SEG Awards ABC Level 3 Certificate in Fabrication and Welding Techniques and Skills

Qualification Guidance

Level 3 Certificate – 603/5757/5



This is a live document and as such will be updated when required. It is the responsibility of the approved centre to ensure the most up-to-date version of the Qualification Guide is in use. Any amendments will be published on our website and centres are encouraged to check this site regularly.

About us

At the Skills and Education Group Awards (ABC Awards)[1] we continually invest in high quality qualifications, assessments and services for our chosen sectors. As a UK leading sector specialist we continue to support employers and skills providers to enable individuals to achieve the skills and knowledge needed to raise professional standards across our sectors.

Skills and Education Group has an on-line registration system to help customers register learners on its qualifications, units and exams. In addition it provides features to view exam results, invoices, mark sheets and other information about learners already registered.

The system is accessed via a web browser by connecting to our secure website using a username and password: https://ors.skillsandeducationgroupawards.co.uk/

Sources of Additional Information

The Skills and Education Group Awards website https://skillsandeducationgroupawards.co.uk/ provides access to a wide variety of information.

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1	1/4/2020	Original document	n/a
2	8/10/2020	Progression Opportunities updated	Page 6
3	07/07/2025	Review date updated to 31/08/2027	Page 8

[1] ABC Awards is a brand of the Skills and Education Group Awards, a recognised awarding organisation and part of the Skills and Education Group. Any reference to ABC Awards, its registered address, company or charity number should be deemed to mean the Skills and Education Group Awards.

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Introduction

- At Skills and Education Group Awards we have updated our suite of Fabrication and Welding qualifications to include the latest fabrication and welding techniques, materials, processes and practices. They are assessed in line with industry demands, which include updated rigorous practical assessments and online on-demand assessments.

- The qualification structures have been developed with the typical learner in mind, to ensure the units contained within them are relevant and facilitate progression, whether that is onto higher levels of learning, employment or specialist fabrication and welding procedures.

The qualifications have been developed in conjunction with academia and industry experts and informed by the work of professional bodies in the fabrication and welding field. At Level 2 and Level 3, the qualifications have been designed to complement the recently developed Apprenticeship Standards in Welding.

Aims

Raise a learner's skill level and enhance their underpinning knowledge to promote progression from basic welding and fabrication skills to a more highly developed understanding of equipment functions and how materials behave when subjected to fabrication and welding process.

Educate the learner in the observation of the correct and safe procedures that are paramount in the fabrication and welding industry.

Target Group

The target group includes, but is not limited to:

- young people who are following an apprenticeship programme
- young people who are new entrants to the industry
- adults wishing to specialise or upskill by pursuing single units
- the self-employed

Qualification Structure

Rules of Combination:

Learners must achieve a minimum of 32 credits
11 credits must be from Group A
7 credits must be from Group B
7 credits must be from Group C
7 credits may be from Group B, C or D

Units	Unit Number	Level	M/O	Credit Value	GLH
Group A					
1. Health and Safety in a Fabrication and Welding Environment	T/618/0753	2	M	3	20
2. Materials, Science and Calculations for Fabrication and Welding Practice	D/616/1291	3	M	8	80
Group B					
3. Manual Metal-Arc Welding – (Vertical) Low Carbon Steel, Stainless Steel or Aluminium	H/616/1292	3	O	7	60
4. Metal-Arc Gas Shielded Welding – (Vertical) Low Carbon Steel, Stainless Steel or Aluminium	K/616/1293	3	O	7	60
5. Tungsten-Arc Gas Shielded Welding – (Vertical) Low Carbon Steel, Stainless Steel or Aluminium	M/616/1294	3	O	7	60
Group C					
6. Fabrication Processes – Plate (3 mm and Above in Thickness)	T/616/1295	3	O	7	60
7.Fabrication Processes – Sheet Metal (below 3 mm in Thickness)	A/616/1296	3	O	7	60
Group D					
8. Engineering Drawing Using Manual and CAD Techniques	M/503/9511	3	O	7	60
9. Materials for fabrication and welding techniques and Skills	D/618/0794	3	O	7	60

GLH: 280 hours, TQT: 320 hours, Credit value: 32

Rules of Combination:

Assessment

In order to successfully achieve this qualification a learner must fully meet all of the learning outcomes. This is done by completing the Skills and Education Group Awards' practical and online multiple-choice assessments.

All centres are required to have internal quality assurance processes in place. Assessment workbooks are available on the Skills and Education Group Awards website for learners to complete to form the internal assessment requirements for each unit. The practical tasks in the workbooks are graded at a pass, merit or distinction.

The Science and Calculations unit is assessed via an externally set and externally assessed multiple choice question (MCQ) assessment. The examination provides the grade for this unit at a:

- Pass – 60%
- Merit – 70% or
- Distinction – 80%.

The overall qualification is graded as pass/fail however, unit achievements at pass, merit or distinction are shown on the qualification transcript.

For further information around assessment including reasonable adjustments and special considerations please review the Access to Assessment Policy here: https://skillsandeducationgroupawards.co.uk/policies-and-procedures/

Practice Assessment Material

Skills and Education Group Awards will make paper-based, multiple choice, practice tests available for learners prior to undertaking the online knowledge test. These questions will be of a comparable level and cover the same subject areas as listed above in the 'assessment' section, but they will not be the same questions as those presented during the online knowledge test.

Teaching Strategies and Learning Activities

Centres should adopt a delivery approach which supports the development of all individuals. The aims and aspirations of all the learners, including those with identified special needs or learning difficulties/disabilities, should be considered and appropriate support mechanisms put in place.

Progression Opportunities

Learners who successfully achieve this qualification could progress into employment within a fabrication and welding environment or a manufacturing environment.

Tutor/Assessor Requirements

Skills and Education Group Awards require those involved in the assessment process to be suitably experienced and/or qualified. In general terms, this usually means that the Tutor/Assessor must be knowledgeable in the subject/occupational area to at least the level they are delivering/assessing at.

Those responsible for Internal Quality Assurance (IQA) must be knowledgeable of the subject/occupational area to a suitable level to carry out accurate quality assurance practices and processes.

Resource Requirements

Centres must provide access to sufficient equipment in the centre or workplace to ensure learners have the opportunity to cover all of the practical activities.

For external assessments the examination should be conducted at the Centre where the course delivery has taken place and should be carried out in accordance with the examination requirements of Skills and Education Group Awards.

Language

These specifications and associated assessment materials are in English only.

Qualification Summary

SEG Awards ABC Level 3 Certificate in Fabrication and Welding Techniques and Skills								
Qualification Number	603/5757/1							
Regulated	The qualification identified above is regulated by Ofqual, Qualifications Wales and CCEA Regulation.							
Assessment	• Internally set, internally assessed • Externally set, internally assessed • Externally set, externally assessed • Internal and external moderation							
Grading	Pass							
Operational Start Date	01/09/2020							
Review Date	31/08/2027							
Skills and Education Group Awards Sector	Engineering							
SSA Sector	4.1 Engineering							
Contact	See the Skills and Education Group Awards website for Customer Support Officer responsible for these qualifications.							
Qualification Purpose	C. Prepare for employment C1. Prepare for employment in a broad occupational area							
Entry Requirements	There are no formal pre-requisites for entry onto this qualification. Each centre is required to notify the awarding body of its policies on access and equality of opportunity. Within the parameters of these policies, a centre is expected to recruit with integrity on the basis of a learner's ability to contribute to and successfully complete the qualification.							
Age Range	Pre 16		16 - 18	✓	18+	✓	19+	✓

Recommended GLH	Level 3 Certificate – 280
Recommended TQT	Level 3 Certificate – 330
Credit Value	Level 3 Certificate – 33
Learning Aims Reference	See Learning Aim Reference Service (LARS) website: https://data.gov.uk/dataset/learning-aim-reference-service
Type of Funding Available	See Learning Aim Reference Service (LARS) website
Qualification Fee	See Skills and Education Group Awards website for current fees and charges.
Additional Information	See Skills and Education Group Awards website for resources available for this qualification.

Unit Details

1. Health and Safety in a Fabrication and Welding Environment

Unit Reference	T/618/0753
Level	2
Credit Value	3
Guided Learning Hours	20
Unit Summary	In this unit, learners will find out about health and safety legislation, and the application of safe working practices within a workplace. They will explore hazards and precautions, signs and symbols and basic safety procedures. Health and Safety must be an integral part of every learner's programme. It is expected that the outcomes listed will be integrated as appropriate into each unit of this qualification. Skills and Education Group Awards has produced a workbook which learners can use to provide evidence of achievement against the learning outcomes and assessment criteria. The workbook is available on the ABC website. Skills and Education Group Awards also provides Learner Achievement Checklists to record achievement. These are also available on ABC's website.
Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Know about health and safety responsibilities	1.1. Identify the basic responsibilities of employer and employee with regard to Health and Safety at Work Act 1974 (where legislation, regulations do not apply in the jurisdiction, relevant ones should be applied) 1.2 Identify the statutory requirements and legislation of the Health and Safety at Work in a fabrication and welding work environment

2. Know how to avoid risks in a fabrication and welding work environment	2.1. Identify and describe where potential health and safety hazards may occur within a fabrication and welding work environment 2.2 Identify potential hazards and the necessary precautions in a fabrication and welding environment for each of the following • when moving and handling materials • when using hand and power tools • when using thermal processes
3. Undertake a risk assessment of fabrication and welding work environment	3.1 Identify the five steps of a risk assessment 3.2 Conduct a risk assessment of a fabrication and welding work environment 3.3 Report findings to an appropriate person in line with organisational requirements
4. Know how to protect themselves in a work environment	4.1 State reasons why protective clothing and equipment should be worn 4.2 Identify common safety guards, screens and fences within a workshop situation 4.3 Locate fire extinguishers, emergency switches and exits in the work environment 4.4 Describe how waste materials should be dealt with to comply with current laws and regulations
5. Know about accident and emergency procedures	5.1 Describe their organisational accident and emergency procedures in relation to • injury to self or others • fire • malfunctions of equipment • problems with hazardous substances
6. Understand safety signs	6.1 Identify safety signs within the following groups • mandatory • warning • safe condition • prohibited

2. Materials, Science and Calculations for Fabrication and Welding Practice

Unit Reference	D/616/1291
Level	3
Credit Value	8
Guided Learning Hours	80
Unit Summary	This is a mandatory unit which will be assessed by a 40 question on-line multi-choice question (MCQ) assessment. Learners will gain an understanding of various topics associated with the related aspects of welding and fabrication. The main areas or key focus points are materials, science, calculations and quality control of welding and fabrication operations. There is no practical requirement for this unit, however, observation of demonstrations concerning various aspects of the assessment criteria carried out in the workshop or laboratory is to be encouraged.

Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Identify a range of materials used in engineering	1.1. Identify the characteristics of materials used in engineering, to include: • ferrous metals • non–ferrous metals • thermoplastics • thermosetting plastics • ceramics • composites 1.2. Identify an engineering application for each material listed in 1.1 1.3. Identify the approximate carbon percentage of: • low carbon steel • medium carbon steel • high carbon steel 1.4. Identify common alloying elements added to steel 1.5. Describe the changes to the mechanical properties of steels by the addition of alloying elements 1.6. Identify typical compositions of common engineering materials, to include • stainless steel • brass • bronze • duralumin
2. Know about the crystalline structure of weld deposits in steels	2.1. Identify the different types of crystalline structure found in both single pass and multi pass weld deposits found in welded joints in steels, to include: • parent material • weld deposit • heat affected zone (HAZ) 2.2. Identify the stages of recrystallisation and grain growth in steel

3. Know about heat treatments and the effects of heat on materials	3.1. Identify the heat treatment process of materials, to include: • annealing • normalising • hardening • tempering • stress relieving 3.2. Describe how the properties of a material can be changed by the application of a heat treatment process 3.3. Describe the effects of hot and cold working on the mechanical properties of steels 3.4. Identify the purpose of using pre and post heating on welded joints in steels 3.5. Describe the effects of welding and cooling rates on the structure and mechanical properties of welded joints
4. Know about the mechanical testing of materials and the properties of materials	4.1. Identify methods of mechanically testing materials, to include: • tensile testing • hardness testing (Brinell, Vickers and Rockwell) • charpy/izod testing • fatigue testing 4.2. Define the terms associated with the properties of materials, to include: • work hardening • weldability of materials • hardenability • cold working 4.3. Identify the effects when different types of forces are applied to a material, to include: • tensile force • compressive force • shear force • torsion
5. Understand the structure and state of matter	5.1. Recognise the three states of matter 5.2. Identify the basic structure of matter, to include: • atoms • molecules • elements • compounds • mixtures 5.3. Be able to give examples of elements, compounds and mixtures

6. Understand the units used in the SI system	6.1. Recognise the SI units for engineering applications, to include: • force • energy • heat • time • length • area • volume • mass • electrical current • gas pressure
7. Understand the electrical principles and conditions of welding processes	7.1. Define: • open circuit voltage (OCV) • arc voltage • welding current 7.2. Identify the effects of increasing/decreasing the arc length when MMA welding on the: • welding current • arc voltage 7.3. Identify the characteristics of a welding power source, to include flat and drooping types 7.4. Identify welding processes that use flat or drooping characteristic type power sources 7.5. Explain the terms associated with welding power sources, to include: • duty cycles • single and three phase systems • tapped reactor • moving core reactor

Be able to use calculations relating to fabrication and welding activities	8.1. Calculate volume and surface areas applicable to fabricated and welded assemblies 8.2. Calculate the cost of welding, to include: • purchase of equipment • cost of consumables • purchase of materials • cost of labour 8.3. Calculate total length of welding required for a fabricated assembly 8.4. Calculate unknown angles and side lengths in right angled triangles using trigonometry 8.5. Calculate unknown side lengths in right angled triangles using the Pythagoras theory 8.6. Calculate the length of flat section required to produce a cylinder of a given diameter using the mean or neutral line 8.7. Calculate bending allowances when producing bends/folds in material
9. Know about the problems associated with the manufacture of fabricated and welded assemblies	9.1. Identify different types of distortion that can occur in welded assemblies, to include: • longitudinal • transverse • angular 9.2. Identify methods used for the control of distortion in welded assemblies 9.3. Describe the importance of selecting and using the correct joint preparation for a given joint type 9.4. Describe typical welding defects specific to the welding processes listed: • MMA welding • MAGS welding • TAG welding 9.5. Identify the problems associated with the conditions found in a completed welded joint, to include: • residual stress • corrosion • shock loading • distortion

10. Know the importance of quality assurance in fabrication and welding activities	10.1. Describe the application and procedures to be followed when carrying out non-destructive testing (NDT) of welded joints, to include: • dye penetrant testing • magnetic particle testing • ultrasonic flaw detection • radiography 10.2. Identify the limitations of using the NDT methods listed in 10.1 10.3. Identify the importance of carrying out quality control checks on welding consumables 10.4. Identify the application and use of quality control documentation, to include: • welding procedure specification (WPS) • Inspection report for welding • certificates of conformity (consumables)

3. Manual Metal-Arc Welding – (Vertical) Low Carbon Steel, Stainless Steel or Aluminium

Unit References	H/616/1292
Level	3
Credit Value	7
Guided Learning Hours	60
Unit Summary	This unit covering manual metal-arc (MMA) welding is designed to further the skills of the learner who has satisfactorily completed and achieved a level 2 qualification in fabrication and welding practice. Learners will further develop skills in the theory of safe working practice and the theoretical aspects of technology associated with this particular welding process. For this qualification all welding is to be carried out in the vertical welding position (PF/PG) covering a range of welded joints. Both the fillet weld and butt joint will be tested to ensure that they are structurally sound.
Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Understand health and safety legislation and follow safe working practices	1.1. Identify the responsibilities of both the employer and the employee when complying with the Health and Safety at Work Act 1974 1.2. Identify the use of current legislation, to include: • COSHH (Control of Substances Hazardous to Health) • PUWER (Provision and Use of Work Equipment) • RIDDOR (Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations) 1.3. Identify the use of a risk assessment procedure 1.4. Identify safe working practices when using the MMA welding process, to include working: • in a confined space

2. Be able to identify and use, in a safe manner, equipment used for MMA welding activities	2.1. Describe the function of the equipment used in MMA welding, to include: • transformer • generator • rectifier • invertors • welding lead cable • welding return cable • secondary earth and connector • electrode holder • cable clamp • low voltage safety devices (LVSD) 2.2. Identify suitable maintenance checks that would be required on the items listed in 2.1 2.3. State the procedures to be followed for the safe storage of welding equipment when the welding activity has been completed
3. Be able to identify consumables used when using the MMA welding process	3.1. Identify a range of electrodes that are used for the MMA welding process, to include: • general purpose • low hydrogen (basic) • positional 3.2. State the function of the flux coating on electrodes 3.3. Describe the effects of incorrect storage of electrodes 3.4. State the effect of using damaged electrodes when carrying out welding activities
4. Understand the welding parameters used when carrying out MMA welding in the vertical welding (PF/PG) position	4.1. Identify and select the welding parameters to be used when welding materials in the vertical welding position (PF/PG), to include: • welding current • OCV (open circuit voltage) • electrode slope and tilt angles • arc length • speed of travel • electrode polarity

5. Know about material preparation and the setting up of MMA welding equipment	5.1. Identify suitable welding preparations for the type of joint and material thickness being welded 5.2. Identify terms associated with welding preparations, to include: • included angle • angle of bevel • root face dimension • root gap dimension 5.3. Describe the application of distortion control techniques, to include: • pre-setting • restraint • joint geometry 5.4. Be able to follow instructions given on a WPS (Welding Procedure Sheet)
6. Be able to complete welds in the vertical welding position (PF/PG) using the MMA welding process	6.1. Identify appropriate safety checks on the welding equipment prior to use 6.2. Select suitable welding parameters to enable the listed joints to be welded by the MMA welding process on low carbon steel or stainless steel or aluminium • tee fillet (PF) • butt (PF) • open outside corner (PF or PG) • lap joint (PF or PG)
7. Know how to carry out visual inspection and destructive tests on completed welds	7.1. Carry out visual inspection of completed welds 7.2. Prepare and carry out nick break tests on the completed fillet welds 7.3. Prepare and carry out destructive tests on completed butt welds, to include: • face bend • root bend • fracture test 7.4. Record the results of the weld examination as detailed in 7.1, 7.2 and 7.3
8. Know about defects found in welds produced by the MMA welding process	8.1. Identify and describe typical defects found in MMA welded joints, to include: • cracks • inclusions (slag) • undercut • arc craters • porosity • lack of penetration 8.2. Identify possible causes of the defects listed in 8.1

4. Metal-Arc Gas Shielded Welding – (Vertical) Low Carbon Steel, Stainless Steel or Aluminium

Unit References	K/616/1293
Level	3
Credit Value	7
Guided Learning Hours	60
Unit Summary	This unit covering metal-arc gas shielded (MAGS) welding is designed to further the skills of the learner who has satisfactorily completed and achieved a level 2 qualifications in fabrication and welding practice. Learners will further develop skills in the theory of safe working practice and the theoretical aspects of technology associated with this particular welding process. For this qualification all welding is to be carried out in the vertical welding position (PF/PG) covering a range of welded joints. Both the fillet weld and butt joint will be tested to ensure that they are structurally sound.
Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Understand health and safety legislation and follow safe working practices	1.1. Identify the responsibilities of both the employer and the employee when complying with the Health and Safety at Work Act 1974 1.2. Identify the use of current legislation, to include: • COSHH (Control of Substances Hazardous to Health) • PUWER (Provision and Use of Work Equipment) • RIDDOR (Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations) 1.3. Identify the use of a risk assessment procedure 1.4. Identify safe working practices when using the MAGS welding process, to include working: • in a confined space • at an height above 2 metres • with containers that have held chemicals or flammable liquids • in damp or wet conditions

2. Be able to identify and use, in a safe manner, equipment used for MAGS welding activities	2.1. Describe the function of the equipment used in the MAGS welding process, to include: • rectifier • welding lead cable and clamp • welding return cable and clamp • secondary earth and connector • torch • contact tip • shroud/nozzle • wire feed mechanism • gas supply, regulator and flow meter 2.2. Identify suitable maintenance checks that would be required on the items listed in 2.1 2.3. State the procedures to be followed for the safe storage of welding equipment when the welding activity has been completed
3. Be able to identify consumables used when using the MAGS welding process	3.1. Identify a range of electrode wires that are used for the MAGS welding process, to include: • non-coated • copper coated 3.2. Describe the effects of incorrect storage of electrode wires 3.3. Recognise the effect of using damaged electrode wires when carrying out welding activities 3.4. Identify the shielding gas/es used in MAGS welding 3.5. Identify the function of the shielding gas used in MAGS welding
4. Understand the welding parameters used when carrying MAGS welding in the vertical welding (PF/PG) position	4.1. Recognise the different modes of metal transfer used in MAGS welding 4.2. Identify and select the welding parameters to be used when welding materials greater than 6 mm in thickness in the vertical welding position (PF/PG). • mode of metal transfer • welding current • arc voltage • torch slope and tilt angles • shielding gas flow rate • wire speed • speed of travel

5. Know about material preparation and the setting up of MAGS welding equipment	5.1. Identify suitable welding preparations for the type of joint and material thickness being welded 5.2. Identify terms associated with welding preparations, to include: • included angle • angle of bevel • root face dimension • root gap dimension 5.3. Describe the application of distortion control techniques, to include: • pre-setting • restraint • joint geometry 5.4. Be able to follow instructions given on a WPS (Welding Procedure Sheet)
6. Be able to complete welds in the vertical welding position (PF/PG) using the MAGS welding process	6.1. Identify appropriate safety checks on the welding equipment prior to use 6.2. Select suitable welding parameters to enable the listed joints to be welded by the MAGS welding process on low carbon steel or stainless steel or aluminium • tee fillet (PF) • butt (PF) • open outside corner (PF or PG) • lap joint (PF or PG)
7. Know how to carry out visual inspection and destructive tests on completed welds	7.1. Carry out visual inspection of completed welds 7.2. Prepare and carry out nick break tests on completed fillet welds 7.3. Prepare and carry out destructive tests on completed butt welds, to include: • face bend • root bend • fracture test 7.4. Record the results of the weld examination as detailed in 7.1, 7.2 and 7.3
8. Know about defects found in welds produced by the MAGS welding process	8.1. Identify and describe typical defects found in the MAGS welding process joints, to include: • cracks • inclusions • undercut • lack of fusion • arc craters • porosity • lack of penetration 8.2. Identify possible causes of the defects listed in 8.1

5. Tungsten-Arc Gas Shielded Welding – (Vertical) Low Carbon Steel, Stainless Steel or Aluminium

Unit References	M/616/1294
Level	3
Credit Value	7
Guided Learning Hours	60
Unit Summary	This unit covering tungsten inert gas shielded (TAG) welding is designed to further the skills of the learner who has satisfactorily completed and achieved a level 2 qualification in fabrication and welding practice. Learners will further develop skills in the theory of safe working practice and the theoretical aspects of technology associated with this particular welding process. For this qualification all welding is to be carried out in the vertical welding position (PF/PG) covering a range of welded joints. Both the fillet weld and butt joint will be tested to ensure that they are structurally sound.
Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Understand health and safety legislation and follow safe working practices	1.1. Identify the responsibilities of both the employer and the employee when complying with the Health and Safety at Work Act 1974 1.2. Identify the use of current legislation, to include: • COSHH (Control of Substances Hazardous to Health) • PUWER (Provision and Use of Work Equipment) • RIDDOR (Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations) 1.3. Identify the use of a risk assessment procedure 1.4. Identify safe working practices when using the TAG welding process, to include working: • in a confined space • at an height above 2 metres • with containers that have held chemicals or flammable liquids • in damp or wet conditions • with hazards from using high frequency units

2. Be able to identify and use, in a safe manner, equipment used for TAG welding activities	2.1. Describe the function of the equipment used in the TAG welding process, to include: • rectifier • inverter • high frequency units • welding lead cable and clamp • welding return cable and clamp • secondary earth and connector • torch • tungsten • collet • shroud • cooling system • gas supply, regulator and flow meter 2.2. Identify suitable maintenance checks that would be required on the items listed in 2.1 2.3. State the procedures to be followed for the safe storage of welding equipment when the welding activity has been completed
3. Be able to identify consumables used with the TAG welding process	3.1. Identify a range of tungsten electrodes that are used for the TAG welding process, to include: • types used • size (diameter) • alloying additions • preparation of electrode tip (shape/dimensions) 3.2. Identify a range of filler wires that are used for the TAG welding process, to include: • types used • size (diameter) • alloying additions 3.3. Describe the effects of incorrect storage of tungsten electrode and filler wires 3.4. State the effect of using damaged tungsten electrode and filler wires when carrying out welding activities 3.5. Identify the shielding gas/es used in TAG welding 3.6. Identify the function of the shielding gas used in TAG welding

4. Understand the welding parameters used when carrying out TAG welding in the vertical welding (PF/PG) position	4.1. Identify and select the welding parameters to be used when welding in the vertical welding position (PF/PG): • welding current • torch slope and tilt angles • filler wire slope and tilt angles • shielding gas flow rate • arc length • speed of travel 4.2. Identify the use of autogenous techniques when using the TAG welding process
5. Know about material preparation and the setting up of TAG welding equipment	5.1. Identify suitable welding preparations for the type of joint and material thickness being welded 5.2. Identify terms associated with welding preparations, to include: • included angle • angle of bevel • root face dimension • root gap dimension 5.3. Describe the application of distortion control techniques, to include: • pre-setting • restraint • joint geometry • chills • weld sequence 5.4. Be able to follow instructions given on a WPS (Welding Procedure Sheet)
6. Be able to complete welds in the vertical welding position (PF/PG) using the TAG welding process	6.1. Identify appropriate safety checks on the welding equipment prior to use 6.2. Select suitable welding parameters to enable the listed joints to be welded by the TAG welding process on low carbon steel or stainless steel or aluminium • tee fillet (PF) • butt (PF) • open outside corner (PF or PG) • lap joint (PF or PG)

7. Know how to carry out visual inspection and destructive tests on completed welds	7.1. Carry out visual inspection of completed welds 7.2. Prepare and carry out nick break tests on completed fillet welds 7.3. Prepare and carry out destructive tests on completed butt welds, to include: • face bend • root bend • fracture test 7.4. Record the results of the weld examination as detailed in 7.1, 7.2 and 7.3
8. Know about defects found in welds produced by the TAG welding process	8.1. Identify and describe typical defects found in the TAG welding process joints, to include: • cracks • inclusions • undercut • lack of fusion • arc craters • porosity • lack of penetration 8.2. Identify possible causes of the defects listed in 8.1

6. Fabrication Processes – Plate (3 mm and above in thickness)

Unit Reference	T/616/1295
Level	3
Credit Value	7
Guided Learning Hours	60
Unit Summary	The practical content of this unit requires the learner to manufacture a fabricated assembly in material of 3 mm thickness or above to given dimensions and within a specified tolerance. Understanding safe working practices when carrying out fabrication activities is an important criterion in all aspects of this unit. Other areas include working from fabrication drawings, marking out, cutting, forming and assembly.

Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Understand safe working practices when carrying out fabrication activities	1.1. Identify safe lifting methods to be used when lifting and handling materials 3 mm in thickness or above using: • manual lifting methods • mechanical lifting methods 1.2. Identify the use of current legislation covering: LOLER (Lifting Operations and Lifting Equipment Regulations) 1.3. Identify the safe working practices required when using fabrication tools and equipment, to include: • hand tools • thermal cutting equipment • shearing machines • drilling machines • rolling machines (manual and powered) 1.4. Identify and describe the importance of safety features on powered machinery, to include: • guarding of moving parts • electrical isolators • emergency stop buttons
2. Understand how to read and interpret fabrication drawings	2.1. Identify the use of orthographic drawings when manufacturing fabricated assemblies 2.2. Understand the need for tolerances in fabrication assembly activities
3. Know about marking out materials greater than 3 mm in thickness	3.1. Identify the importance of the correct storage of marking out equipment when not in use 3.2. Use a range of marking out equipment to mark out material greater than 3 mm in thickness, to include: • rulers/tapes • dividers/trammels • scribers • squares • protractors 3.3. Describe the importance of working from a fixed datum edge, line or point when marking out 3.4. Describe features of marking out, to include: • progressive marking out • chain measuring • cumulative error • pitch circle diameter (PCD) 3.5. Calculate bending and rolling allowances in materials greater than 3 mm in thickness, to include:

	• bends at 90° in 3 mm thick material and above • length of flat section required to produce a cylinder of a fixed diameter using the neutral /mean line of the material
4. Be able to identify and use thermal cutting equipment	4.1. Identify and describe the equipment used for thermal cutting operations, to include: • oxy/fuel gas methods • plasma arc 4.2. Identify the cutting nozzle arrangements when using the following gas mixtures: • oxy/acetylene • oxy/propane 4.3. Use oxy/fuel gas or plasma arc cutting equipment to produce: • straight lines • circles or radii 4.4. Identify the cutting aids and attachments used with thermal cutting activities
5. Be able to identify and use mechanical cutting equipment	5.1. Identify the parameters when selecting a cutting machine, to include: • type of material to be cut • maximum thickness of material • maximum length of cut • blade clearance 5.2. Identify cutting equipment, to include: • powered guillotine • universal steel worker 5.3. Identify the use of cutting machine attachments, to include: • adjustable back stop • squaring arm • stroke counter 5.4. Identify drilling machines, to include: • bench drilling machine • pillar drilling machine 5.5. State the importance of regular maintenance on powered cutting equipment
6. Be able to identify and use forming equipment	6.1. Identify the parameters when selecting and using a forming machine, to include: • type of material to be formed • maximum thickness of material • maximum length of material to be formed • sectional shape required 6.2. Identify forming equipment, to include: • manual folding machine

	• powered press brake • manual sheet rollers • powered rollers (pyramid and pinch type) • powered section bending rollers
7. Know about methods of joining parts in fabricated assemblies in materials above 3 mm in thickness	7.1. Identify a range of mechanical fasteners to join and assemble fabricated components, to include: • black bolts • HSFG (High strength friction grip bolts) • turned barrel bolts 7.2. Identify a range of welding processes used to join and assemble fabricated components 7.3. Describe methods of distortion control that are used when welding fabricated components
8. Be able to assemble fabricated components to given specifications	8.1. Follow instructions given on a Fabrication Specification Sheet (FSS) 8.2. Identify a range of assembly aids used to locate parts and maintain alignment during assembly, to include: • bridge and wedges • draw bolts • cleats • clamps • drifts • magnets 8.3. Plan the sequence of manufacture and assembly of a fabricated component
9. Be able to produce a fabricated assembly in materials above 3 mm in thickness	9.1. Produce a fabricated component in material 3 mm in thickness or above, to include: • marking out • cutting material • rolling • bending/folding • drilling • assembling 9.2. Carry out the requirements as listed in 9.1 to the required tolerance and dimensional accuracy as detailed on the drawing 9.3. Carry out inspection of the completed assembly using a range of inspection equipment

7. Fabrication Processes – Sheet Metal (Below 3 mm in Thickness)

Unit Reference	A/616/1296
Level	3
Credit Value	7
Guided Learning Hours	60
Unit Summary	The practical content of this unit requires the learner to manufacture a fabricated assembly in sheet metal (below 3 mm in thickness) to given dimensions and within a specified tolerance. Understanding safe working practices when carrying out sheet metal fabrication activities is an important criterion in all aspects of this unit. Other areas include working from fabrication drawings, marking out, cutting, forming and assembly.

Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Understand safe working practices when carrying out sheet metal activities	1.1. Identify safe lifting methods to be used when lifting and handling sheet metal below 3 mm in thickness using: • manual lifting methods • mechanical lifting methods 1.2. Identify the use of current legislation covering: LOLER (Lifting Operations and Lifting Equipment Regulations) 1.3. Identify the safe working practices required when using fabrication tools and equipment, to include: • hand tools • shearing machines • forming machines • drilling machines • rolling machines (manual and powered) 1.4. Identify and describe the importance of safety features on powered machinery, to include: • guarding of moving parts • electrical isolators • emergency stop buttons
2. Understand how to read and interpret	2.1. Identify the use of orthographic drawings when manufacturing fabricated assemblies

fabrication drawings	2.2. Understand the need for tolerances in sheet metal fabrication assembly activities
3. Know about marking out materials less than 3 mm in thickness	3.1. Identify the importance of the correct storing of marking out equipment when not in use 3.2. Use a range of marking out equipment to mark out sheet metal, to include: • rulers/tapes • dividers/trammels • scribers • squares • protractors 3.3. Describe the importance of working from a fixed datum edge, line or point when marking out 3.4. Describe features of marking out, to include: • progressive marking out • chain measuring • cumulative error 3.5. Calculate bending and rolling allowances in sheet metal, to include: • bends at 90° in sheet metal material • length of flat section required to produce a cylinder of a fixed diameter using the neutral/mean line of the material
4. Be able to identify and use cutting equipment	4.1. Identify the parameters when selecting a cutting machine, to include: • type of material to be cut • maximum thickness of material • maximum length of cut • blade clearance 4.2. Identify mechanical/manual cutting equipment, to include: • powered guillotine • nibbling machine • bench shears • tin snips 4.3. Identify the use of mechanical cutting machine attachments, to include: • adjustable back stop • squaring arm • stroke counter 4.4. Identify drilling machines, to include: • bench drilling machine • pillar drilling machine • hand held power drill 4.5. State the importance of regular maintenance on powered cutting equipment

	4.6. Recognise the application and use of plasma arc cutting on materials less than 3 mm in thickness
5. Be able to identify and use forming equipment	5.1. Identify the parameters when selecting and using a forming machine, to include: • type of material to be formed • maximum thickness of material • maximum length of material to be formed • sectional shape required 5.2. Identify forming equipment, to include: • manual folding machine • powered press brake • manual sheet rollers(pyramid and pinch type) • powered rollers (pyramid and pinch type)
6. Know about methods of joining parts in fabricated assemblies in sheet metal	6.1. Identify a range of mechanical fasteners to join and assemble fabricated components, to include: • black bolts • hollow rivets • self-tapping screws 6.2. Identify a range of welding processes used to join and assemble fabricated components, to include: • MAGS welding • TAG welding • resistance spot welding 6.3. Describe methods of distortion control that are used when welding fabricated components 6.4. Identify a range of self-securing joints used to fasten materials less than 3 mm in thickness, to include: • grooved seam • knocked up • paned down 6.5. Recognise methods used to stiffen sheet metal assemblies
7. Be able to assemble fabricated components to given specifications	7.1. Follow instructions given on a Fabrication Specification Sheet(FSS) 7.2. Identify a range of assembly aids used to locate parts and maintain alignment during assembly, to include: • supports • jigs/fixtures • clamps • magnets 7.3. Plan the sequence of manufacture and assembly of a fabricated component
8. Be able to produce a fabricated	8.1. Produce a fabricated component in sheet metal, to include:

assembly in sheet metal	• marking out • cutting material • rolling • bending/folding • drilling • assembling 8.2. Carry out the requirements as listed in 8.1 to the required tolerance and dimensional accuracy as detailed on the drawing 8.3. Carry out inspection of the completed assembly using a range of inspection equipment

8. Engineering Drawing Using Manual and CAD Techniques

Unit Reference	M/503/9511
Level	3
Credit Value	7
Guided Learning Hours	60
Unit Summary	By following this unit, learners will use both manual drawing and CAD systems to produce orthographic drawings of fabricated assemblies. Further drawings using both methods will cover the principles and applications of radial line, parallel line, triangulation, cutting planes and the use of the common central sphere to produce pattern developments for various components. There will be a strong emphasis on presentation and accuracy of completed drawings ensuring they conform to current BS. EN and/or ISO standards

Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Be able to produce engineering drawings using manual techniques	1.1 Produce drawings of fabricated assemblies using orthographic projection 1.2 Dimension drawings to current BS, EN and/or ISO Standards

	1.3 Apply welding symbols to current BS, EN and/or ISO Standards
2. Be able to develop patterns using manual techniques	2.1 Use the parallel line method to produce pattern developments 2.2 Use the radial line method to produce pattern developments 2.3 Use triangulation to produce pattern developments
3. Be able to determine lines of intersection	3.1 Use cutting planes to determine the line of intersection between two sections 3.2 Use the principle of the common centre sphere (CCS) to determine the lines of intersection
4. Produce engineering drawings using CAD software	4.1 Set up the CAD system to include • Layers • Paper sizes • Co-ordinates X-Y • Grid and snap references 4.2 Identify and use commands to facilitate CAD drawings 4.3 Produce drawings of fabricated assemblies using orthographic projection 4.4 Dimension drawings to current NS, EN and/or ISO Standards 4.5 Add text to drawings
5. Develop simple pattern developments using CAD	5.1 Use the parallel line method of development to produce half and full patterns 5.2 Use the radial line method of development to produce half and full patterns
6. Be able to manage file systems	6.1 Save the completed work in a suitable file system 6.2 Retrieve work from files created 6.3 Print/plot completed drawings/patterns

9. Materials for Fabrication and Welding Techniques and Skills

Unit Reference	D/618/0794
Level	3
Credit Value	7
Guided Learning Hours	60
Unit Summary	This unit explores and develops the learner's understanding of metallurgy, heat treatment and mechanical testing. Common causes of failure are identified and the mechanisms by which they of occur in welded fabrications are also included within this unit. All processes are to conform to current BS, EN and/or ISO standards

Learning Outcomes The learner will:	Assessment Criteria The learner can:
1. Understand aspects of basic metallurgy	1.1 For mixtures of metals, describe the terms • solubility • solid solutions
2. Understand heat treatment	2.1 Describe the effect of gain structure on annealing, normalising and hardening techniques with reference to temperatures and cooling rates. 2.2 Define • hardenability • weldability to British Standards • work hardening 2.3 Define the critical cooling velocity with reference to • changes in microstructure • changes in mechanical properties • influence of mass/section of welded structures • hard zone cracking 2.4 Describe the effects of alloying elements used to produce Alloy steels 2.5 Calculate carbon equivalents to current British Standards 2.6 Describe hot and cold cracking in terms of • cooling rate

	• hydrogen influence of impurities
3. Understand mechanical Testing	3.1 Describe the behaviour of a material subject to a tensile force in terms of • stress, strain and elasticity • yield strength • tensile strength • percentage elongation • percentage reduction in area • stiffness (without proof of Young's modulus) • proof stress 3.2 State Hooke's Law 3.3 Describe in simple terms the effects of compressive force and shear stress on common materials 3.4 Describe the following mechanical testing methods • hardness testing (Brinell, Vickers and Rockwell) • fatigue testing • charpy impact test 3.5 Describe how mechanical properties can affect the testing of metals 3.6 Describe in simple terms the mechanism by which creep occurs 3.7 Describe the mechanism by which the following types of corrosion (stress, galvanic, rusting) occurs 3.8 Give examples of where the methods (mechanical barriers, inhibitors and sacrificial anodes) are used to overcome the effects caused by the types of corrosion described above

Appendices

Recognition of Prior Learning, Exemption and Credit Transfer

Skills and Education Group Awards policy enables learners to avoid duplication of learning and assessment in a number of ways:

- Recognition of Prior Learning (RPL) – a method of assessment that considers whether a learner can demonstrate that they can meet the assessment requirements for a unit through knowledge, understanding or skills they already possess and do not need to develop through a course of learning.
- Exemption - Exemption applies to any certificated achievement which is deemed to be of equivalent value to a unit within Skills and Education Group Awards qualification but which does not necessarily share the exact learning outcomes and assessment criteria. It is the assessor's responsibility, in conjunction with the Internal Moderator, to map this previous achievement against the assessment requirements of the Skills and Education Group Awards qualification to be achieved in order to determine its equivalence.
  Any queries about the relevance of any certificated evidence, should be referred in the first instance to your centre's internal moderator and then to Skills and Education Group Awards.
  It is important to note that there may be restrictions upon a learner's ability to claim exemption or credit transfer which will be dependent upon the currency of the unit/qualification and a learner's existing levels of skill or knowledge.
  Where past certification only provides evidence that could be considered for exemption of part of a unit, learners must be able to offer additional evidence of previous or recent learning to supplement their evidence of achievement.
- Credit Transfer – Skills and Education Group Awards may attach credit to a qualification, a unit or a component. Credit transfer is the process of using certificated credits achieved in one qualification and transferring that achievement as a valid contribution to the award of another qualification. Units / Components transferred must share the same learning outcomes and assessment criteria along with the same unit number. Assessors must ensure that they review and verify the evidence through sight of:
  - original certificates OR
  - copies of certificates that have been signed and dated by the internal moderator confirming the photocopy is a real copy and make these available for scrutiny be the External Moderator.
- Equivalencies – opportunities to count credits from the unit(s) from other qualifications or from unit(s) submitted by other recognised organisations towards the place of mandatory or optional unit(s) specified in the rule of combination. The unit must have the same credit value or greater than the unit(s) in question and be at the same level or higher.

Skills and Education Group Awards encourages its centres to recognise the previous achievements of learners through RPL, Exemption and Credit Transfer. Prior achievements may have resulted from past or present employment, previous study or voluntary activities.

Centres should provide advice and guidance to the learner on what is appropriate evidence and present that evidence to the external moderator in the usual way.

Further guidance can be found in 'Delivering and Assessing Skills and Education Group Awards Qualifications' which can be downloaded from: https://skillsandeducationgroupawards.co.uk/wp-content/uploads/2017/12/SEG-Awards_Delivering-and-Assessing-Qualifications-19-20.pdf

Certification

Learners will be certificated for all units and qualifications that are achieved and claimed.

Skills and Education Group Awards policies and procedures are available on the Skills and Education Group Awards website.

Glossary of Terms

Guided Learning Hours (GLH)
GLH is where the learner participates in education or training under the immediate guidance or supervision of a tutor (or other appropriate provider of education or training). It may be helpful to think – 'Would I need to plan for a member of staff to be present to give guidance or supervision?'

GLH is calculated at the unit/component level and added up at the qualification level.
Examples of guided learning include:

- Face-to-face meeting with a tutor
- Telephone conversation with a tutor
- Instant messaging with a tutor
- Taking part in a live webinar
- Classroom-based instruction
- Supervised work
- Taking part in a supervised or invigilated assessment
- The learner is being observed.

TQT (Total Qualification Time)
The number of notional hours which represents an estimate of the total amount of time that could reasonably be expected to be required, in order for a learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification.' The size of a qualification is determined by the TQT.

TQT is made up of the GLH plus all other time taken in preparation, study or any other form of participation in education or training but not under the direct supervision of a lecturer, supervisor or tutor.

TQT is calculated at qualification level and not unit/component level.

Examples of unsupervised activities that could contribute to TQT include:

- Researching a topic and writing a report
- Watching an instructional online video at home/e-learning
- Watching a recorded webinar
- Compiling a portfolio in preparation for assessment
- Completing an unsupervised practical activity or work
- Rehearsing a presentation away from the classroom
- Practising skills unsupervised
- Requesting guidance via email – will not guarantee an immediate response.