describe the organisational quality systems (standards to be achieved; data download from machine; corrective actions; production records to be kept)	
		2.13	Describe the personal weld test/certification and their applicability to their work	
		2.14	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.15	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Marking Out Components for Fabrication

Unit aim

This unit covers the skills and knowledge needed to prove the competences required for marking out sheet and plate work, rolled sections, and pipes/tubes using templates and basic tools, in accordance with approved procedures. The learner will be required to select the required materials to use and the appropriate marking out tools and equipment, based on the information presented to them and the accuracy to be achieved. Marking out will be the preparation required for cutting and shaping sheet materials, plate and sections, as appropriate to the application, and will include marking out workpiece datum's, centre lines and cutting details, including hole centering and outlining details.

Items to be marked out may include ferrous and non-ferrous materials. Certain materials will require the learner to take the grain flow into account to avoid later production process problems.

Unit introduction

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

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

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

Assessment

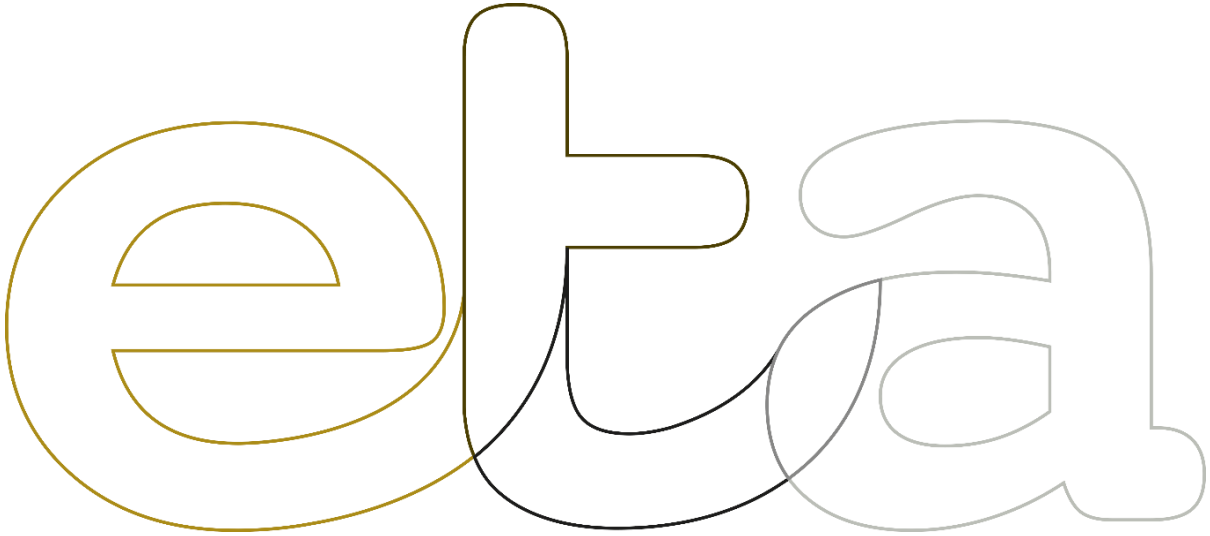
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/504/9251
Qualification Framework		RQF
Title		Marking Out Components for Fabrication
Unit Level		Level 2
Guided Learning Hours		63
Unit Credit Value		15
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Marking Out Components for Fabrication	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Obtain and use the correct information for marking out	
		1.3	Obtain the appropriate marking out equipment and check that it is in a usable condition	
		1.4	Mark out directly onto sheet or plate from drawings, using four of the following tools and instruments: • scriber • centre punch • rule and tape • straight edge • square • etching • laser • dividers or trammels • chalk, bluing or paint • templates	
		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 from the following: • hot-rolled mild steel • cold-rolled mild steel • coated mild steel (primed, tinned or galvanised) • stainless steel • aluminium • brass	

			• copper • non-metallic materials	
		1.8	Mark out sheet or plate for three of the following forms/shapes of component: • bar and section lengths • cutting detail for flat covers and plates • frames or structures • fish plates, gussets • spars and brackets • pipe/tube sections • structural support pads, bed plates • columns, beams or struts • simple seatings (such as boiler saddles, tank cradles)	
		1.9	Mark out material to include three of the following features: • datum and centre lines • square/rectangular profiles • circles • curved profiles • cutting detail • hole centring and outlining (circular and linear)	
		1.10	Check that the marking out complies with the specification	
		1.11	Produce marked out component which meet all of the following quality and accuracy standards: • dimensionally accurate (to drawing or specification) • uses recognised marking out conventions • clearly defined for required processes	
		1.12	Deal promptly and effectively with problems within their control and report those that cannot be resolved	
2.	Know how to Mark Out Components for Fabrication	2.1	Explain the specific safety precautions to be taken when working in a fabrication environment with sheet, plate or rolled section materials (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the personal protective clothing and equipment (PPE) to be worn when carrying out the fabrication activities (such as leather gloves, eye protection, safety helmets)	
		2.3	Describe the correct methods of moving or lifting sheet, plate and rolled-section materials	
		2.4	Describe the hazards associated with marking out fabricated components (such as working in a fabrication environment, lifting and handling sheet/fabricated components, slivers/burrs	

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



Level 2 Unit – Cutting Sheet Metal to Shape using Hand and Machine Tools

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to cut and shape sheet metal (up to and including 3 mm), in order to fabricate clips, brackets, covers and similar components, in accordance with approved procedures. The learner will be required to select the appropriate equipment to use for the material, thickness and accuracy to be achieved, and will use hand tools, hand power tools and machinery, as applicable. The cutting and shaping will involve producing straight cuts and external curved contours.

Items to be cut and shaped may include ferrous and non-ferrous materials. This will call for care in selecting the right tools, so as to avoid damage or contamination to the tools and danger to oneself.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		A/504/9281
Qualification Framework		RQF
Title		Cutting Sheet Metal to Shape using Hand and Machine Tools
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting Sheet Metal to Shape using Hand and Machine Tools	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow relevant specifications for the component to be produced	
		1.3	Obtain the appropriate tools and equipment for the shaping operations and check they are in a safe and usable condition	
		1.4	Shape the materials using appropriate methods and techniques	
		1.5	Cut and finish material to the marked out shape, using four of the following tools: • tin snips • bench shears • guillotine • hacksaw • band saw • hand power tools (drill, nibbling) • pillar drill • files • punch/cropping machine • laser • thermal devices • water cutter	
		1.6	Perform cutting operations to produce all of the following shapes: • straight cuts • external and internal curved contours • round holes	
		1.7	Use sheet metal of various thicknesses, up to and including 3 mm, for two appropriate materials and two thicknesses from the following:	

			• hot-rolled mild steel • cold-rolled mild steel • coated mild steel (such as primed, tinned, galvanised) • stainless steel • aluminium • brass • copper	
		1.8	Check that all the required shaping operations have been completed to the required specification	
		1.9	Produce cut and shaped components which meet all the following quality and accuracy standards: • dimensionally accurate (to drawing or specifications) • free from distortion • free from sharp edges, slivers or burrs	
		1.10	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Cut Sheet Metal to Shape using Hand and Machine Tools	2.1	Explain the specific safety precautions to be taken when working with sheet metal equipment and materials in a fabrication environment (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the personal protective clothing and equipment to be worn when carrying out the fabrication activities (such as leather gloves, eye/ear protection, safety helmets)	
		2.3	Describe the correct methods of moving or lifting sheet metal	
		2.4	Explain the safe working practices and procedures to be observed when using manual and power-operated tools	
		2.5	Describe the hazards associated with fabrication work (such as using dangerous or badly maintained tools and equipment, operating guillotines, and when using hand and bench shears), and how they can be minimised	
		2.6	Describe the procedures for obtaining the necessary drawings and specifications, and how to check that they are the latest issue	
		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 the marking out conventions on the materials to be cut and shaped (such as cutting lines, centre lines)	
		2.9	Describe the tools and techniques available for cutting and shaping sheet metal (such as tin snips, bench shears, guillotines, portable power tools, bench drills, saws)	

		2.10	Describe what preparations may have to be carried out on the material prior to cutting it	
		2.11	Describe the material characteristics and process considerations that need to be taken into account when cutting and shaping sheet metal	
		2.12	Describe the use and care of tools and equipment, including checks that need to be made to ensure that the tools are fit for purpose (sharp, undamaged, plugs and cables secure and free from damage, machine guards or safety devices operating correctly)	
		2.13	Explain the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations	
		2.14	Describe the problems that can occur with cutting and shaping sheet metal, and explain how these can be avoided	
		2.15	Describe the importance of using the machine guards and safety protection equipment at all times	
		2.16	Describe the inspection techniques that can be applied to check that shape and dimensional accuracy are to specification and within acceptable limits	
		2.17	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.18	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Forming Sheet Metal using Hand and Machine Tools

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to form sheet metal (up to and including 3mm) using hand tools and machine tools, in accordance with approved procedures. The learner will be required to select the appropriate equipment to use, based on the operations required, material to be formed and the accuracy to be achieved, and this will include such equipment as hammers and stakes, formers, bending machines and rolling machines. The components/shapes to be produced will include bends, folds, cylinders and curved sections, ducting or trunking.

Unit introduction

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

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

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

Assessment

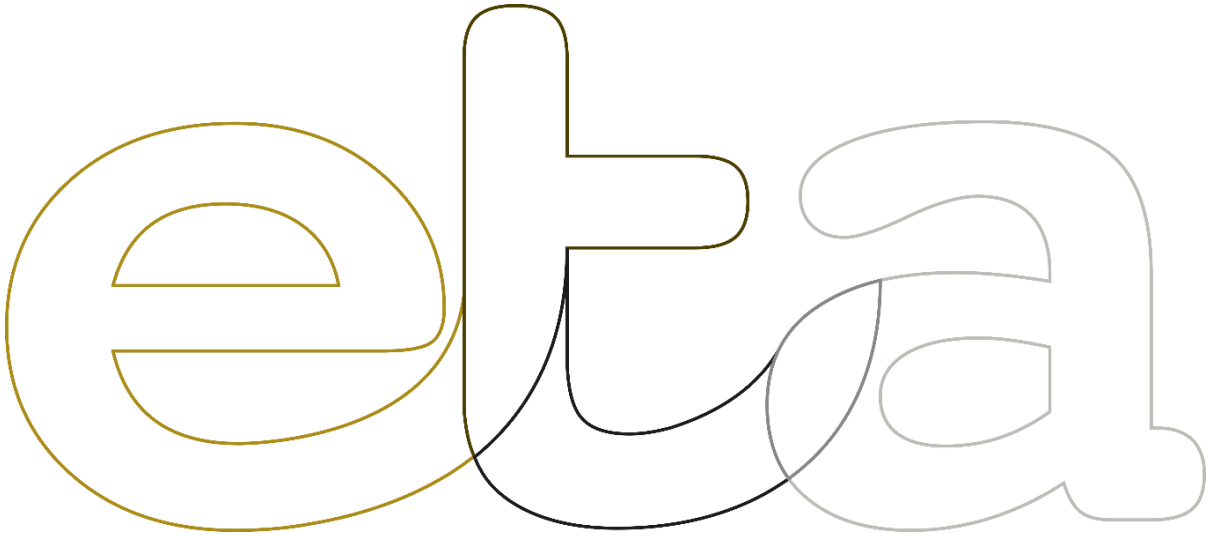
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/504/9282
Qualification Framework		RQF
Title		Forming Sheet Metal using Hand and Machine Tools
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Forming Sheet Metal using Hand and Machine Tools	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the correct component drawing and any other related specifications for the component to be produced	
		1.3	Determine what has to be done and how this will be achieved	
		1.4	Use the appropriate tools and equipment for the pressure shaping operations and check that they are in a safe and usable condition by carrying out all of the following checks: • hand tools are in a usable condition (hammer shafts secure; stakes, formers and striking faces free from defects and damage) • the appropriate machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly • forming tools are appropriate and in a serviceable condition (secure, correct shape, free from damage)	
		1.5	Shape the materials to the required specification using appropriate methods and techniques	
		1.6	Use two of the following types of forming equipment/techniques: • hammers • stakes and formers • bending machine (hand or powered) • rolling machine (hand or powered)	
		1.7	Carry out forming operations which produce three of the following shapes: • bends • folds • curved panels • cylindrical sections • ducting or trunking	
		1.8	Produce components made from two different materials from the following:	

			• mild steel • tinned steel • galvanised plate • stainless steel • aluminium • brass • copper	
		1.9	Check that all the required shaping operations have been completed to the required standard	
		1.10	Produce components which meet all of the following quality and accuracy standards: • dimensional accuracy is within specification tolerances • finished components meet the required shape • completed components are free from excessive tooling marks, deformation or cracking	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Form Sheet Metal using Hand and Machine Tools	2.1	Explain the specific safety precautions to be taken when working with sheet metal equipment and materials in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the personal protective clothing and equipment (PPE) to be worn when carrying out the fabrication activities (such as leather apron and gloves, eye/ear protection, safety helmets)	
		2.3	Describe the correct methods of moving or lifting sheet or plate materials	
		2.4	Describe the hazards associated with sheet metalwork (such as handling sheet/fabricated components, using machinery, using dangerous or badly maintained tools and equipment), and how they can be minimised	
		2.5	Describe how to obtain the necessary drawings, specifications and work instructions	
		2.6	Explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards in relation to work undertaken)	
		2.7	Explain the marking out conventions used in sheet metalwork, and how to recognise cutting detail and bending and folding lines	
		2.8	Describe how hand tools are used in the sheet metal forming activities, and typical operations that they are used for (range of hammers, stakes)	
		2.9	Describe the various machine-tool forming equipment that can be used to produce a range of shapes (such as bends, cylinders and curved sections)	
		2.10	Describe how the materials are to be prepared for the forming operations	

		2.11	Describe the tool and equipment care and maintenance procedures	
		2.12	Describe the dimensional and forming inspection checks that need to be carried out, and the tools and equipment to be used	
		2.13	Describe the problems that can occur with forming sheet metal, and how these can be avoided	
		2.14	Describe the limitations of the various forming processes, and the accuracy that may realistically be achieved	
		2.15	Describe ways of avoiding inaccuracies in forming activities	
		2.16	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.17	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Producing Sheet Metal Assemblies

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to produce basic sheet metal (up to and including 3mm) assemblies, in accordance with approved procedures. The learner will be required to work in accordance with instructions, to bring together, prepare for joining and assemble, in the right order, sheet metal components and/or light sections, in order to construct complete fabricated assemblies or sub-assemblies, such as ducting, tanks, cylindrical sections. The learner will be required to lay out and secure the various component parts of the structure using mechanical fastenings, clamps or jigs, ready for welding or to use self-securing methods, in the correct order, and the learner will ensure they are assembled in a manner that is fit for purpose.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/504/9283
Qualification Framework		RQF
Title		Producing Sheet Metal Assemblies
Unit Level		Level 2
Guided Learning Hours		119
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Sheet Metal Assemblies	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Carry out all of the following during the sheet metal assembly operations: • correctly prepare and set up the components and faces to be joined • use the correct datum faces • use the specified or appropriate fixing method • correctly align the components and faces to be joined • assemble/fabricate the sheet metal components in the correct order or manner • produce an assembly which meets the required specification	
		1.3	Follow the relevant instructions, assembly drawings and any other specifications	
		1.4	Check that the specified components are available and that they are in a usable condition	
		1.5	Use three of the following types of components in the assemblies produced: • sheet metal covers • pre-fabricated square/rectangular components • pre-fabricated cylindrical/conical components • brackets • flanges • pipes • light rolled section (angle, channel or tee section) • stiffeners and frame components	
		1.6	Use the appropriate methods and techniques to assemble the components in their correct positions	

		1.7	Assemble sheet metal components using two of the following methods: • temporary tack welding • soldering or brazing • resistance spot welding • riveting (hollow or solid) • adhesive bonding • flanged and mechanically fastened (bolts, screws)	
		1.8	Secure the components using the specified connectors and securing devices	
		1.9	Produce four of the following sheet metal assemblies: • frames • tanks • ducting • guards • hoods • panels • sectional trunking • square, rectangular and box sections • cylindrical sections • conical sections • reduction pieces	
		1.10	Check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification to include all of the following: • all components are correctly assembled and aligned in accordance with the specification • overall dimensions are within specification tolerances • assemblies meet appropriate geometric tolerances (square, straight, angles free from twists) • where appropriate, pitches of erection holes meet specification requirements completed assemblies have secure and firm joints, and are clean and free from burrs or flash	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Produce Sheet Metal Assemblies	2.1	Explain the specific safety precautions to be taken when working in a fabrication environment and when producing sheet metal assemblies (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	

		2.2	Describe the personal protective clothing and equipment that needs to be worn when carrying out the fabrication activities (such as leather gloves, eye protection, safety helmets, ear protection)	
		2.3	Describe the safe working practices and procedures to be used when producing sheet metal assemblies	
		2.4	Describe the correct methods of moving or lifting bulky fabrications	
		2.5	Describe the hazards associated with sheet metal fabrication and assembly work (such using dangerous or badly maintained tools and equipment, lifting and handling long and heavy components, cuts, slips trips and falls), and how they can be minimised	
		2.6	Describe 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	Describe how to interpret marking out conventions (such as cutting lines, centre lines)	
		2.9	Describe the preparations that need to be carried out on the components prior to assembling them	
		2.10	Describe the various methods of securing the assembled components; the range of mechanical fastening devices that are used (such as nuts and bolts, screws, special fasteners, resistance and tack welding methods and techniques, adhesive bonding of components)	
		2.11	Explain how to set up and align the various components, and the tools and equipment to be used	
		2.12	Describe the methods of temporarily holding the joints together to aid the assembly activities (such as clamps, rivet clamps)	
		2.13	Describe the use and care of tools and equipment, and their control procedures	
		2.14	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	
		2.15	Describe the problems that can occur when producing sheet metal assemblies, and explain how these can be avoided	
		2.16	Describe the inspection techniques that can be applied to check that shape (including straightness) and dimensional accuracy are to specification and within acceptable limits	
		2.17	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.18	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Heat Treating Materials for Fabrication Activities

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to heat treat ferrous and non-ferrous materials in order to assist with the fabrication activities, in accordance with approved procedures. The learner will be required to identify and use the appropriate materials, apply the relevant processes and use appropriate tools and equipment, based on the information presented to them, in order to achieve the required condition. The heat treatment processes will include hardening, tempering, annealing and normalising and stress relieving, and can be applied to the fabricator's tools, such as punches, chisels and scribers, or to the component/materials to be worked on.

Unit introduction

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

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

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

Assessment

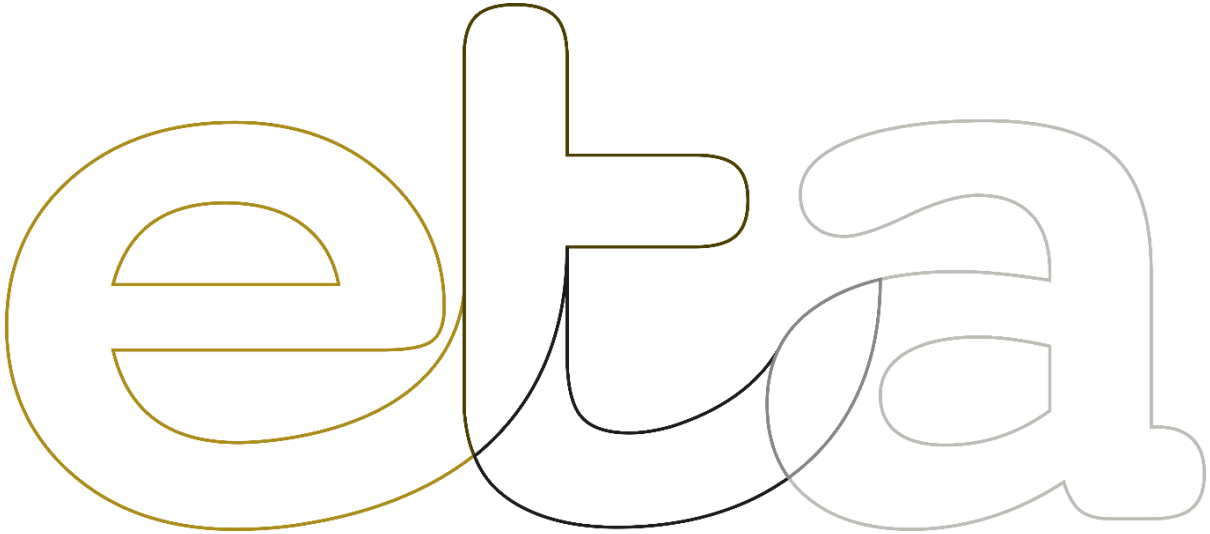
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		L/504/9284
Qualification Framework		RQF
Title		Heat Treating Materials for Fabrication Activities
Unit Level		Level 2
Guided Learning Hours		56
Unit Credit Value		10
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Heat Treating Materials for Fabrication Activities	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Carry out all the following during the heat treatment activities: • use the correct heat treatment procedure and quality documentation • follow relevant COSHH and risk assessment procedures • apply the required heat treatment processes, safely and correctly • ensure the safety of self and others while carrying out the processes • leave the work area in a safe condition on completion of the activities	
		1.3	Ensure the materials to be processed are suitably prepared for the processing operations to be carried out	
		1.4	Apply the appropriate heat treatment process to one of the following: • ferrous components/sections • ferrous high carbon tools (punches, chisels, scribes) • hot steel rivets • non-ferrous sheet or plate	
		1.5	Check and monitor that the processing equipment is set up and maintained at satisfactory operating conditions throughout the processing operations	
		1.6	Carry out the process in accordance with operating procedures and the workpiece specification requirements	
		1.7	Carry out one of the following heat treatment processes/techniques: • hardening • tempering • annealing • pre-heating	

			• normalising/stress relieving	
		1.8	Carry out heat treatment processes using **one** of the following types of equipment • furnace • Induction heating • blacksmiths forge • gas torch • electrical resistance heating	
		1.9	Carry out the heat treatment process using **one** of the following cooling/quenching techniques • water • oil • sand • air • brine	
		1.10	Ensure that the processed workpiece achieves the required characteristics and meets the processing specification	
		1.11	Carry out heat treatment processes to all of the following quality and accuracy standards, as applicable to the process carried out: • tools are of the correct hardness for the application and, where appropriate, suitably tempered • hardened materials are free from cracks • materials/components are suitably treated to allow working • distortion is limited and controlled	
		1.12	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.13	Dispose of waste and excess materials in line with agreed organisational procedures	
		1.14	Shut down the processing equipment to a safe condition on completion of the processing activities	
2.	Know how to Heat Treat Materials for Fabrication Activities	2.1	Explain the specific safety precautions to be taken and safe working practices to be employed when carrying out the heat treatment of materials in a fabrication environment (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the personal protective clothing and equipment to be worn when working on heat treatment processes (such as gloves, eye/ear protection, aprons)	
		2.3	Describe the handling precautions and correct methods of moving materials, particularly when they are hot	

		2.4	Describe the hazards associated with fabrication heat treatment processes (such as handling sheet/fabricated components, handling hot materials, overheating quenching oils), and how they can be minimised	
		2.5	Explain the reasons for heat treating materials	
		2.6	Describe the various heat treatment processes, methods and procedures that may be applied	
		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 the type of equipment that can be used to carry out the various heat treatment processes (such as furnaces, blacksmiths forge, gas torches)	
		2.9	Describe the safe handling techniques for hot metal components	
		2.10	Describe how the materials need to be prepared in readiness for the heat treatment operations	
		2.11	Describe the type of materials that can be heat treated, and the processes that may be applied	
		2.12	Explain the various cooling and quenching techniques that are applied to the processes, and why it is important to use the correct process (water, oil, sand, air)	
		2.13	Describe ways of limiting distortion during the heat treatment process	
		2.14	Describe the quality control procedures and recognition of defects	
		2.15	Describe the problems that can occur when heat treating materials, and how these can be avoided	
		2.16	Describe the limitations of the various processes	
		2.17	Describe the organisational procedures for disposing of and recycling of waste	
		2.18	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.19	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Cutting and Shaping Materials using CNC Laser Profiling Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out cutting and profiling operations using computer numerical controlled (CNC) laser profiling machines, in accordance with approved procedures.

The learner will take charge of the prepared machine and check that it is ready for the machining operations to be performed. This will involve checking that all the required materials and consumables are present, and that the machine has been approved for production. In operating the machine, the learner will be expected to follow the correct procedures for calling up the machine-operating program, dealing with any error messages, and executing the program activities safely and correctly.

The components produced will have a number of different features, including square and rectangular profiles, angular profiles, curved profiles, circles, slots, holes linearly positioned and holes radially positioned. The learner will be required to continuously monitor the cutting operations, making any necessary adjustments to machine parameters, in line with their permitted authority. Meeting production targets will be an important issue, and the learner's production records must show consistent and satisfactory performance.

Unit introduction

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

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

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

Assessment

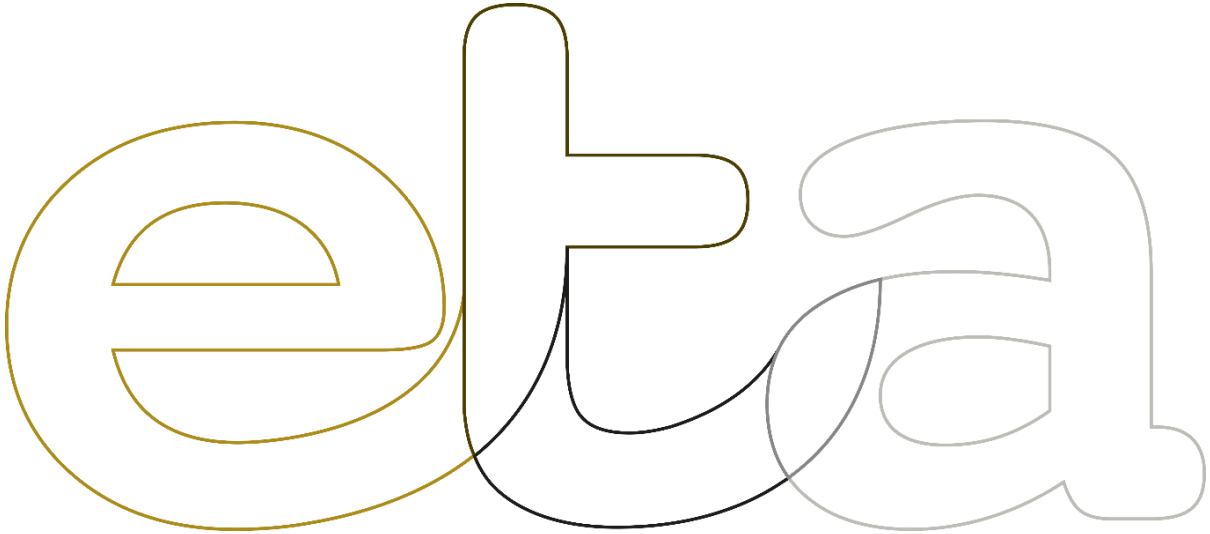
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		Y/504/9286
Qualification Framework		RQF
Title		Cutting and Shaping Materials using CNC Laser Profiling Machines
Unit Level		Level 2
Guided Learning Hours		154
Unit Credit Value		37
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting and Shaping Materials using CNC Laser Profiling Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Confirm that the equipment is set up and ready for operation by checking all of the following: • the machine has been approved for production • all safety equipment and guards are in place and functioning correctly • materials are correctly positioned and held securely without distortion • the laser lens is clean and in a suitable condition • the operating program is at the correct start point • safe working practices and start up procedures are observed • machine settings are adjusted as required to maintain accuracy	
		1.3	Follow the defined procedures for starting and running the operating system	
		1.4	Deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved	
		1.5	Monitor the computer process and ensure that the production output is to the required specification	
		1.6	Produce cut and shaped components which cover five of the following features: • square/rectangular profiles • angular profiles • curved profiles • circles • ellipses • holes linearly positioned • holes radially positioned • slots and apertures • other specific features	

		1.7	Machine one of the following types of material: • ferrous • non-ferrous • stainless steel • alloy steel • other appropriate material	
		1.8	Produce components within all of the following quality and accuracy standards: • dimensional accuracy is within the tolerance specified on the drawing/specification or within +/- 1.5mm • angled cuts are within specification requirements (perpendicular/angularity) • cuts are clean and smooth and free from flutes • components are free from distortion	
		1.9	Shut down the equipment to a safe condition on conclusion of the activities	
2.	Know how to Cut and Shape Materials using CNC Laser Profiling Machines	2.1	Explain the safe working practices and procedures to be observed when operating CNC laser cutting and profiling machines (care when working with high power laser beams; machine guards; ventilation and fume extraction; machine safety devices)	
		2.2	Describe how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities	
		2.3	Describe the importance of ensuring the machine is isolated from the power supply before working with machinery; and the care needed, particularly when working with laser beams	
		2.4	Explain the importance of wearing the appropriate protective clothing and equipment (PPE), and of keeping the work area clean and tidy	
		2.5	Describe the hazards associated with using laser cutting and profiling machines (dangers from the laser beam; live electrical components; moving parts of machinery), and how they can be minimised	
		2.6	Describe the principles and operation of lasers and laser machines and explain the terminology used	
		2.7	Explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)	
		2.8	Describe how to interpret the visual display and understand the various messages displayed	
		2.9	Describe the function of error messages, and what to do when an error message is displayed	
		2.10	Describe how to find the correct restart point in the program when the machine has been stopped before completion of the program	
		2.11	Explain the operation of the various hand and automatic modes of machine control (such as program operating and control buttons)	

		2.12	Describe how to operate the machine using single block run, full program run and speed override controls	
		2.13	Describe how to make adjustments to machine-operating programs to take account of out-of-specification components	
		2.14	Describe how to take care of equipment and operating programs, including safe storage of electronic materials away from possible contamination and corruption	
		2.15	Describe how to monitor the machine during the cutting process; recognition of problems and action to be taken	
		2.16	Describe the problems that can occur during the laser cutting activities, and how to prevent them	
		2.17	Describe the organisational quality systems (standards to be achieved; production records to be kept)	
		2.18	Explain the extent of their own authority and explain whom they should report to if they have problems they cannot resolve	



Level 2 Unit – Cutting and Shaping using CNC Plasma or Gas Cutting Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out cutting and profiling operations using computer numerical controlled (CNC) plasma or gas cutting and profiling machines, in accordance with approved procedures.

The learner will take charge of the prepared machine and check that it is ready for the cutting operations to be performed. This will involve checking that all the required materials and consumables are present, and that the machine has been approved for production. In operating the machine, the learner will be expected to follow the correct procedures for calling up the machine-operating program, dealing with any error messages, and executing the program activities safely and correctly.

The components produced will have a number of different features, including square and rectangular profiles, angular profiles, curved profiles, circles, slots, holes linearly positioned and holes radially positioned. The learner will be required to continuously monitor the cutting and shaping operations, making any necessary adjustments to machine parameters, in line with their permitted authority.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		D/504/9287
Qualification Framework		RQF
Title		Cutting and Shaping using CNC Plasma or Gas Cutting Machines
Unit Level		Level 2
Guided Learning Hours		154
Unit Credit Value		37
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting and Shaping using CNC Plasma or Gas Cutting Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Use one of the following thermal cutting methods: • oxy/fuel gas cutting • plasma gas cutting	
		1.3	Confirm that the equipment is set up and ready for operation to include checking all of the following: • the machine has been approved for production • all safety equipment and guards are in place and functioning correctly • materials are correctly positioned and held securely without distortion • the cutting nozzles are clean and in a suitable condition • the operating program is at the correct start point • the workpiece is clear of the machine spindle • safe working practices and start-up procedures are observed • machine settings are adjusted as required to maintain accuracy	
		1.4	Follow the defined procedures for starting and running the operating system	
		1.5	Deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved	
		1.6	Monitor the computer process and ensure that the production output is to the required specification	
		1.7	Produce components which are cut and shaped, and which cover six of the following features: • square/rectangular profiles • angular profiles • curved profiles	

			• circles • ellipses • round holes • slots and apertures • angled cuts • bevelled edge (weld preparations) • other specific features	
		1.8	Machine one of the following types of material: • mild steel • carbon steel • aluminium • copper • stainless steel • other alloy steels • other appropriate material	
		1.9	Produce components within all of the following quality and accuracy standards: • dimensional accuracy is within the tolerance specified on the drawing/specification or within +/- 1.5mm • angled cuts are within specification requirements (perpendicular/angularity) • cuts are clean and smooth and free from flutes • components are free from distortion	
		1.10	Shut down the equipment to a safe condition on conclusion of the activities	
2.	Know how to Cut and Shape using CNC Plasma or Gas Cutting Machines	2.1	Explain the safe working practices and procedures to be observed when operating CNC plasma and gas cutting/ profiling machines (general workshop and site safety, appropriate personal protective equipment (PPE), fire and explosion prevention, protecting other workers; fume control; accident procedure; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials; machine safety devices)	
		2.2	Describe how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities	
		2.3	Describe the importance of ensuring the machine is isolated from the power supply before working with machinery; and the care needed when working with compressed gases	
		2.4	Explain the equipment that needs to be worn when working with fabrications and thermal cutting equipment (such as leather aprons and gloves, eye protection, safety helmets)	
		2.5	Describe the hazards associated with using CNC thermal cutting equipment (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal, moving parts of machinery), and explain how they can be minimised	
		2.6	Describe the correct methods of moving or lifting plate materials and components	

		2.7	Describe the principles and operation of the plasma or gas cutting equipment, and the terminology used in thermal cutting, in relation to the operations being performed	
		2.8	Explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant International or ISO standards in relation to work undertaken)	
		2.9	Describe how to interpret the visual display and understand the various messages displayed	
		2.10	Describe the function of error messages, and what to do when an error message is displayed	
		2.11	Describe how to find the correct restart point in the program when the machine has been stopped before completion of the program	
		2.12	Explain the operation of the various hand and automatic modes of machine control (such as program operating and control buttons)	
		2.13	Describe how to operate the machine using single block run, full program run and speed override controls	
		2.14	Describe how to make adjustments to machine-operating programs to take account of out-of-specification components	
		2.15	Describe how to set up the correct operating conditions; flame control and the effects of mixtures and pressures associated with thermal cutting	
		2.16	Describe the effects of oil, grease, scale or dirt on the cutting process	
		2.17	Explain how to take care of equipment and operating programs, including safe storage of material away from possible contamination and corruption	
		2.18	Describe how to monitor the machine during the cutting process; recognition of problems and action to be taken	
		2.19	Describe the actions to be taken prior to cutting (setting up the material/workpiece, checking cleanliness of materials used)	
		2.20	Describe the work holding methods that are used to aid thermal cutting, and equipment that can be used	
		2.21	Describe the problems that can occur with thermal cutting and explain how they can be avoided; causes of distortion during thermal cutting and methods of controlling distortion	
		2.22	Describe the organisational quality systems (standards to be achieved; production records to be kept)	
		2.23	Describe the extent of their authority and explain whom they should report to if they have problems that they cannot resolve	
		2.24	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Assembling Components using Mechanical Fasteners

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to undertake the preparation and making of joints between fabricated components, using mechanical means, in accordance with approved procedures. The learner will be required to produce suitable and appropriate joints, using appropriate methods for the materials to be joined that meet the specified conditions and subsequent operating conditions to be demanded of the joint. Particular attention will be needed in the preparation and finishing of the materials, so that the finished component is fit for purpose and meets the level of accuracy required. The mechanical fastenings used will include rivets, self-tapping screws, bolts and screwed fittings, anchor nuts and proprietary fasteners, as appropriate to the application and/or specification. The joint will be of two or more materials and may include non-metallic materials and joints of dissimilar metals.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		K/504/9289
Qualification Framework		RQF
Title		Assembling Components using Mechanical Fasteners
Unit Level		Level 2
Guided Learning Hours		70
Unit Credit Value		18
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Assembling Components using Mechanical Fasteners	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the relevant instructions, assembly drawings and any other specifications	
		1.3	Check that the specified components are available and that they are in a usable condition	
		1.4	Carry out all of the following during the joining process: • correctly prepare the faces of the materials to be joined • select the appropriate/specified fixings • correctly align the materials and faces to be joined • assemble the components in the correct order or manner • produce a joint that meets the requirements of the specification	
		1.5	Use the appropriate methods and techniques to assemble the components in their correct positions	
		1.6	Use four of the following assembly methods and techniques: • riveting using solid rivets • riveting using pop/blind rivets • self-tapping screws • use of proprietary fasteners • crimping • assembling using bolt fittings • using screw fittings to tapped components • nuts and (spot welded) screw studs • locking methods and devices • clinching	

		1.7	Produce assemblies which include four of the following: • flat and flanged joints on flat or curved surfaces • square/rectangular trunking • circular trunking • access flanges and cover plates • tanks and tank covers • joints with gasket or sealant • pipes • structural components • long or critical alignments • permanent and temporary assemblies	
		1.8	Join the components in three of the following joining positions or access and environmental conditions: • horizontal • vertical • overhead • in workshop conditions • in the field • internal and confined spaces	
		1.9	Secure the components using the specified connectors and securing devices	
		1.10	Check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification	
		1.11	Produce joints to all of the following quality and accuracy standards, as applicable to the application: • joints are accurately assembled and aligned in accordance with the specifications • joints are secure and firm • bolted and screwed joints are tightened to the correct torque • riveted joints are free from excessive material deformation and hammer marks • pitch of holes meet the specification • completed joints are clean and free from burrs	
		1.12	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Assemble Components using Mechanical Fasteners	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	Explain the personal protective clothing and equipment to be worn when carrying out the joining activities (such as leather gloves, eye/ear protection, safety helmets)	

		2.3	Describe the hazards associated with the joining operations (such as handling sheet/fabricated components, drilling holes, handling and using sealants and cleaning agents, dangerous or badly maintained tools and equipment), and how they can be minimised	
		2.4	Describe 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	Describe the use of manufacturers' specifications for the types of fasteners used	
		2.7	Describe the various joining processes that are used, and the tools and equipment required	
		2.8	Describe the preparations to be carried out on the materials/components prior to joining them (such as materials to be degreased, dry and clean, with holes and flanges de-burred)	
		2.9	Explain how to set up and align the joints prior to fixing, and the tools and methods that can be used (such as clamps, rivet gripping tools, temporary fixings, jacking and supporting devices)	
		2.10	Describe how to produce a secure joint using blind rivets, and the type of riveting tools that are available	
		2.11	Describe how to produce a good solid riveted joint, and the use of the various riveting tools	
		2.12	Describe how to determine the length of the rivets required to give a properly formed rivet head and secure joint	
		2.13	Describe the range of bolts and screwed fasteners that are to be used; why it is important to use the correct type of washer; sequence of tightening bolts on flanged joints; and the tools and equipment used to ensure they are tightened to the required torque	
		2.14	Describe the checks to be carried out on the tools and equipment prior to use to ensure that they are in a safe, tested and usable condition (such as condition of plugs and leads on power tools, condition of striking faces on hammers, condition of riveting tools and rivet snaps)	
		2.15	Describe the equipment setting, operating and care procedures; explain why equipment and tools need to be correctly set up and in good condition	
		2.16	Describe the importance of using the tools only for the purpose intended; the care that is required when using the equipment and tools; the proper way of preserving and storing tools and equipment between operations	
		2.17	Describe the problems that can occur with the joining operations, and how these can be avoided	
		2.18	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.19	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Bonding Engineering Materials using Adhesives

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to undertake the joining of engineering materials using adhesive bonding processes, in accordance with approved procedures. The learner will be required to work to instructions, using appropriate or specified bonding agents for the materials to be joined, that meet the specified conditions and subsequent operating conditions to be demanded of the joint. Particular attention will be needed in the preparation of the materials and the application of the bonding agent, as well as the means of securing the joint until the setting or curing process has been completed, so that the finished component meets the level of accuracy required. The adhesive bonding agents used will include impact adhesives, cold curing adhesives, rubber mastic, solvent adhesives, epoxy resins and thermally cured adhesives. The joint will be of two or more materials and may include metallic and/or non-metallic materials and joints of dissimilar materials.

Unit introduction

The learner's responsibilities will require them to comply with organisational policies and procedures, and/or those of the bonding agent manufacturers. The learner will be expected to report any problems with the bonding agents, materials or bonding activities that they cannot resolve them self, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/504/9217
Qualification Framework		RQF
Title		Bonding Engineering Materials using Adhesives
Unit Level		Level 2
Guided Learning Hours		56
Unit Credit Value		14
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Bonding Engineering Materials using Adhesives	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Carry out all of the following during the adhesive bonding process: • correctly prepare the materials for bonding • select the right constituents and bonding methods • check the surfaces to be bonded mate properly to make a sound joint possible • ensure the joint is rigidly secure during the curing period • remove surplus material and clean up at the appropriate time	
		1.3	Follow the relevant bonding procedure specification and job instructions	
		1.4	• Check that the materials to be bonded and bonding agents comply with the specification	
		1.5	Carry out adhesive bonding activities using two of the following types of material: • metallic • non-metallic • combinations of materials	
		1.6	Use two of the following types of adhesives: • impact adhesives • cold curing adhesives • rubber mastic • solvent adhesives • epoxy resins • thermally cured adhesives	
		1.7	Correctly prepare the parent materials and bonding agents in line with the bonding specification	
		1.8	Carry out the bonding operations using the specified processes and techniques to position and bond the materials in their correct locations	

		1.9	Produce bonded joints in three of the following types of component: • flat and flanged joints on flat surfaces • flat and flanged joints on curved surfaces • vertical components • horizontal components • rectangular trunking • circular trunking • access flanges, panels and cover plates • tanks and tank covers • pipework	
		1.10	Use a range of bonding equipment and devices, to include four of the following: • mixing vessels • spatulas, brushes, knives • spray equipment • jigs • formers • clamps • presses • weights • temporary fixtures (clips, wiring)	
		1.11	Use a range of preparation and cleaning agents, to include two of the following: • detergents • solvents • petroleum products • acids	
		1.12	Ensure that any equipment used to maintain surface contact during the bonding activities is set up and used correctly	
		1.13	Achieve bonds of the required quality and within the specified dimensional accuracy which comply with all of the following: • components are dimensionally accurate and of the correct orientation • joints meet the required application standard • completed joints are clean and free from surplus adhesive • the completed joint has the required appearance	
		1.14	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Bond Engineering Materials using Adhesives	2.1	Explain the specific safety precautions to be taken when bonding engineering materials using adhesives in a fabrication environment (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations)	

		2.2	Explain the personal protective clothing and equipment to be worn when carrying out bonding as part of the fabrication activities (such as gloves, eye protection, safety helmets, respiratory protection)	
		2.3	Describe the importance of good workshop practice and house keeping, ventilation and fume control equipment, first aid procedures and actions, hazardous substances and relevant sections of COSHH	
		2.4	Describe the correct methods of moving or lifting sheet or plate materials	
		2.5	Describe the hazards associated with bonding fabricated components, and explain how they can be minimised	
		2.6	Describe 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	Describe the material preparations that are required, and the equipment and consumables that are used	
		2.9	Describe the importance of working to organisational and bonding agent manufacturers' instructions whilst carrying out the bonding activities	
		2.10	Describe the methods and techniques used for bonding the materials (such as gluing, impact, chemical and thermal reaction techniques)	
		2.11	Describe the basic characteristics of the adhesives that are to be used	
		2.12	Explain the application of, and precautions to be taken when using, adhesives and solvents	
		2.13	Describe the maintenance and care of tools and equipment	
		2.14	Describe the methods of degreasing components and producing a keying surface	
		2.15	Describe the type and suitability of the adhesives; setting or curing requirements and time, strength and appearance and shelf life	
		2.16	Describe the common causes of defects associated with the bonding processes, and how to avoid them	
		2.17	Describe the effects of the environment on the bonding process (such as temperature, humidity, cleanliness)	
		2.18	Describe how to identify, select, use, and clean, the appropriate bonding agent holding vessels, brushes, stirrers and spatulas, scrapers, knives, clamps and weights	
		2.19	Explain the importance of cleaning up after use, to ensure everything can be used again and to minimise the need for replacement of equipment	
		2.20	Describe the reasons for checking that components are assembled in the correct sequence, are positioned dimensionally accurately and to the correct orientation, in accordance with the specifications, prior to bonding	
		2.21	Describe how to check that completed joints are firm, sound and fit for purpose	

		2.22	Describe the procedures for cleaning off surplus adhesive and tidying up the appearance of joints	
		2.23	Describe the problems that can occur with the bonding operations, and how these can be avoided	
		2.24	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.25	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Joining Materials by Resistance Spot Welding

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and use portable, and simple fixed spot welding machines, in accordance with approved instructions or welding procedures. The learner will be expected to check that the equipment is fit for purpose, that electrodes are correctly profiled, and that the component parts are in the correct condition for spot welding. In preparing the equipment, the learner will need to set the welding current, welding and squeeze times and electrode pressure. The learner must operate the equipment safely and correctly and make any necessary adjustments to the equipment settings and parameters within permitted tolerances, in order to achieve a weld quality and tolerances that meet the specification.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/504/9218
Qualification Framework		RQF
Title		Joining Materials by Resistance Spot Welding
Unit Level		Level 2
Guided Learning Hours		35
Unit Credit Value		7
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Joining Materials by Resistance Spot Welding	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Confirm that the resistance spot welding equipment is fit for purpose, by carrying out all of the following checks: • equipment range is suitable for the operations to be performed • portable equipment power leads are undamaged and securely connected • electrodes are of the correct type, size and profile • all equipment mechanical and electrical systems operate correctly • supplies of components are adequate and suitably prepared • appropriate safety screens are available	
		1.3	Follow the relevant joining procedure and work instructions	
		1.4	Confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out	
		1.5	Set up, check, adjust and operate one of the following resistance spot welding machines: • portable spot welding machines • fixed simple spot welding machines	
		1.6	Set up the equipment parameters in accordance with instructions and the welding procedure specification, to include setting all of the following: • electrode tip diameter/profile • welding current • welding and squeeze times • electrode pressure • water cooling flow rate (as applicable)	
		1.7	Check that the parent material, components, consumables and joint preparation comply with specifications	
		1.8	Carry out and monitor the machine operations in accordance with specifications and job	

			instructions	
		1.9	Monitor the process operation and make adjustments to parameters, in order to produce welded components covering both of the following: • two different components • two different material thicknesses	
		1.10	Achieve joints of the required quality and specified dimensional accuracy	
		1.11	Produce welded components which meet all the following requirements: • achieve a weld quality as specified in the application standard • spot welds are correctly pitched out • welded components meet the required dimensional accuracy within specified tolerance	
		1.12	Make sure that the rate of output is as specified	
		1.13	Deal promptly and effectively with problems within their control and report those that they cannot solve	
		1.14	Shut down the equipment to a safe condition on conclusion of the joining activities	
2.	Know how to Join Materials by Resistance Spot Welding	2.1	Explain the specific safety precautions to be taken when operating resistance welding equipment (working with machinery, the use of appropriate personal protective equipment (PPE); the use of safety screens; operation of machine safety devices; closing down the machine on completion of the welding activities; statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with resistance welding equipment (dangers from live internal electrical components, fumes, hot metal, expulsion of hot particles, moving parts of machines), and how they can be minimised	
		2.3	Describe the basic principles of resistance welding; heat and pressure to form a weld; heating effect of welding current; principal features of the welded joint; heat input; welding and pressure cycles; terminology used in welding	
		2.4	Describe the key components and features of the equipment used (power source; welding head; power range; electrical parameters (such as arc voltage, current, electrode pressure and welding time); systems for parameter control; how variation in the parameters influence weld features, quality and output)	
		2.5	Explain how to extract the information required from the drawings and welding procedure specifications (to include symbols and conventions to appropriate BSEN or ISO standards in relation to the work undertaken)	
		2.6	Describe the operation of the machine controls and their function; equipment care procedures	
		2.7	Describe how to monitor the equipment during the welding process; fine tuning parameters to maintain quality; recognition of problems and action to be taken	
		2.8	Describe problems that can occur with the welding activities; materials and weld defects	

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

Level 2 Unit – Slinging, Lifting and Moving Materials and Components

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to move loads by slinging and lifting, in accordance with approved procedures. The learner will be required to use correctly specified items of lifting gear, which will include hand, and/or power operated cranes and winches, and associated lifting accessories. The learner must check that the lifting equipment is within current authorisation dates, is undamaged and within the permitted safe working load (SWL or working load limit (WLL)). The learner will be expected to correctly estimate the weight of the load to be moved and attach the appropriate slings to suitable or designated lifting points on the load in order to achieve a safe and balanced lift. The learner must check the area that the load will move through, to ensure that it is free from obstructions and is safe for the load to be moved. The learner will also be expected to give the correct hand and verbal signals during the lifting activities.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for the slinging, signalling and lifting activities undertaken, and to report any problems with the slinging and lifting equipment or the lifting activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with minimum supervision, taking personal responsibility for their own actions and for the safety and integrity of the materials being moved.

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		D/504/9260
Qualification Framework		RQF
Title		Slinging, Lifting and Moving Materials and Components
Unit Level		Level 2
Guided Learning Hours		56
Unit Credit Value		14
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Slinging, Lifting and Moving Materials and Components	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Confirm that the equipment to be used is suitable for the components being lifted, and is in a safe and usable condition, by checking all of the following: • equipment is certified and is compliant, within current test dates • all lifting equipment registers are up to date • all slings are free from obvious defects • the lifting equipment selected is suitable and has a sufficient SWL/WLL for the application • the identification number and SWL/WLL are clearly marked on the equipment selected • the equipment selected is suitable for the environment of operation	
		1.3	Find the weight of the materials/loads to be moved using all of the following: • check against documentation • calculation from drawings • by estimation • by converting metric-imperial	
		1.4	Use two of the following lifting and moving methods and techniques: • crane • winch • powered lifting equipment • lifting appliances • pulling appliances • multi-sheaved block combinations • hand operated lifting equipment • jacks, skates and trolleys	

		1.5	Position the moving equipment so that the weight of the load is evenly distributed	
		1.6	Attach the appropriate handling equipment securely to the load, using approved methods to eliminate slippage	
		1.7	Use two of the following slinging methods: • single-leg slings • two-leg slings • three- and four-leg slings	
		1.8	Confirm that the load is secure before moving	
		1.9	Move the load over the selected suitable route	
		1.10	Move two of the following types of loads: • sheet materials • pipes, bars, joists (single and in bundles) • fragile items • hot/radiant items • components with evenly distributed weight • components with uneven distributed weight • awkward shaped loads • corrosive substances/chemicals	
		1.11	Move loads safely and correctly, to be re-positioned in two of the following positions: • to differing elevations • as part of an assembly • through complex rigging operations • along the same elevation • turn a load	
		1.12	Position and release the load safely in its intended final location	
2.	Know how to Sling, Lift and Move Materials and Components	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 requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the hazards associated with slinging and lifting of loads, and how they can be minimised	
		2.3	Describe their understanding of ACOP for safe use of lifting equipment, and Lifting Operation & Lifting Equipment Regulations (LOLER) also BS 7121	
		2.4	Describe the specific requirements for the marking of lifting equipment, and the specific method used in the organisation in which they are working	
		2.5	Describe the range of equipment to be used for the lifting operations (such as hand and power operated cranes, winches pulling equipment)	

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

Level 2 Unit – Cutting Plate and Sections using Shearing Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required for cutting and shaping metal plate and sections (3 mm thickness and above) for fabrications using guillotines and section cropping machines, in accordance with approved procedures. The learner will be required to select the appropriate equipment and machine settings to use, for the material, thickness and the accuracy to be achieved. Items to be cut and shaped may include ferrous and non-ferrous materials, and will include parallel cuts, square cuts, and cuts that are at an angle. These cuts will be achieved by working to marking out, and by setting the machine's backstop when multiple cutting is required. This will call for care in selecting the right tools, so as to avoid damage to the materials and tools, or danger to oneself.

Unit introduction

This unit covers the skills and knowledge needed to prove the competences required for cutting and shaping metal plate and sections (3 mm thickness and above) for fabrications using guillotines and section cropping machines, in accordance with approved procedures. The learner will be required to select the appropriate equipment and machine settings to use, for the material, thickness and the accuracy to be achieved. Items to be cut and shaped may include ferrous and non-ferrous materials, and will include parallel cuts, square cuts, and cuts that are at an angle. These cuts will be achieved by working to marking out, and by setting the machine's backstop when multiple cutting is required. This will call for care in selecting the right tools, so as to avoid damage to the materials and tools, or danger to oneself.

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

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

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

Assessment

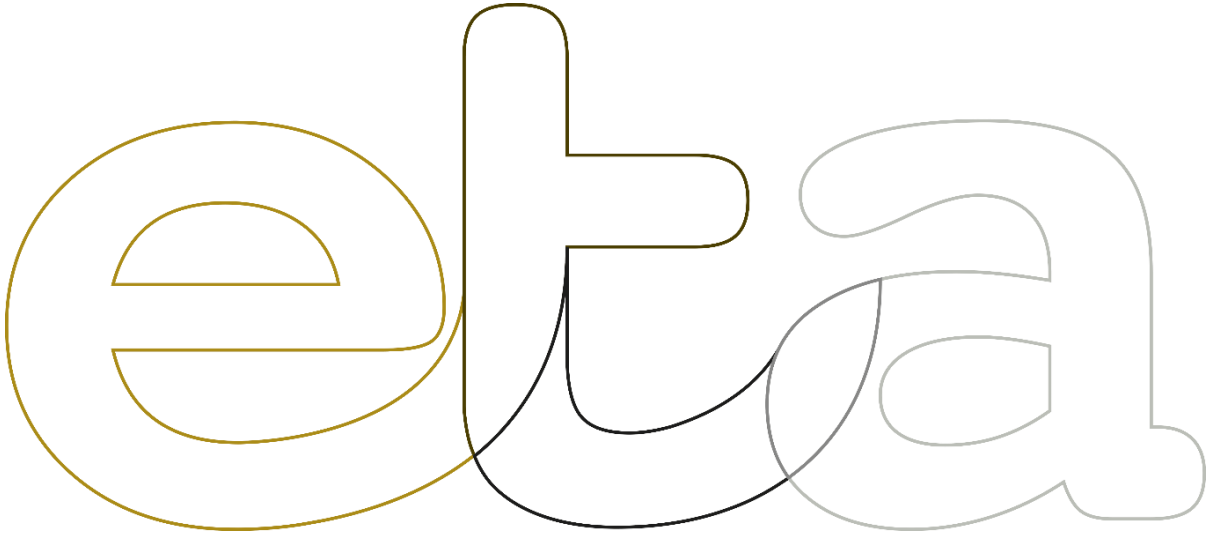
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/504/9291
Qualification Framework		RQF
Title		Cutting Plate and Sections using Shearing Machines
Unit Level		Level 2
Guided Learning Hours		98
Unit Credit Value		21
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting Plate and Sections using Shearing Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Confirm that the equipment is safe and fit for purpose by carrying out all of the following checks: • the appropriate equipment/machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly	
		1.3	Confirm that the machine is set up and ready for the machining activities to be carried out	
		1.4	Cut metal plate using both of the following types of shearing machine: • guillotines • section cropping machine	
		1.5	Manipulate the machine tool controls safely and correctly in line with operational procedures	
		1.6	Cut materials using both of the following techniques: • to markings • using machine backstop for multiple cutting	
		1.7	Perform operations that produce straight and accurate cuts, which include both of the following: • parallel cuts • square cuts	
		1.8	Cut plate, sections or bars for one material from the following: • mild steel • stainless steel • aluminium • brass or copper • tin plate • other specific materials	

		1.9	Produce components to the required quality and within the specified dimensional accuracy which meet all of the following: • dimensional accuracy is within the tolerances specified on the drawing/specification • cut components are free from excessive distortion • cut edges are neat and free from false tool cuts and shearing slivers	
		1.10	Carry out quality sampling checks at suitable intervals	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.12	Shut down the equipment to a safe condition on conclusion of the machining activities	
2.	Know how to Cut Plate and Sections using Shearing Machines	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 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 to be worn when carrying out the fabrication activities (such as leather gloves, eye protection, safety helmets)	
		2.3	Describe the safe working practices and procedures for operating machine tools	
		2.4	Describe the correct methods of moving or lifting heavy plate, and the equipment to be used	
		2.5	Describe the hazards associated with fabrication work and shearing operations (such as using dangerous or badly maintained tools and equipment; lifting and handling plate; operating machinery), and how they can be minimised	
		2.6	Describe 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	Describe how to interpret marking out conventions (such as cutting lines, centre lines)	
		2.9	Describe the various shearing machine cutting methods and techniques (such as cutting to marking out using machine backstops)	
		2.10	Describe the material handling and preparation methods (such as degreasing, de-burring, straightening)	
		2.11	Describe the material cutting characteristics and process considerations that need to be taken into account when shearing plate material	
		2.12	Describe how to set and adjust guillotine blades for the material thickness	
		2.13	Describe the tool and equipment care and control procedures, and explain how to recognise when the cutting blades require changing	
		2.14	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	

		2.15	Explain the safety mechanisms and devices that are on the machine, and explain why they must always be used (machine guards, interlocks, safety operating devices)	
		2.16	Describe the problems that can occur when using shearing machines, and explain how these can be avoided	
		2.17	Describe the inspection techniques that can be applied to check that shape and dimensional accuracy are to specification and within acceptable limits	
		2.18	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.19	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Cutting Materials using Hand Operated Thermal Cutting Equipment

Unit 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 assist in assembling and setting up the appropriate equipment to be used, for the material and thickness to be cut, the type of operation to be carried out and the accuracy to be achieved. Materials to be cut and shaped may include mild steel, stainless steel, special steels and other appropriate materials, and will include guided cuts, external curved contours, round and square holes and demolition work, as appropriate. This will call for care in the use of the equipment and tools, so as to avoid damage to the material and tools, and danger to oneself.

Unit introduction

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

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

The learner will understand the safety precautions required when working with the thermal cutting equipment, especially those with regards 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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

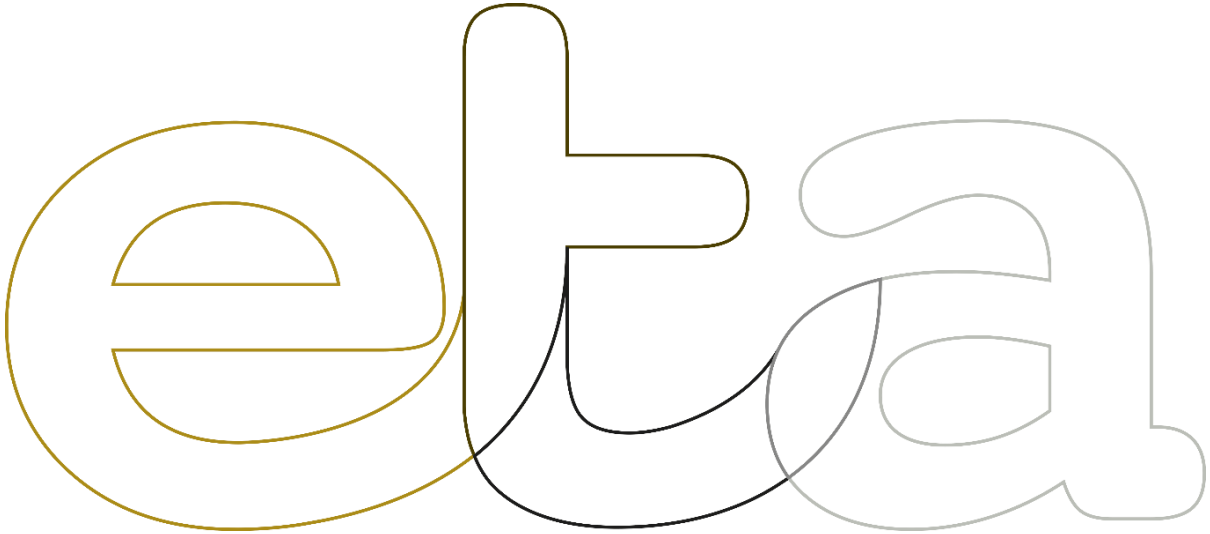
Unit Reference Number		M/504/9293
Qualification Framework		RQF
Title		Cutting Materials using Hand Operated Thermal Cutting Equipment
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting Materials using Hand Operated Thermal Cutting Equipment	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Use one of the following thermal cutting methods: • hand held oxy/fuel gas cutting equipment • hand held plasma gas cutting equipment • simple portable track driven cutting equipment (electrical or mechanical)	
		1.3	Confirm that the machine is set up and ready for the machining activities to be carried out by carrying out all of the following checks: • regulators, hoses and valves are securely connected and free from leaks and damage • the correct gas nozzle is fitted to the cutting torch • that a flashback arrestor is fitted to gas equipment • gas pressures are set and maintained as instructed • the correct procedure is used for lighting, adjusting and extinguishing the cutting flame • hoses are safely routed and protected at all times • gas cylinders are handled and stored safely and correctly	
		1.4	Manipulate the machine tool controls safely and correctly in line with operational procedures	
		1.5	Perform thermal cutting operations to produce four of the following features: • down-hand straight cuts (freehand) • down-hand straight cuts (track guided) • vertical cuts • square/rectangular shapes • irregular shapes • angled cuts • external curved contours • round holes	

			• square holes • rough cutting (demolition) • weld preparations	
		1.6	Produce thermal cuts in two of the following forms of material (metal of 3mm and above, and two different thickness): • plate • bar • rolled sections • pipe/tube • structures	
		1.7	Produce cut profiles for one type of material from the following: • mild steel • stainless steel • special steels • other appropriate metal	
		1.8	Produce components to the required quality and within the specified dimensional accuracy	
		1.9	Produce thermally cut components which meet all of the following: • dimensional accuracy is within the tolerances specified on the drawing/specification or within +/- 3 mm • angled cuts are within specification requirements (perpendicular/angularity) • cuts are clean and smooth and free from flutes	
		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	
2.	Know how to Cut Materials using Hand Operated Thermal Cutting Equipment	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 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 that needs to be worn when working with fabrications and thermal cutting equipment (such as leather aprons and gloves, eye protection, safety helmets)	
		2.3	Describe the correct methods of moving or lifting plate materials and components	
		2.4	Describe the hazards associated with thermal cutting (naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal, elevated working, enclosed spaces), and how they can be minimised	

		2.5	Describe the safe working practices and procedures for using thermal equipment in line with British Compressed Gas Association (BCGA) codes of practice, to include setting up procedures, permit-to-work procedures and emergency shutdown procedures	
		2.6	Describe how to obtain the necessary drawings and thermal cutting 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	Describe the thermal cutting process (basic principles of thermal cutting and related equipment; the various techniques and their limitation; care of the equipment to ensure that it is safe and ready to use)	
		2.9	Describe the various types of thermal cutting equipment available, and typical applications of each type	
		2.10	Describe the accessories that can be used with hand held thermal cutting equipment to aid cutting operations (such as guides, trammels, templates); arrangements for attaching cutting aids to the equipment	
		2.11	Describe the types of gases used in thermal cutting; gas identification and colour codes; their particular characteristics and safety procedures	
		2.12	Describe how to set up the thermal cutting equipment (connection of hoses, regulators and flashback arrestors, selection of cutting torch and nozzle size in relationship to material thickness and operations performed)	
		2.13	Describe the preparations that need to be carried out prior to cutting (checking connections for leaks, setting gas pressures, setting up the material/workpiece, checking cleanliness of materials used)	
		2.14	Explain the holding methods that are used to aid thermal cutting, and the equipment that can be used	
		2.15	Describe how to set the correct operating conditions (flame control and the effects of mixtures and pressures associated with thermal cutting)	
		2.16	Describe the correct procedure for lighting and extinguishing the flame, and the importance of following the procedure	
		2.17	Describe the procedures to be followed for cutting specific materials, and describe why these procedures must always be adhered to	
		2.18	Describe the material thermal cutting characteristics and material preparation requirements	
		2.19	Describe the terminology used in thermal cutting in relation to the operations being performed	
		2.20	Describe the problems that can occur with thermal cutting, and describe how they can be avoided; causes of distortion during thermal cutting and methods of controlling distortion	
		2.21	Describe the effects of oil, grease, scale or dirt on the cutting process	

		2.22	Describe the causes of cutting defects, how to recognise them, and methods of correction and prevention	
		2.23	Describe the quality requirements of the type of work being undertaken	
		2.24	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.25	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Cutting and Shaping Materials using Gas Cutting Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required for cutting and shaping plate (3mm thickness and above), rolled sections, pipe and tube for fabrications using gas cutting machines, in accordance with approved procedures. The learner will be required to assist in the assembling and setting up of the appropriate equipment to be used, for the material and thickness to be cut, the type of operation to be carried out and the accuracy to be achieved.

Materials to be cut and shaped may include mild steel, stainless steel, special steels and other appropriate materials, and will include straight cuts, external curved contours, round and square holes and internal curved contours. This will call for care in the use of the equipment and tools so as to avoid damage to the material, tools and danger to oneself.

Unit introduction

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

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

The learner will understand the safety precautions required when working with the gas cutting equipment, especially those with regards 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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		A/504/9295
Qualification Framework		RQF
Title		Cutting and Shaping Materials using Gas Cutting Machines
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting and Shaping Materials using Gas Cutting Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Confirm that the machine is set up, safe and ready for the cutting activities to be carried out by carrying out all of the following checks: • hoses and equipment are securely connected, and are free from leaks and damage • the correct gas nozzle is fitted to the cutting torch • appropriate gas pressures are set and maintained, as instructed • the correct procedure is used for lighting, adjusting and extinguishing the cutting flame • hoses are safely routed and protected at all times • where appropriate, gas cylinders are handled and stored, safely and correctly	
		1.3	Manipulate the machine tool controls safely and correctly in line with operational procedures	
		1.4	Perform thermal cutting operations to produce four of the following features: • straight cuts • square/rectangular shapes • irregular shapes • angled cuts • external curved contours • round holes • square holes • internal curved contours • weld preparations	
		1.5	Produce thermal cuts in two of the following forms of material (metal of 3mm and above, and two different thickness): • plate • bar	

			• rolled sections • pipe/tube	
		1.6	Produce cut profiles for one type of material from the following: • mild steel • stainless steel • special steels • other appropriate metal	
		1.7	Produce components to the required quality and within the specified dimensional accuracy	
		1.8	Produce cut components which meet all of the following quality and accuracy standards: • dimensional accuracy is within the tolerances specified on the drawing/specification or within +/- 2 mm • angled cuts are within specification requirements (perpendicular/angularity) • cuts are clean and smooth and free from flutes	
		1.9	Carry out quality sampling checks at suitable intervals	
		1.10	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.11	Shut down the equipment to a safe condition on conclusion of the machining activities	
2.	Know how to Cut and Shape Materials using Gas Cutting Machines	2.1	Explain the specific safety precautions to be taken when working with gas cutting machines in a fabrication environment (general workshop and site safety, appropriate personal protective equipment, fire and explosion prevention, protecting other workers, safety in enclosed/confined spaces; fume control; accident procedure; statutory regulations)	
		2.2	Explain the personal protective clothing and equipment (PPE) that needs to be worn when working with fabrication materials and gas cutting equipment (such as leather aprons and gloves, eye/ear protection, safety helmets)	
		2.3	Describe the correct methods of moving or lifting plate materials and components	
		2.4	Describe the hazards associated with using gas cutting machines (such as naked flames, fumes and gases, explosive gas mixtures, oxygen enrichment, spatter, hot metal), and explain how they can be minimised	
		2.5	Describe the safe working practices and procedures for using gas cutting machines in line with British Compressed Gas Association (BCGA) Codes of practice to include setting up procedures, permit-to-work procedures and emergency shutdown procedures	
		2.6	Describe how to obtain the necessary drawings and gas cutting 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	Describe how to interpret the drawings or sketches in first or third angle projection	

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

Level 2 Unit – Cutting Materials using Saws and Abrasive Discs

Unit 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.

Unit introduction

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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		L/504/9219
Qualification Framework		RQF
Title		Cutting Materials using Saws and Abrasive Discs
Unit Level		Level 2
Guided Learning Hours		42
Unit Credit Value		13
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting Materials using Saws and Abrasive Discs	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Use two of the following types of cutting equipment: • machine saw • band saw • hand held portable abrasive disc • radiac abrasive disc	
		1.3	Ensure that the equipment is fit for purpose and used safely by carrying out all of the following: • selecting the appropriate equipment/machine for the operation being performed • checking that machine guards and safety devices are in position and function correctly • checking that cutting discs/blades are in a serviceable condition (sharp, and free from damage or chips) • isolating the equipment from its power supply whilst changing blades or discs using the equipment safely and correctly and only for its intended purpose	
		1.4	Confirm that the machine is set up and ready for the machining activities to be carried out	
		1.5	Manipulate the machine tool controls safely and correctly in line with operational procedures	
		1.6	Carry out all of the following cutting and shaping activities: • straight sawing • abrasive disc cutting • contour shaping using saws	
		1.7	Cut and shape components which contain all of the following features: • straight parallel cuts • square cuts	

			• curved contours • angled/mitred cuts	
		1.8	Cut and shape three of the following forms of material: • flat plate • solid bar (such as square, round, hexagonal) • rolled sections (angle, channel, RSJ) • pipe/tube • rail section • non-ferrous material	
		1.9	Produce components to the required quality and within the specified dimensional accuracy	
		1.10	Produce components that comply with all of the following quality and accuracy standards: • material dimensional accuracy is within specification tolerances • cuts are square, clean and free from excessive burrs • angled cuts are within specification requirements	
		1.11	Carry out quality sampling checks at suitable intervals	
		1.12	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.13	Shut down the equipment to a safe condition on conclusion of the machining activities	
2.	Know how to Cut Materials using Saws and Abrasive Discs	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	

Level 2 Unit – Bending and Forming Plate using Power Operated Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required for bending and forming plate (of 3mm and above) for fabrications using power operated equipment such as press brakes, bending machines and power presses, in accordance with approved procedures. The learner will be required to operate the appropriate bending and forming equipment, in accordance with the instructions for the operations being performed. The learner will need to ensure that all the required safety devices are operating correctly, and that the machine guards are in place and correctly adjusted.

Items to be bent and formed may include ferrous and non-ferrous materials, and tasks will include producing bends of various angles, setting plate ends for rolling operations, and producing curved sections. This will call for care in selecting the right tools, so as to avoid damage to the tools and danger to oneself.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/504/9296
Qualification Framework		RQF
Title		Bending and Forming Plate using Power Operated Machines
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Bending and Forming Plate using Power Operated Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Operate one of the following types of power-operated bending equipment: • press brakes • powered bending machine • power press • rolls	
		1.3	Confirm that the equipment is safe to use and fit for purpose, by carrying out all of the following checks: • the appropriate machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly	
		1.4	Confirm that the equipment is set up correctly and is ready for use	
		1.5	Manipulate the machine controls safely and correctly in line with operational procedures	
		1.6	Perform operations that produce all of the following: • bends at 90° • bends of various angles using various bend radii • set plate ends • box, square and rectangular sections • curved plates	
		1.7	Bend and form metal plate of 3mm or greater thickness, for one appropriate material and two thicknesses: • mild steel • stainless steel • aluminium • special metals	

		1.8	Produce components to the required specification	
		1.9	Produce components that conform to all of the following quality and accuracy standards: • bend position and dimensional accuracy is within the specification tolerances • the form or sharpness of the bend conforms to best practice and or specification, without deformation or cracking • the bend conforms to the required shape/geometry (to the template profile)	
		1.10	Carry out quality sampling checks at suitable intervals	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.12	Shut down the equipment to a safe condition on conclusion of the machining activities	
2.	Know how to Bend and Form Plate using Power Operated Machines	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 requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Explain the correct protective clothing, and handling precautions to be taken, when working with heavy platework	
		2.3	Describe the correct methods of moving or lifting sheet or plate materials	
		2.4	Describe the hazards associated with power operated bending and forming processes (such as handling heavy sheet materials and components; operating moving equipment; using faulty or badly maintained tools and equipment), and how they can be minimised	
		2.5	Explain the safe working practices and procedures required for operating power-operated bending machines	
		2.6	Describe 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	Describe the marking out conventions applicable to the bending process (such as centre lines; bending lines)	
		2.9	Describe the various types of power-operated bending machines that are used, and their typical applications	
		2.10	Describe ways of limiting distortion, marking and creases in the finished workpiece	
		2.11	Describe the preparations to be carried out on the materials prior to bending them	
		2.12	Describe the basic characteristics of the materials with regard to the bending operations undertaken	
		2.13	Describe the need to take care of the bending tools and equipment; how to recognise faulty or damaged forming tools; how bending and forming tools should be stored	

		2.14	Describe the problems that can occur with the bending and forming activities, and explain how they can be avoided	
		2.15	Describe the organisational quality control procedures that are used, and explain how to recognise defects in the bends that they produce	
		2.16	Explain how to make dimensional and forming inspection checks, and the tools and equipment that can be used	
		2.17	Describe the accuracy and limitations of processes	
		2.18	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.19	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Forming Platework using Power Rolling Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to bend and form plate for fabrications, in accordance with approved procedures, using power-operated pinch or pyramid rolls which may be hand adjusted or console controlled. The learner will be required to operate the power rolling machine as instructed, based on the operations to be performed and the thickness and size of the material to be rolled. Setting the rolls will involve setting and adjusting the gap between feed and forming rolls to suit plate thickness, positioning side roller(s) and adjusting to suit the required radius, checking and setting parallelism of rollers, and applying suitable pressure to rollers throughout the forming operation.

The learner will be expected to carry out the rolling operation in a manner that ensures material is formed to the required profile without flats or deformities. The learner will also need to ensure that all the required safety devices are operating correctly, and that the machine guards are in place and correctly adjusted. Items to be rolled may include ferrous and non-ferrous materials and will include operations such as rolling cylinders and cones, producing curved sections, counter-curved sections, pipe sections and plate straightening. This will call for care in using the right machine for the job, and using it in the correct way, so as to avoid damage to the tools and danger to oneself.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/504/9297
Qualification Framework		RQF
Title		Forming Platework using Power Rolling Machines
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Forming Platework using Power Rolling Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Use one of the following types of power rolling machine: • powered rolls (hand adjusted) • powered rolls (console adjusted) • different roll sizes (diameter and power)	
		1.3	Confirm that the equipment is safe to use and fit for purpose, by carrying out all of the following checks: • the rolls are appropriate for the material used and the operations being performed • the machine guards and safety devices are in position and operating correctly • rolls are appropriate for the operation and are in a serviceable condition (suitable diameter; free from damage) • roll settings are suitable for the material thickness and operations to be performed • equipment for supporting the plate at the start of the rolling operations is in place	
		1.4	Confirm that the equipment is set up correctly and is ready for use	
		1.5	Manipulate the machine controls safely and correctly in line with operational procedures	
		1.6	Perform rolling operations that produce three of the following: • cylinders • cones • segments of a cylindrical tank • curved section or sector of an otherwise flat plate • counter-curved sections • pipe sections • flattening or straightening plate	

		1.7	Carry out rolling operations on one type of material from the following: • carbon steel • stainless steel • aluminium • special metals	
		1.8	Produce components to the required specification	
		1.9	Produce rolled components that conform to all of the following quality and accuracy standards: • dimensional accuracy is within the specification tolerances • the rolled section conforms to best practice and/or specification, without deformation or cracking • the component conforms to the required shape/geometry (to the template profile)	
		1.10	Carry out quality sampling checks at suitable intervals	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.12	Shut down the equipment to a safe condition on conclusion of the machining activities	
2.	Know how to Form Platework using Power Rolling Machines	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 requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the checks that need to be carried out to ensure that the power rolls are safe and are in a fit condition to use	
		2.3	Explain the personal protective clothing and equipment to be worn when working with heavy platework (such as gloves, eye/ear protection, safety helmets)	
		2.4	Describe the handling precautions and correct methods of moving or lifting sheet or plate materials	
		2.5	Explain the hazards associated with fabrication work (such as handling sheet/fabricated components, using hot metal techniques, using dangerous or badly maintained tools and equipment, moving parts of power rolling machines), and how they can be minimised	
		2.6	Describe 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	Describe the marking out conventions used in platework, and how to recognise the bending, forming and cutting lines	
		2.9	Describe the basic principle of operation of the power rolling machine used, and the type of work it can perform	

		2.10	Describe how to set up the machine to produce the required form (cylinders, cones, curved sections, straightening plates)	
		2.11	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)	
		2.12	Describe how to release the rolls and remove the workpiece when rolling cylindrical and conical sections	
		2.13	Describe the ways of limiting distortion, marking, creases and flats in curved sections	
		2.14	Describe how the materials need to be prepared prior to rolling, and the effects of raw material scale or burrs on the finished article	
		2.15	Describe the material characteristics with regard to forming using rolling machines	
		2.16	Describe the care and maintenance procedures to be observed to ensure the machines are in a serviceable condition	
		2.17	Describe the problems that can occur with the forming activities, and how they can be avoided	
		2.18	Describe the organisational quality control procedures, and explain how to recognise rolling defects	
		2.19	Describe the inspection checks to be carried out, and the tools and equipment that are used	
		2.20	Describe the accuracy that can be achieved by rolling, and explain the limitations of the rolling processes	
		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	

Level 2 Unit – Producing Platework Assemblies

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to produce heavy platework (3mm thick plate and above) assemblies, in accordance with instructions and approved procedures. The learner will be required to interpret specifications and drawings correctly, to bring together, prepare for joining and assemble, in the right order, platework components and sections, in order to construct completed fabricated assemblies or sub-assemblies, such as square and rectangular plate structures, covers and side plates, tanks, pressure vessels, cylindrical sections, conical sections, reduction pieces, simple and complex boiler seatings. The learner will be required lay out and secure the various component parts of the structure, using mechanical fastenings, temporary tack welding, flanged and mechanically fastened or adhesive bonding techniques, in the correct order and ensuring they are assembled in a manner that is fit for purpose.

Unit introduction

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

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		L/504/9298
Qualification Framework		RQF
Title		Producing Platework Assemblies
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Platework Assemblies	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Carry out all of the following during the platework assembly operations: • correctly prepare and set up the components and faces to be joined • use the correct datum faces • use the specified or appropriate fixing method • correctly align the components and faces to be joined • assemble/fabricate the platework components in the correct order or manner as per the build sequence • produce an assembly which meets the required specification	
		1.3	Follow the relevant instructions, assembly drawings and any other specifications	
		1.4	Confirm that the specified components are available and that they are in a usable condition	
		1.5	Use four of the following types of components in the assemblies produced: • plates or covers • pre-fabricated square/rectangular components • pre-fabricated cylindrical/conical components • brackets • flanges • pipes • rolled section components (angle, channel or tee section)	
		1.6	Use the appropriate methods and techniques to assemble the components in their correct positions	
		1.7	Assemble platework components, using two of the following methods: • temporary tack welding • clamped or jigged	

			• riveting (hot or cold) • flanged and mechanically fastened (nuts and bolts) • adhesive bonding	
		1.8	Secure the components using the specified connectors and securing devices	
		1.9	Produce four of the following platework assemblies: • frames • tanks • covers and side plates • square, rectangular and box sections • cylindrical • conical • reduction pieces • segmented bends • steel and composite material assemblies • simple or complicated seatings (tank or boiler seats)	
		1.10	Check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification	
		1.11	Produce platework assemblies which meet all of the following quality and accuracy standards: • all components are correctly assembled and aligned in accordance with the specification • overall dimensions are within specification tolerances • assemblies meet appropriate geometric tolerances (square, straight, angles, free from twists) • where appropriate, pitches of erection holes meet specification requirements • completed assemblies have secure and firm joints, and are clean and free from burrs or flash	
		1.12	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Produce Platework Assemblies	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 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 to be worn when carrying out the fabrication activities (such as leather gloves, eye protection, safety helmets, ear protection)	
		2.3	Describe the safe working practices and procedures for producing platework assemblies	
		2.4	Describe the correct methods of moving or lifting bulky and heavy fabrications	

		2.5	Describe the hazards associated with platework fabrication and assembly work (such using dangerous or badly maintained tools and equipment; lifting and handling long and heavy components; cuts, slips trips and falls), and how they can be minimised	
		2.6	Describe 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	Describe how to interpret the marking out conventions (such as cutting lines; centre lines)	
		2.9	Describe the preparations to be carried out on the components prior to assembling them	
		2.10	Describe the various methods of securing the assembled components (nuts and bolts; tack welding methods and techniques; hot and cold riveting; adhesive bonding of components)	
		2.11	Explain how to set up and align the various components, and describe the tools and equipment to be used	
		2.12	Describe how to hold the joints together to aid the assembly activities (jigs, clamps, rivet clamps, jacks and wedges)	
		2.13	Describe the use and care of tools and equipment, and describe their control procedures	
		2.14	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	
		2.15	Describe the problems that can occur when producing platework assemblies, and explain how these can be avoided	
		2.16	Describe the inspection techniques that can be applied to check that shape (including straightness) and dimensional accuracy is to specification and within acceptable limits	
		2.17	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.18	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Producing Holes using Drilling Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to produce holes in sheet, plate, rolled section or pipe, using drilling machines, in accordance with approved procedures. The learner will be required to select the appropriate drilling equipment to use, based on the operations to be performed and the size of the component worked on. The learner will be expected to use appropriate work holding methods and techniques to secure the work piece for the drilling operations, and this will include the use of jigs, clamps, machine vice and other appropriate holding devices. In drilling the holes, the learner will need to position the drill bits accurately and use appropriate speeds and feeds to drill and finish the holes to the required specification. Drilling and finishing operations will include through holes, blind holes, counterbored holes, countersunk holes, spot facing, reaming and tapping.

Unit introduction

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

The learner's knowledge will be sufficient to provide a good understanding of their work and will provide an informed approach to applying the drilling and finishing procedures. The learner will have an understanding of the drilling equipment used and its application, together with the material characteristics and the appropriate tooling for carrying out the drilling and finishing process. The learner will know about the basic principles and requirements of securing the work piece prior to carrying out the process, in adequate depth to provide a sound basis for carrying out the drilling activities, correcting faults and ensuring the work output meets the required specification.

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		R/504/9299
Qualification Framework		RQF
Title		Producing Holes using Drilling Machines
Unit Level		Level 2
Guided Learning Hours		49
Unit Credit Value		10
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Holes using Drilling Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Use two of the following drilling machines: • hand held drilling machine • pillar/bench drill • radial arm drill • other types of clamped drills (such as magnetic, vacuum)	
		1.3	Use two of the following work holding devices: • jigs/fixtures • machine vice • clamps • 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: • selecting the appropriate drilling equipment/machine for the operation being performed • checking that machine guards and safety devices are in position and function correctly • checking that drill bits and cutting tools are in a serviceable condition (sharp, free from damage or chips) • isolating the equipment from its power supply whilst changing drill bits • securely clamping/restraining the components during the drilling operations • using the equipment safely and correctly and only for its intended purpose	
		1.5	Confirm that the machine is set up and ready for the machining activities to be carried out	
		1.6	Manipulate the machine tool controls safely and correctly in line with operational procedures	

		1.7	Carry out three of the following drilling and finishing operations: • drilling through holes • drilling holes to a depth • counterboring holes • countersinking holes • centre drilling • spot facing • trepanning holes • tapping holes • jig or template drilling • component alignment drilling	
		1.8	Produce drilled holes in two of the following material types: • ferrous sheet metal • stainless steel sheet metal • non-ferrous sheet metal • ferrous plate or components • stainless steel plate or components • non-ferrous plate or components • non-metallic materials • composite materials	
		1.9	Produce components to the required quality and within the specified dimensional accuracy which meet all of the following, as applicable to the process: • dimensional and positional accuracy is within specification tolerances • drilled holes are correctly formed and free from excessive tool marks • counterbores, countersinks and spot facings meet job requirements	
		1.10	Carry out quality sampling checks at suitable intervals	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.12	Shut down the equipment to a safe condition on conclusion of the machining activities	
2.	Know how to Produce Holes using Drilling Machines	2.1	Explain the specific safety precautions to be taken when working in a fabrication environment and when carrying out drilling and finishing operations on materials used in fabrication (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; 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 to be worn when carrying out the fabrication activities (such as leather gloves, eye/ear protection, safety helmets)	
		2.3	Describe the correct methods of moving or lifting materials	

		2.4	Describe the safe working practices and procedures to be used when using portable power operated tools and drilling machines (including emergency stop procedures for the machines)	
		2.5	Describe the hazards associated with drilling work (such as using dangerous or badly maintained tools and equipment; insecure or poorly clamped workpieces; airborne metal particles; sharp edges and splinters), and how they can be minimised	
		2.6	Describe how to obtain the necessary drawings, specifications and work instructions	
		2.7	Explain 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 various types and application of drilling machines (including portable power tools, bench and pedestal machines and radial arm machines)	
		2.10	Describe the range of drilling and hole finishing tools available (including twist drills, reamers, counterbore tools, countersink tools, spot facing tools) and how to check their serviceability	
		2.11	Describe the methods of holding and securing the drills and finishing tools into the machine spindle (chucks, taper shank sleeves, collet chucks)	
		2.12	Describe how to hold and secure the workpieces for drilling (including jigs and fixtures, machine vices, clamps and restraining devices)	
		2.13	Describe the methods used to align the drill with the workpiece, and describe the use of centre drills and pilot drills	
		2.14	Describe how to check that the drill hole is in the correct position before drilling to the full diameter	
		2.15	Describe how to correct a drill that has been started off centre	
		2.16	Describe how to determine the correct speeds and feeds for drilling, reaming and finishing operations	
		2.17	Describe how to select the correct cutting fluids and compounds for drilling	
		2.18	Describe how to set and adjust the tools and equipment (use of depth stops)	
		2.19	Describe the material characteristics and process considerations to be taken into account when carrying out drilling operations	
		2.20	Describe the care and control of tools and equipment; checking portable power tool leads, plugs and sockets are in a safe, tested 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 that dimensional accuracy and finish is to specification and within acceptable limits	
		2.24	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.25	Explain the reporting lines and procedures, line supervision and technical experts	

Level 2 Unit – Forming Structural Sections using Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to bend and form rolled sectional material using presses, bending machines and power rolls, in accordance with instructions and approved procedures. The learner will be required to use the most appropriate type and size of machine, based on the operations to be performed and the type and section of material being used. In producing the components, the learner will be required to operate the equipment safely and correctly to form the material to the required profile without flats or deformities. The operations to be performed will include bending beams, curved beams, circular sections, counter curved sections, twisted beams and straightening of beams.

Unit introduction

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

The learner's knowledge will be sufficient to provide a good understanding of their work and will provide an informed approach to forming structural section material using power machine procedures. The learner will have an understanding of the forming equipment being used, the forming principles, and their application, and will know about the processes involved and their limitations, in sufficient depth to provide a sound basis for carrying out the activities, correcting any faults and ensuring the work output is produced to the required specification.

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

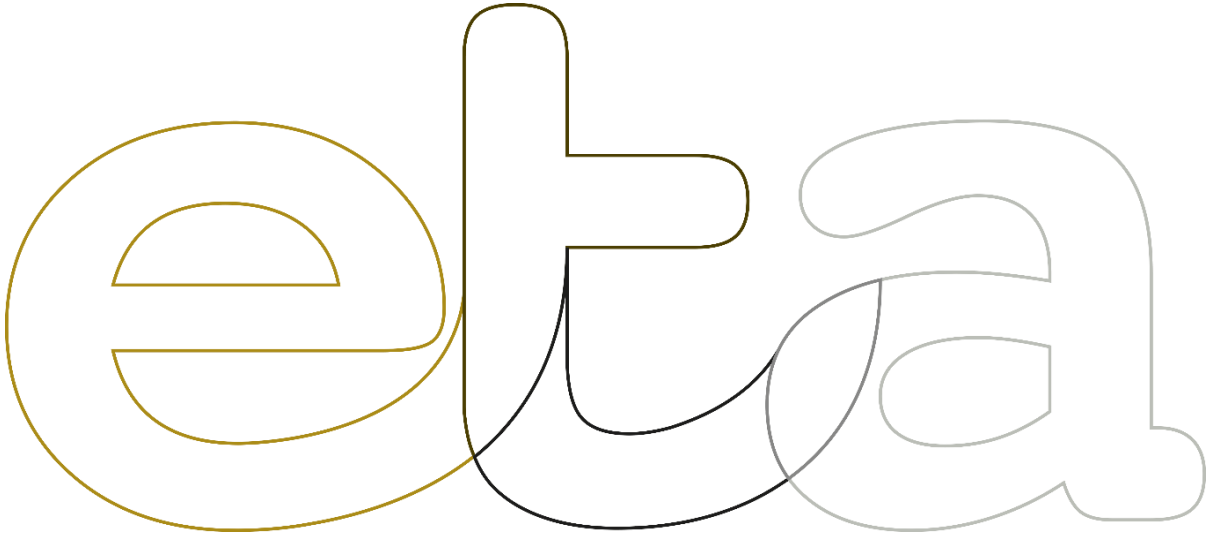
Unit Reference Number		A/504/9300
Qualification Framework		RQF
Title		Forming Structural Sections using Machines
Unit Level		Level 2
Guided Learning Hours		119
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Forming Structural Sections using Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Use one of the following types of machines: • power press • hammer machines • section bending machine • powered rolls • special-purpose machines	
		1.3	Confirm that the equipment is set up correctly and is ready for use by carrying out all of the following checks: • the appropriate machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly • forming tools are appropriate and in a serviceable condition (secure, correct shape, free from damage) • machine settings are suitable for the material thickness and operations to be performed	
		1.4	Manipulate the machine controls safely and correctly in line with operational procedures	
		1.5	Produce formed structural sections which contain three of the following features: • right-angled bends • angular bends • curved beams • circular sections • counter-curved sections • twisted section • straightening	
		1.6	Bend and form structural components made from three of the following forms of material:	

			• rolled steel joists (RSJ) • angle section • channel section • tee angle • structural tubes/pipes • extrusions • other specific components	
		1.7	Produce components to the required specification	
		1.8	Produce structural components which meet all of the following quality and accuracy standards: • bend position and dimensional accuracy is within the specification tolerances • the form or sharpness of the bend conforms to best practice and/or specification, without deformation or cracking • the bend conforms to the required shape/geometry (to the template profile)	
		1.9	Carry out quality sampling checks at suitable intervals	
		1.10	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.11	Shut down the equipment to a safe condition on conclusion of the machining activities	

2.	Know how to Form Structural Sections using Machines	2.1	Explain the specific safety precautions to be taken when working with power operated bending and forming equipment (such as presses, bending machines and rolling machines) in a fabrication environment	
		2.2	Describe the general workshop and site safety requirements, statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials	
		2.3	Explain the correct personal protective equipment (PPE) and handling precautions to be taken when working with structural section materials (such as gloves, eye protection, safety helmets, ear protection)	
		2.4	Describe the handling precautions and correct methods of moving or lifting heavy structural sections (such as RSJs)	
		2.5	Describe the hazards associated with power-operated bending processes (such as handling heavy structural materials and components; operating moving equipment; using faulty or badly maintained tools and equipment), and how they can be minimised	
		2.6	Describe the safe working practices and procedures for operating power operated bending and forming machines	
		2.7	Describe how to obtain the necessary structural drawings and bending procedure specifications	

		2.8	Explain 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	Describe 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 for structural section materials, and their typical applications	
		2.11	Explain how to prepare the machine for a range of different bends (angled bends, curved sections, twisted sections and straightening of sections)	
		2.12	Describe the types of bending tools that are used for the various operations, and explain how they are secured and set to the machine's toolholding device	
		2.13	Describe ways of limiting distortion, marking and creases in the finished workpiece	
		2.14	Describe the preparations to be carried out on the materials prior to bending them	
		2.15	Describe the basic characteristics of the materials with regard to the bending operations undertaken	
		2.16	Describe why some materials may require a heating process before bending begins	
		2.17	Describe 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 describe how they can be avoided	
		2.19	Describe the organisational quality control procedures that are used, and how to recognise defects in the bends that they produce	
		2.20	Describe how to make dimensional and forming inspection checks, and the tools and equipment that can be used	
		2.21	Describe the accuracy and limitations of the processes	
		2.22	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.23	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Producing Structural Steel Ancillary Components

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to cut and shape plate or section materials to produce structural steel components such as fishplates, gussets, brackets, support pads and bed plates, in accordance with approved procedures. The learner will be required to interpret drawings, mark out simple shapes and hole positions, cut out and shape plate and sections, drill and prepare structural components ready for the assembly of major structural components.

Unit introduction

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

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

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

Assessment

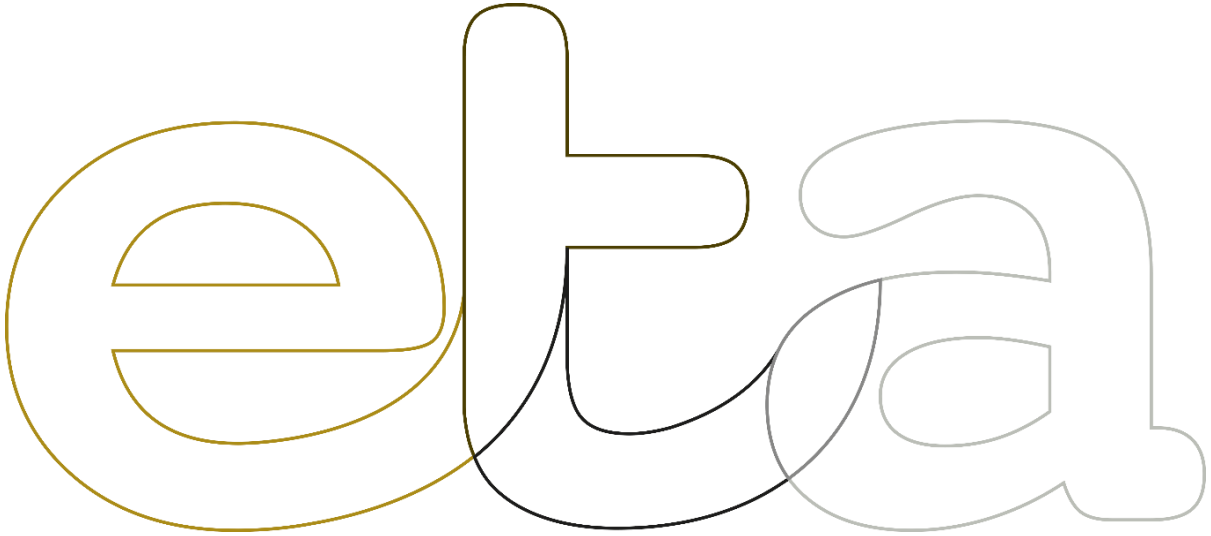
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/504/9302
Qualification Framework		RQF
Title		Producing Structural Steel Ancillary Components
Unit Level		Level 2
Guided Learning Hours		111
Unit Credit Value		24
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Structural Steel Ancillary Components	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Carry out all of the following during the manufacturing activities: • use the tools and equipment safely and correctly and only for its intended purpose • mark out the components accurately using recognised conventions • set up and hold the components firmly during the shaping operations • use approved and safe cutting and shaping methods at all times • produce the components to the correct size and shape • ensure all holes are of the correct size and are at the correct centres for fixings	
		1.3	Follow relevant specifications for the component to be produced	
		1.4	Obtain the appropriate tools and equipment for the shaping operations and check they are in a safe and usable condition	
		1.5	Shape the materials using appropriate methods and techniques	
		1.6	Cut and shape material to the marked-out shape, using three of the following methods: • shearing/cropping • sawing • burning • drilling • bending	
		1.7	Produce structural steel components, to include three of the following: • fishplates • gussets • brackets • support pads	

			• flanges • bed plates • tie bars • stiffening plates	
		1.8	Produce structural steel components from both of the following: • steel plate (3mm or greater thickness) • rolled steel section	
		1.9	Check that all the required shaping operations have been completed to the required specification	
		1.10	Produce structural steel components which are cut and shaped to meet all the following quality and accuracy standards: • company/customer standards requirements • dimensionally accurate (to drawing or specifications) • free from distortion • free from sharp edges, slivers or burrs	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Produce Structural Steel Ancillary Components	2.1	Explain the specific safety precautions to be taken when working in a fabrication environment and when cutting plate or rolled sections to shape (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; 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 to be worn when carrying out the fabrication activities (such as leather gloves, eye/ear protection, safety helmets)	
		2.3	Describe the correct methods of moving or lifting plate and rolled section materials	
		2.4	Describe the safe working practices and procedures to be observed when using manual and power-operated tools	
		2.5	Describe the hazards associated with fabrication work (such as using dangerous or badly maintained tools and equipment; operating shearing machines; handling plate and fabricated components; using hot metal techniques), and how they can be minimised	
		2.6	Describe the procedures for obtaining the necessary drawings and specifications, and describe how to check that they are the latest issue	
		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 the preparations to be carried out on the material prior to marking out, to enhance clarity, accuracy and safety	
		2.9	Describe the principles of marking out, and the tools and equipment that are used	

		2.10	Describe the use of marking out conventions (such as datums, cutting detail, centre lines)	
		2.11	Describe ways of laying out the shapes/patterns to maximise the use of plate or sheet materials	
		2.12	Explain how to mark out and transfer information from templates, and how to transfer information to the underside of the plate	
		2.13	Describe the tools and techniques available for cutting and shaping plate and section materials (such as shearing machines, saws, burning equipment, drills)	
		2.14	Describe the use and care of tools and equipment, including checks that need to be made to ensure that the tools are fit for purpose (cutting tools are sharp and undamaged; plugs and cables secure and free from damage; machine guards or safety devices operating correctly)	
		2.15	Describe how to produce weld preparations, and the type of preparations required for different joints and material thicknesses	
		2.16	Describe how to set and adjust the tools and equipment including the use of backstops on guillotines	
		2.17	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	
		2.18	Describe the safety and control procedures for shaping plate and rolled steel sections	
		2.19	Describe problems that can occur with cutting and shaping plate and section materials, and describe how these can be avoided	
		2.20	Describe the use of machine guards and safety protection equipment	
		2.21	Describe the inspection techniques that can be applied to check that shape and dimensional accuracy is to specification and within acceptable limits	
		2.22	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.23	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Assembling Structural Steelwork

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the trial assembly of pre-fabricated structural steelwork, prior to its assembly and erection on site, to specification and in accordance with approved procedures. Steelwork can include any structural framing material, and will include such items as support structures, building frames and roofs, mezzanine platforms, rigs, access staging and platforms.

Unit introduction

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

The learner's knowledge will be sufficient to provide a good understanding of their work and will provide an informed approach to applying structural steel assembly procedures. The learner will have an understanding of the principles and processes associated with the assembly of the structures, and their application. The learner will know about the ways of handling structural steelwork and the means of fixing them in position, as well as the care and use of the tools and equipment, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when assembling the structural components and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

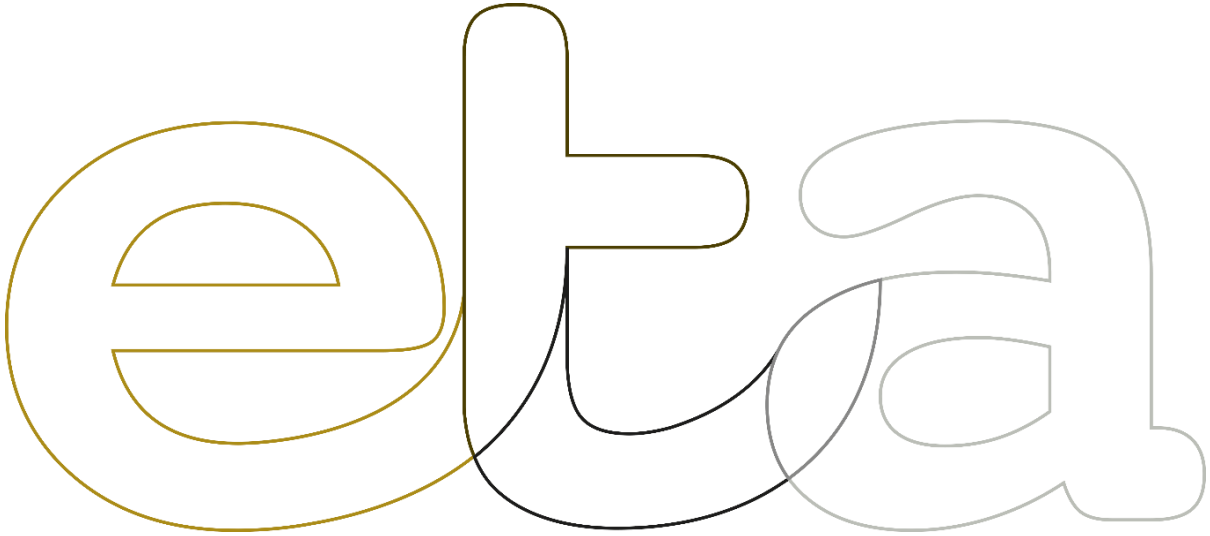
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		L/504/9303
Qualification Framework		RQF
Title		Assembling Structural Steelwork
Unit Level		Level 2
Guided Learning Hours		119
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Assembling Structural Steelwork	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Determine what has to be done and how this will be achieved	
		1.3	Carry out all of the following during the structural assembly operations: • comply with health and safety and site regulations at all times • use safety and personal equipment (such as safely helmet, footwear and gloves) • use the correct construction drawings and interpret them correctly • correctly prepare the components and faces to be erected and assembled • use the correct datum faces • assemble the structural components in the correct order and manner • correctly align the components and faces to be joined • use the specified or appropriate fixing method, and ensure all bolts are tightened to the required torque • produce an assembly which meets the required specification	
		1.4	Select the appropriate construction elements and check that they are in a usable condition	
		1.5	Use four of the following types of components in the assemblies produced: • columns • beams • roof trusses • frames • bed plates • staircases • bulkheads • roof sheeting/cladding • fishplates	

			• brackets • support plates • guards and hand rails • safety cages • platforms and ladders	
		1.6	Position and secure the construction elements in line with the specification	
		1.7	Assemble structural steelwork for one of the following: • building frames and roofs • support structures • mezzanine platforms • rigs • access staging and platforms	
		1.8	Use all of the following during the assembly activities: • hand tools and equipment (podger, crow bar, spanners, torque wrenches) • assembly and alignment techniques and procedures (levels, plumb lines, laser equipment) • mechanical fastening techniques and procedures (bolted, riveted) • slinging and lifting techniques (ropes, chains, cranes) • temporary staging or mobile platforms	
		1.9	Produce assemblies which meet all of the following quality and accuracy standards: • all components are correctly assembled and aligned, in accordance with the specification • overall dimensions are within specification tolerances • assemblies meet appropriate geometric tolerances (square, straight, angles, free from twists) • completed assemblies meet specification	
		1.10	Securely fix any necessary temporary support facilities	
		1.11	Take appropriate measures to protect the finished construction	
		1.12	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Assemble Structural Steelwork	2.1	Explain the specific safety precautions to be taken when working in a steel construction environment and when assembling structural components (general site safety, appropriate personal protective equipment (PPE), accident procedure; working at height and statutory regulations relating to it, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Explain the personal protective clothing and equipment to be worn when carrying out the assembly activities (such as leather gloves, eye protection, safety helmets, ear protection, safety harness)	

		2.3	Describe the safe working practices and procedures for assembling structural components	
		2.4	Describe the correct methods of moving or lifting heavy structural sections	
		2.5	Describe the hazards associated with assembling structural components (such as using dangerous or badly maintained tools and equipment, lifting and handling long and heavy components, working at height, slips trips and falls), and how they can be minimised	
		2.6	Describe how to obtain the necessary construction and site drawings and joining specifications	
		2.7	Explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards in relation to work undertaken)	
		2.8	Describe the preparations to be carried out on the components prior to assembling them	
		2.9	Describe the equipment and temporary installations that may be required to support the structure during the assembly activities	
		2.10	Describe the various methods of securing the assembled components (the range of nuts and bolts used, including close-tolerance location bolts; temporary tack welding methods and techniques)	
		2.11	Explain how to set up and align the various components, and the tools and equipment that is used for this	
		2.12	Describe the use and care of tools and equipment, and their control procedures	
		2.13	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	
		2.14	Describe the problems that can occur when producing structural components/assemblies, and explain how these can be avoided	
		2.15	Describe the inspection techniques that can be applied to check that the construction is to specification and within acceptable limits	
		2.16	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot solve	
		2.17	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Forming Pipework by Machine Bending

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to bend and form pipes using pipe bending machines, in accordance with approved procedures. The learner will be required to work to instruction with the appropriate type and size of machine and former, based on the pipe type, size and operations to be performed. In producing the components, the learner will be required to operate the equipment safely and correctly, or to direct operations for their effective use, and to bend and form the pipe to the required profile without flats or deformations. The pipe bending and forming operations will include bending at right angles, bending to other angles, producing offsets, bridge sets, curved sections and expansion loops.

Unit introduction

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

The learner's knowledge will be sufficient to provide a good understanding of their work and will provide an informed approach to forming pipework using machine procedures. The learner will have an understanding of the characteristics of the equipment being used, the forming principles, and their application, and will know about the processes involved and their limitations, in sufficient depth to provide a sound basis for carrying out the activities, correcting any faults and ensuring the work output is produced to the required specification.

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		R/504/9304
Qualification Framework		RQF
Title		Forming Pipework by Machine Bending
Unit Level		Level 2
Guided Learning Hours		126
Unit Credit Value		35
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Forming Pipework by Machine Bending	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Use one of the following types of pipe bending machines: • hand operated manual bending machines (small diameter pipe) • hydraulically operated bending machines • powered pipe bending machines • CNC bending machines • power press with different former radii and sizes (pipe diameter)	
		1.3	Confirm that the equipment is set up correctly, safe and is ready for use by carrying out all of the following checks: • the appropriate machine is selected for the operation being performed • the machine guards and safety devices are in position and function correctly • forming tools are appropriate and in a serviceable condition (secure, correct diameter, free of damage) • machine settings are suitable for the pipe diameter, material thickness and operations to be performed	
		1.4	Manipulate the machine controls safely and correctly in line with operational procedures	
		1.5	Bend and form one of the following types of pipework: • heavy duty pipes • small bore lubrication/fuel piping • cable ducting pipework • structural pipes • high pressure pipes	
		1.6	Produce pipework forms that include three of the following: • right-angled bends	

			• angular bends • offsets • bridge sets • expansion loops • curved sections	
		1.7	Bend and form pipes made from one of the following types of material: • ferrous steel • non-ferrous • special metals	
		1.8	Produce components to the required specification	
		1.9	Produce pipe bends and forms which comply with all of the following quality and accuracy standards: • meet drawing, specification, template or job requirements • meet customer requirements • have the required dimensional accuracy within specified tolerances • the form or sharpness of the bend conforms to best practice and or specification without deformation or cracking • the bend conforms to the required shape/geometry (to the template profile)	
		1.10	Carry out quality sampling checks at suitable intervals	
		1.11	Deal promptly and effectively with problems within their control and report those that cannot be solved	
		1.12	Shut down the equipment to a safe condition on conclusion of the machining activities	
2.	Know how to Form Pipework by Machine Bending	2.1	Explain the specific safety precautions to be taken when working with pipe bending equipment/bending machines in a fabrication environment	
		2.2	Describe the general workshop and site safety requirements (statutory requirements, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.3	Describe the safe working practices and procedures for operating power-operated bending and forming machines	
		2.4	Explain the specific personal protective equipment (PPE) to be worn when carrying out the pipe bending activities (such as gloves, eye protection, safety helmets, ear protection)	
		2.5	Describe the handling precautions and correct methods of moving or lifting long lengths or heavy pipes	
		2.6	Describe the hazards associated with the pipe bending activities (handling long pipe lengths; using power operated bending equipment; using dangerous or badly maintained tools and equipment; using heating equipment), and how they can be minimised	

		2.7	Describe how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards in relation to work undertaken)	
		2.8	Explain the principles and methods of marking out pipework, and the type of equipment used (such as direct marking, use of templates, use of set wires)	
		2.9	Describe the marking out conventions applicable to the bending process (such as centre lines, bending lines)	
		2.10	Describe how to prepare the pipes in readiness for the bending and forming activities (visually checking for defects, cleaning the materials, removing burrs and sharp edges)	
		2.11	Describe the characteristics of the various materials used, with regard to the bending operations and explain why some materials may require the addition of heat to aid the bending process	
		2.12	Describe the various types of machines used to bend and form the pipe (including the use of hand bending machines, hydraulic bending equipment, power-operated equipment and heating methods)	
		2.13	Explain how to prepare and set up the machine for a range of different bends (angled bends, curved sections, twisted sections and straightening of sections)	
		2.14	Describe how to produce the various bends required (such as angled bends, dog-leg sets, bridge sets and expansion loops)	
		2.15	Describe ways of limiting distortion, wrinkles, marking and creases in the finished workpiece	
		2.16	Describe the problems that can occur with the bending and forming activities, and explain how they can be avoided	
		2.17	Describe the organisational quality control procedures that are used, and explain how to recognise defects in the bends that they produce	
		2.18	Explain how to make dimensional and forming inspection checks, and the tools and equipment that can be used	
		2.19	Describe the extent of their own authority 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	

Level 2 Unit – Producing Socket and Flange Fillet Welded Joints In Pipe using a Manual Welding Process

Unit aim

This unit covers the skills and knowledge needed to prove the competences required in producing socket and flange fillet welded joints in pipe, using a manual welding process such as manual metal arc (MMA), MIG, MAG, TIG, flux cored wire, plasma 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 to the required quality, and this could be through tests according to BS 4872 or EN 287 or EN9606-1.

Unit introduction

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

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

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

Assessment

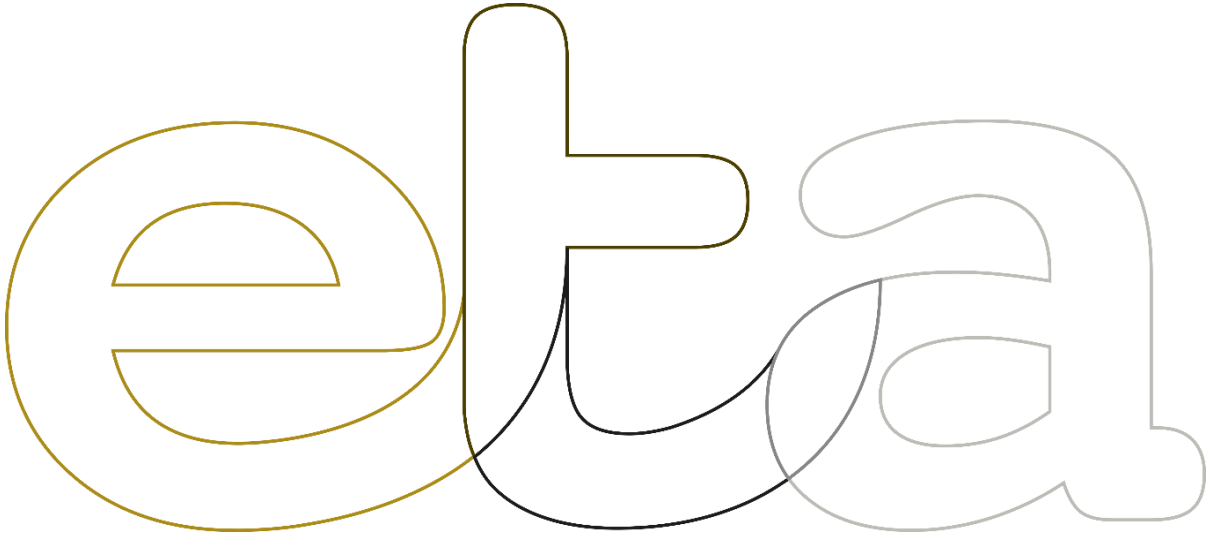
To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		Y/504/9305
Qualification Framework		RQF
Title		Producing Socket and Flange Fillet Welded Joints in Pipe using a Manual Welding Process
Unit Level		Level 2
Guided Learning Hours		175
Unit Credit Value		50
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Socket and Flange Fillet Welded Joints in Pipe using a Manual Welding Process	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	Confirm that the joint preparation complies with the specification	
		1.4	Confirm that joining and related equipment and consumables are as specified and fit for purpose	
		1.5	Set up, check, adjust and use welding and related equipment for one of the following welding processes: • Manual Metal Arc • MIG/MAG • TIG • Flux Cored wire • Plasma • Oxy/fuel Gas welding	
		1.6	Use consumables appropriate to the material and application, to include either of the following: two types of electrode from: • rutile • basic • cellulosic • nickel alloy • aluminium OR	

			• two types of filler wire from different material groups	
		1.7	Produce socket and flange fillet welded joints in one of the following: • small bore pipe (50mm outside diameter or less) • large bore pipe (above 50mm outside diameter)	
		1.8	Make the joints as specified using the appropriate thermal joining technique	
		1.9	Weld joints, in good access situations, in one of the following BS EN ISO 6947 positions: • Flat (PA) rotating • Horizontal vertical (PB) fixed • Horizontal vertical (PB) rotating • Vertical upwards (PF) fixed • Vertical down (PG) fixed • Horizontal overhead (PD) fixed	
		1.10	Produce joints of the required quality and of specified dimensional accuracy which: • meet the required dimensional accuracy within specified tolerance • achieve 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 EN 30042 / ISO 10042), as required by the application standard or specification	
		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	
2.	Know how to Produce Socket and Flange Fillet Welded Joints in Pipe using a Manual Welding Process	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 regulations, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations; safe disposal of waste materials)	
		2.2	Describe the correct handling and storage of gas cylinders (manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)	
		2.3	Describe the hazards associated with the selected welding process (live electrical components, poor earthing, arc radiation, fumes and gases, gas supply leaks, spatter, hot slag and metal, elevated working, enclosed spaces, slips, trips and falls), and explain how they can be minimised	

		2.4	Describe the manual welding process selected, and describe the different types of welding equipment available (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 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 BS or ISO 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 application, types of shielding gas and their application, gas supply and control, correct 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	Describe the methods of setting up and restraining 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, earthing arrangements; equipment calibration, setting welding parameters)	
		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	Describe 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; weld standards to be achieved; weld inspection and test procedures used (including visual and non-destructive tests)	
		2.14	Describe the personal approval tests, and their applicability to their work	
		2.15	Describe the extent of their own authority and explain whom they should report to if they have problems that they cannot resolve	
		2.16	Explain the reporting lines and procedures, line supervision and technical experts	



Level 2 Unit – Cutting and Shaping Materials using CNC Water Jet Cutting Machines

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out cutting and shaping operations using computer numerical controlled CNC water jet cutting machines, in accordance with approved procedures. The learner will take charge of the prepared machine and check that it is ready for the machining operations to be performed. This will involve checking that all the required materials and consumables are present, and that the machine has been approved for production. In operating the machine, the learner will be expected to follow the correct procedures for calling up the machine-operating program, dealing with any error messages, and executing the program activities safely and correctly.

The components produced will have a number of different features, including square and rectangular profiles, angular profiles, curved profiles, circles, slots, holes linearly positioned and holes radially positioned. The learner will be required to continuously monitor the cutting operations, making any necessary adjustments to machine parameters, in line with their permitted authority. Meeting production targets will be an important issue, and the learner's production records must show consistent and satisfactory performance.

Unit introduction

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

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

The learner will understand the safety precautions required when working with the water jet cutting/profiling machine and its associated 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.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/504/9307
Qualification Framework		RQF
Title		Cutting and Shaping Materials using CNC Water Jet Cutting Machines
Unit Level		Level 2
Guided Learning Hours		133
Unit Credit Value		28
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Cutting and Shaping Materials using CNC Water Jet Cutting Machines	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the defined procedures for starting and running the operating system	
		1.3	Confirm that the water jet cutting equipment is set up and ready for operation, to include checking all of the following: • the machine has been approved for production • all safety equipment and guards are in place and functioning correctly • materials are correctly positioned and held securely without damage and distortion • the correct nozzle has been selected and fitted • the operating program is at the correct start point • safe working practices and start-up procedures are observed • machine settings are adjusted as required to maintain accuracy	
		1.4	Deal promptly and effectively with error messages or equipment faults that are within your control and report those that cannot be solved	
		1.5	Produce cut and shaped components which cover five of the following features: • square/rectangular profiles • holes linearly positioned • angular profiles • holes radially positioned • curved profiles • slots and apertures • circles	

			• ellipses • other specific features	
		1.6	Machine one of the following types of material: • ferrous • non-ferrous • stainless steel • alloy steel • other appropriate material	
		1.7	Produce components within all of the following quality and accuracy standards: • dimensional accuracy is within the tolerance specified on the drawing/specification or within +/- 1.5mm • angled cuts are within specification requirements (perpendicular/angularity) • cuts are clean and smooth to the specified finish • cut components are free from damage and distortion	
		1.8	Monitor the computer process and ensure that the production output is to the required specification	
		1.9	Shut down the equipment to a safe condition on conclusion of the activities	
2.	Know how to Cut and Shape Materials using CNC Water Jet Cutting Machines	2.1	Explain the safe working practices and procedures to be observed when operating CNC water jet cutting machines (care when working with high power water jets; machine guards; ventilation and waste water extraction; machine safety devices)	
		2.2	Describe how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities	
		2.3	Describe the importance of ensuring the machine is isolated from the power supply before working with machinery; and the care needed, particularly when working with high pressure water	
		2.4	Explain the importance of wearing the appropriate protective clothing and equipment (PPE) and of keeping the work area clean and tidy	
		2.5	Describe the hazards associated with using water jet cutting machines (dangers from the water jets; live electrical components; moving parts of machinery; noise) and how they can be minimised	
		2.6	Describe the principles and operation of water jet cutting machines (such as pure water, abrasive, 5 axis and 3D cutting machines) and the terminology used	
		2.7	Describe the types of abrasives that can be used in the cutting process and the variations that they produce in the cut finish and the effect of other variable parameters (such as cutting speed, cutting head to workpiece distance, water pressure)	

		2.8	Describe the types of cutting heads and jet nozzles that can be used and how to recognise the correct one to use	
		2.9	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)	
		2.10	Describe how to interpret the visual display and understand the various messages displayed	
		2.11	Describe the function of error messages, and what to do when an error message is displayed	
		2.12	Describe how to find the correct restart point in the program when the machine has been stopped before completion of the program	
		2.13	Describe the operation of the various hand and automatic modes of machine control (such as, program operating and control buttons)	
		2.14	Describe how to operate the machine using single block run, full program run and speed override controls	
		2.15	Describe how to make adjustments to machine-operating programs to take account of out-of-specification components	
		2.16	Describe the care of equipment and operating programs, including safe storage of material away from possible contamination and corruption	
		2.17	Describe how to monitor the machine during the cutting process; recognition of problems and action to be taken	
		2.18	Describe problems that can occur during the water jet cutting activities, and how to prevent them	
		2.19	Describe the organisational quality systems (standards to be achieved; production records to be kept)	
		2.20	Describe the environmental practice or legislative requirements relating to the use of the machine and disposal of waste products	
		2.21	Explain the extent of their own authority and whom they should report to if they have problems they cannot resolve	