QUALIFICATION HANDBOOK

Level 3 NVQ Diploma in Fabrication and Welding – Rail Welding (1782-30)

September 2018 version 1.2

City & Guilds

Qualification at a glance

Subject area	**Engineering**
City & Guilds number	1782-30
Age group approved	16+
Entry requirements	None
Assessment	Portfolio of evidence
Automatic approval	Available
Support materials	Centre handbook
Registration/ certification dates	See City & Guilds website for details

Title and level	GLH	TQT	City & Guilds number	Accreditation number
Level 3 NVQ Diploma in Fabrication and Welding Engineering – Rail Welding	393	1240	1782-30	601/0078/3

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

Contents

1 Introduction

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

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

Structures

The minimum credit required to achieve this qualification pathway is **126 credits.**

To achieve the **Level 3 NVQ Diploma in Fabrication and Welding Engineering (Rail Welding)**, learners **must** achieve the **15 credits** from the mandatory units (201-202, 303) and **must** achieve a minimum of **111** credits from any **one of the following pairs** of units; units 356 and 357 **or** units 358 and 359.

Unit accreditation number	City & Guilds unit number	Unit title	Credit value
Mandatory			
A/601/5013	201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	202	Using and interpreting engineering data and documentation	5
K/601/5055	303	Working efficiently and effectively in engineering	5
Optional group A			
Y/504/9207	356	Welding Rails using the Aluminothermic Welding Process	63
D/504/9208	357	Restore Rails to Operational Condition using an Arc Welding Process	48
Optional group B			
H/504/9209	358	Preparing Flash Welding Machines for Operation	61
Y/504/9210	359	Joining Rails using Flash Welding Equipment	50

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

Total Qualification Time

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

Title and level	GLH	TQT
Level 3 NVQ Diploma in Fabrication and Welding – Rail Welding	393	1240

2 Centre requirements

Approval

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

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

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

Resource requirements

Centre staffing

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

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

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

Assessors and internal verifier

Assessor Requirements to Demonstrate Effective Assessment Practice

Assessment must be carried out by competent Assessors that as a minimum must hold the Level 3 Award in Assessing Competence in the Work Environment**.** Current and operational assessors that hold units D32 and/or D33 or A1 and/or A2 as appropriate for the assessment requirements set out in this Unit Assessment Strategy. However, they will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace assessment to the most up to date National Occupational Standards (NOS)

Assessor Technical Requirements

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

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

Assessors must also be:

Fully conversant with the Awarding Organisation's assessment recording documentation used for the NVQ units against which the assessments and verification are to be carried out, other relevant documentation and system and procedures to support the QA process.

Verifier Requirements (internal and external)

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

External quality assurance **(External Verification)** must be carried out by competent External Verifiers that as a minimum must hold the Level 4 Award in the External Quality Assurance of Assessment Processes and Practices**.** Current and operational External Verifiers that hold external verification units V2 or D35 will not be required to achieve the Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the Level 3 Award in Assessing Competence in the Work Environment

External and Internal Verifiers will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace Quality Assurance (verification) of Assessment Processes and Practices to the most up to date National Occupational Standards (NOS) Verifiers, both Internal and External, will also be expected to be fully conversant with the terminology used in the NVQ units against which the assessments and verification are to be carried out, the appropriate Regulatory Body's systems and procedures and the relevant Awarding Organisation's documentation,

Continuing professional development (CPD)

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

Candidate entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully so should have the opportunity to gather work based evidence.

The SEMTA Engineering Manufacture apprenticeship framework suggests that:

Employers would be interested in candidates that:

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

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

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

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

- The use of high quality, realistic simulations/replication, which impose pressures which are consistent with workplace expectations, should only be used in relation to the assessment of the following:-
  - rare or dangerous occurrences, such as those associated with health, safety and the environment issues, emergency scenarios and rare operations at work;
  - the response to faults and problems for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence;

- aspects of working relationships and communications for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence.

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

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

Age restrictions

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

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

3 Delivering the qualification

Initial assessment and induction

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

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

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

Recommended delivery strategies

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

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

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

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

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

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

Recording documents

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

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

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

Recording forms are available on the City & Guilds website.

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

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

4 Assessment

Assessment of the qualification

Candidates must:

- have a completed portfolio of evidence for each unit chosen

Time constraints

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

- Candidates must finish their assessment within the period of registration

Evidence requirements

Carrying Out Assessments

The NVQ units were specifically developed to cover a wide range of activities. The evidence produced for the units will, therefore, depend on the learners choice of “bulleted items” listed in the unit assessment criteria.
Where the assessment criteria gives a choice of bulleted items (for example ‘any three from five’), assessors should note that learners do not need to provide evidence of the other items to complete the unit (in this example, two) items, particularly where these additional items may relate to other activities or methods that are not part of the learners normal workplace activity or area of expertise.

Minimum Performance Evidence Requirements

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

The most effective way of assessing competence, is through direct observation of the learner. Assessors must make sure that the evidence provided reflects the learner’s competence and not just the achievement of a training programme.

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

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

Performance evidence must be a combination of:

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

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

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

Assessing knowledge and understanding

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

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

Evidence of knowledge and understanding will **not** be required for those bulleted items in the assessment criteria that have not been selected by the learner.
The achievement of the specific knowledge and understanding requirements of the units cannot simply be inferred by the results of tests or assignments from other units, qualifications or training programmes. Where evidence is submitted from these sources, the assessor must, as with any assessment, make sure the evidence is valid, reliable, authentic, directly attributable to the learner, and meets the full knowledge and understanding requirements of the unit. Where oral questioning is used the assessor must retain a record of the questions asked, together with the learner's answers.

Witness testimony

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

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

Recognition of prior learning (RPL)

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

RPL is allowed and is also sector specific.

5 Units

Availability of units

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

Structure of units

These units each have the following:

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

Unit 201 Complying with statutory regulations and organisational safety requirements

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

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

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

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

dangerous occurrences or hazardous malfunctions of equipment

1.6 recognise and control hazards in the workplace

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

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

1.8 use correct manual lifting and carrying techniques

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

a. lifting alone
b. with assistance of others
c. with mechanical assistance

1.10 apply safe working practices and procedures to include:

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

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

Assessment criteria

The learner can:

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

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

2.3 describe the warning signs for the nine main groups of hazardous substances defined by classification, packaging and labelling of dangerous substances regulations

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

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

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

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

Unit 202 Using and interpreting engineering data and documentation

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

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

Learning outcome	**The learner will:**
1. use and interpret engineering data and documentation	
Assessment criteria	
The learner can: 1.1 use the approved source to obtain the required data and documentation 1.2 use the data and documentation and carry out all of the following: a. check the currency and validity of the data and documentation used b. exercise care and control over the documents at all times c. correctly extract all necessary data in order to carry out the required tasks d. seek out additional information where there are gaps or deficiencies in the information obtained e. deal with or report any problems found with the data and documentation f. make valid decisions based on the evaluation of the engineering information extracted from the documents g. return all documents to the approved location on completion of the work h. complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation 1.3 correctly identify, interpret and extract the required information 1.4 extract information that includes three of the following: a. materials or components required b. dimensions c. tolerances d. build quality e. installation requirements f. customer requirements g. time scales h. financial information i. operating parameters j. surface texture requirements k. location/orientation of parts l. process or treatments required m. dismantling/assembly sequence n. inspection/testing requirements o. number/volumes required p. repair/service methods	

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

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

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

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

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

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

k. health and safety standards relating to the activity (such as COSHH)
l. other specific related documentation

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

1.9 report any inaccuracies or discrepancies in documentation and specifications.

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

Assessment criteria

The learner can:

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

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

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

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

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

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

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

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

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

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

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

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

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

2.14 explain what types of documentation are used and how they interrelate (such as production drawings, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)

2.15 explain the imperial and metric systems of measurement; tolerancing and fixed reference points

2.16	describe the meaning of the different symbols and abbreviations found on the documents that they use (such as surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)
2.17	describe the extent of their own responsibility, when to act on their own initiative to find, clarify and evaluate information, and to whom they should report if they have problems that they cannot resolve.

Unit 303 Working efficiently and effectively in engineering

UAN:	**K/601/5055**
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from SEMTA national occupational standard: Working efficiently and effectively in engineering (Suite 3).
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they have the appropriate job specifications and instructions and that any tools, equipment, materials and other resources required are available and in a safe and usable condition. On completion of the engineering activity, the learner will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used. In order to be efficient and effective in the workplace, the learner will also be required to demonstrate that they can create and maintain effective working relationships with colleagues and line management. The learner will also be expected to review

objectives and targets for their personal development and make recommendations to, and communicate any opportunities for, improvements that could be made to working practices and procedures.

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

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

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

Learning outcome	The learner will:
1. work efficiently and effectively in engineering	
Assessment criteria	

The learner can:

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

1.2 prepare the work area to carry out the engineering activity

1.3 prepare to carry out the engineering activity, taking into consideration all of the following, as applicable to the work to be undertaken:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Learning outcome	The learner will:
2. know how to work efficiently and effectively in engineering	
Assessment criteria	
The learner can: 2.1 describe the safe working practices and procedures to be followed whilst preparing and tidying up their work area 2.2 describe the correct use of any equipment used to protect the health and safety of themselves and their colleagues 2.3 describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity 2.4 describe the action that should be taken if documentation received is incomplete and/or incorrect 2.5 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity 2.6 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity 2.7 describe the action that should be taken if tools and equipment are not in full working order 2.8 describe the checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity 2.9 describe the action that should be taken if materials do not meet the requirements of the activity 2.10 explain whom to inform when the work activity has been completed 2.11 describe the information and/or documentation required to confirm that the activity has been completed 2.12 explain what materials, equipment and tools can be reused 2.13 explain how any waste materials and/or products are transferred, stored and disposed of 2.14 explain where tools and equipment should be stored and located 2.15 describe the importance of making recommendations for improving working practices 2.16 describe the procedure and format for making suggestions for improvements 2.17 describe the benefits to organisations if improvements can be identified 2.18 describe the importance of maintaining effective working relationships within the workplace 2.19 describe the procedures to deal with and report any problems that can affect working relationships 2.20 describe the difficulties that can occur in working relationships 2.21 describe the regulations that affect how they should be treated at work (such as equal opportunities act, race and sex discrimination, working time directive) 2.22 describe the benefits of continuous personal development 2.23 describe the training opportunities that are available in the workplace 2.24 describe the importance of reviewing their training and development 2.25 explain with whom to discuss training and development issues 2.26 describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve.	

Unit 356 Welding rails using the aluminothermic welding process

UAN:	**Y/504/9207**
Level:	3
Credit value:	63
GLH:	168
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 56: Welding Rails using the Aluminothermic Welding Process (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce satisfactory welds on site in steel rails using the aluminothermic welding process, in accordance with approved procedures. In this context, steel rail means grades and profiles 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, the learner will need to identify the rail material and section and to take account of any wear on the railhead. The learner will be expected to prepare the joint area and the welding equipment, to make and finish the weld, and to provide instructions to their assistant. 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.

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 with minimum supervision, taking personal responsibility for their own actions and those of their assistant, 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 the aluminothermic welding procedures. The learner will understand the equipment, materials and consumables used, in adequate depth to provide a sound background for the welding operations to be performed, recognising and correcting faults, and for ensuring the work output is produced to the required specification. Visual inspection of their work is implied.

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

Learning outcome
The learner will: 1. weld rails using the aluminothermic welding process
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and job instructions 1.3 check that the joint preparation complies with the specification 1.4 check that joining and related equipment and consumables are as specified and fit for purpose 1.5 carry out all of the following in accordance with applicable specifications: a. confirm the welding equipment, consumables and ancillary equipment is available and fit for purpose b. identify the correct rail and measure rail wear c. cut the rail using the oxy-fuel process, a band saw or an

abrasive disc
   d. align the rail and mark datum (reversed logical)
   e. preheat the crucible and the joint area
   f. join the rails using safe and approved welding methods and procedures
   g. re-instate the track to the required standard on completion of the welding activities
   h. dispose of waste and surplus materials in accordance with approved procedures

1.6 set up, check, adjust and use aluminothermic and related welding equipment for one of the following process variants, in accordance with the appropriate process manual:
   a. Thermit
   b. Railtech

1.7 use moulds and consumables appropriate to the material and application, to include all of the following:
   a. join new rail to worn rail
   b. worn to worn rail
   c. two different rail materials
   d. produce composite welds

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

1.9 weld joints according to approved welding procedures in both of the following:
   a. normal gap
   b. wide gap

1.10 check and record the welds by carrying out all of the following:
   a. correctly applying tensor equipment
   b. inspecting the weld and deciding on its acceptance
   c. recording the weld and marking the rail accordingly

1.11 produce welds which meet all of the following quality and specified dimensional accuracy standards:
   a. achieve a minimum weld quality required by the application standard
   b. meet the required dimensional accuracy within specified tolerance
   c. have been finished to the required specification in terms of removal of risers and excess metal
   d. are ground to the required standard

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

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

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

Learning outcome
The learner will: 2. know how to weld rails using the aluminothermic welding process

Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures to be observed when working on rail construction sites using aluminothermic welding equipment (general site safety, appropriate personal protective equipment (PPE), fire prevention, protecting other workers, accident procedure; statutory regulations; client requirements) 2.2 describe the hazards associated with aluminothermic welding (poor gas supply, leaks, hot metal, and exothermic reactions), and explain how they can be minimised 2.3 explain how to extract the required information from the procedure specifications 2.4 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) 2.5 explain the different types of rail materials, sections and rail support and attachment systems 2.6 explain rail wear and rail alignment 2.7 describe the equipment and consumables used for aluminothermic welding 2.8 explain the aluminothermic welding process and use of the process manuals 2.9 explain how to set up the joint (such as cutting, alignment, moulds, luting) 2.10 explain how to set up 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) 2.11 explain the techniques of operating the welding equipment to produce a range of joints in accordance with the appropriate process manual 2.12 explain the importance of complying with job instructions and the welding process specification 2.13 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 2.14 explain rail stressing and the use of tensor equipment 2.15 describe how to finish the welds (removal of risers, shearing and grinding) 2.16 explain the procedures to be followed to ensure the track is correctly reinstated on completion of the welding activities 2.17 describe the organisational quality systems used, finished weld acceptance criteria and weld standards to be achieved, weld inspection and test procedures used, including visual inspection and non-destructive tests 2.18 explain weld sentencing and the actions to be taken if the finished weld is not acceptable 2.19 explain the personal approval tests and their applicability to their work 2.20 describe the extent of their own responsibility and explain whom they should report to if they have problems that they cannot resolve

Unit 357 Restore rails to operational condition using an arc welding process

UAN:	**D/504/9208**
Level:	3
Credit value:	48
GLH:	147
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 57: Restore Rails to Operational Condition using an Arc Welding Process (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to 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. The learner's responsibilities will require them to comply with organisational policy and procedures for the welding activities undertaken, and to report any problems with the welding equipment or welding activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, taking personal responsibility for their own actions and for the quality and

accuracy of the work that they 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 understand 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 will be required to demonstrate safe working practices throughout. The learner will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. restore rails to operational condition using an arc welding process
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the repair activities: a. determine or confirm the specific repair to be carried out b. prepare the area of the rail to be repaired using grinding and penetrant testing c. use safe and approved repair welding procedures at all times d. finish the repair using approved methods and techniques e. test the repaired area using the penetrant method f. re-instate the track to the required standard on completion of the repair activities g. dispose of waste and surplus materials in accordance with approved procedures 1.3 use one of the following arc welding processes: a. manual metal arc b. 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: a. confirming welding equipment, consumables and ancillary equipment is available b. checking that all leads/cables are secure and in a safe and usable condition c. checking that the wire feed mechanism or electrode holder is securely connected and free from damage

d. ensuring that the correct type and size of wire or electrode is loaded to the wire feed mechanism or electrode holder
e. setting and adjusting the welding conditions in line with the instructions or welding procedure specification
f. 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:
a. two different wire or electrode types
b. 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:
a. normal grade rail
b. austenitic-manganese rail

1.10 produce repairs which include both of the following:
a. resurfacing
b. repair

1.11 ensure that the repaired component meets the specified operating conditions

1.12 produce welded repairs which meet all of the following quality and accuracy standards:
a. achieve a minimum weld quality as required by the application standard
b. meet the required dimensional accuracy within specified tolerances
c. are ground to the required standard

1.13 produce accurate and complete records of all the repair work carried out

Learning outcome
The learner will: 2. know how to restore rails to operational condition using an arc welding process
Assessment criteria
The learner can: 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 regulations) 2.2 describe the hazards associated with arc welding (live electrical components, poor earthing, the electric arc, fumes and gases, spatter, hot metal), and explain how they can be minimised 2.3 explain 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	explain how to identify the various steels used in rails, switches and crossings, and explain how they will effect the welding repair procedure
2.7	explain how to prepare the area of the rail to be repaired by grinding and penetrant testing
2.8	explain how to prepare the welding equipment, and checks that need to be made to ensure that it is safe and ready to use (electrical connections, 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	explain how to complete and finish the repaired rails (grinding off excess material, finish profiling and penetrant testing)
2.12	explain 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	explain 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	explain 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

Unit 358 Preparing flash welding machines for operation

UAN:	**H/504/9209**
Level:	3
Credit value:	61
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 58: Preparing Flash Welding Machines for Operation (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to prepare flash welding machines for operation, in accordance with approved procedures. The learner will be required to set up and check both the welding installation and all associated mechanical and electrical apparatus forming part of the mechanised or automated installation. This will include setting up of handling and loading equipment, workholding arrangements, transfer mechanisms and safety equipment, as applicable to the machine type. In setting up the welding conditions, the learner will be expected to set the electrical conditions, process cycle times, and weld and forge travel. The learner must produce trial welds and prove the machine is working satisfactorily before declaring the installation ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role. The learner's responsibilities will require them to comply with organisational policy and procedures for setting up the welding equipment, 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 with

minimum 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 provide a good understanding of their work, and will provide an informed approach to applying flash welding procedures. The learner will understand the welding process carried out, and its application, and will know about the equipment, relevant materials and consumables, in adequate depth to provide a sound basis for setting up the equipment, 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 machine and its associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. prepare flash welding machines for operation
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure specification and job instructions for the work to be produced 1.3 check that the equipment is as specified and in usable condition 1.4 obtain the required components and check that the joint preparation complies with the specification 1.5 set up the handling, work-holding and associated equipment to achieve correct joint positioning 1.6 set up the components to achieve correct joint fit-up and alignment, to include setting and checking all of the following, as applicable to the type of installation: a. surface preparation and condition of joint faces is in accordance with the specification b. handling and loading equipment c. workholding devices d. transfer mechanisms e. safety devices 1.7 select and prepare the appropriate consumables in line with the joining procedure specification 1.8 set and adjust the machine operating conditions to achieve joints of the required quality and within specified dimensional accuracy

1.9 set up the welding equipment and parameters in accordance with the welding procedure specification, to include setting all of the following, as applicable to the type of installation:
   a. heat and forge cycle times
   b. heat and forge loads (forces)
   c. weld and forge travel
   d. electrical settings

1.10 set up the equipment to produce welded components which cover both of the following:
   a. two different rail sections
   b. two different rail materials

1.11 check that all safety mechanisms are in place and that the equipment is operating satisfactorily

1.12 prove the installation is operating correctly and is ready for production, by producing specified trial welds and checking all of the following, as applicable to the application:
   a. visual appearance of the weld
   b. dimensional accuracy
   c. quality of weld
   d. machine settings are as specified

1.13 solve problems in production relating to two of the following:
   a. machine performance
   b. joint set-up
   c. condition of materials being joined
   d. consumables

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

Learning outcome
The learner will: 2. know how to prepare flash welding machines for operation
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures to be observed when setting and operating a flash welding installations (working with machinery; the use of appropriate personal protective equipment (PPE), machine guards; ventilation and fume extraction; machine safety devices; stopping the machine in an emergency; closing the machine down on completion of activities) 2.2 describe the hazards associated with flash welding machines (dangers from live electrical components; fumes; hot metal; moving parts of machinery), and explain how they can be minimised 2.3 explain the basic principles of flash welding (using heat generated by electricity to join metals by welding; forming a weld; principal features of a welded joint; welding cycle, parameters, heat input; how variation in the parameters influences the weld features, quality and output; 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 explain mechanised and automated welding basics (types of installations; machine functions: loading, handling, clamping and transfer of components; control of machine 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 explain how to prepare the joint faces (finish, tolerances) 2.8 describe the problems that can occur with the flash welding activities, and explain how these can be overcome (welding characteristics of parent materials and sources of weld defects; methods of prevention) 2.9 explain how to set up the welding equipment to the welding procedure specification (setting welding cycle; heating and forging forces, electrical conditions) 2.10 explain how to check the machine functions to the required specification (running pre-production trials to prove that the installation is working satisfactorily) 2.11 describe the organisational quality systems (standards to be achieved; production records to be kept, methods of testing flash welds and principles of quality control in production) 2.12 explain the personal approval tests and their applicability to their work 2.13 describe the extent of their authority and explain whom should they report to if they have problems that they cannot resolve

Unit 359 Joining rails using flash welding equipment

UAN:	**Y/504/9210**
Level:	3
Credit value:	50
GLH:	147
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 59: Joining Rails using Flash Welding Equipment (Suite 3)
Assessment requirements specified by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to operate flash welding installations, which have already been prepared for production in accordance with approved instructions, or welding procedures. The learner will be expected to check that the installation has been approved for production, and that sufficient supplies of all required materials and consumables are present and correct, and ready for production operations to be performed. The learner must operate the installation safely and correctly, in accordance with instructions and approved procedures, and achieve a weld quality and tolerances that meet the product specification. The production output may be inspected by visual and non-destructive testing methods to check that the specified quality is being achieved. The learner must continuously monitor the operation of the installation and make any necessary adjustments to equipment settings, in line with their permitted authority, in order to produce the welded joints to the required specification. Meeting production requirements will be an important issue, and their production records must show consistent and satisfactory performance. The learner's responsibilities will require them to comply with organisational policy

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

The learner's underpinning knowledge will be sufficient to provide a sound basis of 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.

Learning outcome
The learner will: 1. join rails using flash welding equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant joining procedure and work instructions 1.3 confirm that the installation is ready for operation by checking all of the following: a. the installation has been approved for production b. supplies of components and consumables are adequate and correctly prepared c. machine settings comply with instructions and the welding procedure specification d. all safety equipment is in place and functioning correctly 1.4 check that the parent material, components, consumables and joint preparation comply with specifications 1.5 confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out 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:
   a. heat and forge cycle time
   b. heat and forge loads (forces)
   c. electrical conditions
   d. weld and forge travel
   e. weld appearance (correct extrusion)

1.8 produce welded components covering both of the following:
   a. two different rail sections
   b. two different rail material groups

1.9 achieve joints of the required quality and specified dimensional accuracy

1.10 produce welded rails which meet all of the following quality and accuracy standards:
   a. achieve a weld quality as specified in the application standard
   b. meet the required dimensional accuracy within specified tolerances

1.11 achieve the rate of output is as specified

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

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

Learning outcome
The learner will: 2. know how to join rails using flash welding equipment
Assessment criteria
The learner can: 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) 2.2 describe the hazards associated with flash welding machines (dangers from live electrical components; fumes; hot metal; moving parts of machinery), and explain how they can be minimised 2.3 explain the principles of flash welding; 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 explain the mechanised and automated welding basics; types of installations; machine 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 explain the operation of the machine; controls and their function; care of equipment 2.8 explain how to set up and align the workpiece 2.9 explain how to monitor the equipment 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 explain the self inspection of the completed work 2.12 describe the organisational quality systems (standards to be achieved; feedback from machine; corrective actions; production records to be kept) 2.13 explain the personal approval tests and their applicability to their work 2.14 describe the extent of their own responsibility and explain whom they should report to if they have problems that they cannot resolve

Appendix 1 Relationships to other qualifications

Links to other qualifications

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

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

This qualification has connections to the:

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

Literacy, language, numeracy and ICT skills development

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

- Functional Skills (England) – see **www.cityandguilds.com/functionalskills**
- Essential Skills (Northern Ireland) – see **www.cityandguilds.com/essentialskillsni**
- Essential Skills Wales (from September 2010).

Appendix 2 Sources of general information

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

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

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

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

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

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

City & Guilds

Skills for a brighter future

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Useful contacts

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

About City & Guilds

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

City & Guilds Group

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

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