

# Level 3 NVQ Extended Diploma in Mechanical Engineering (Pipe Fitting and Assembly) (1712-34)

November 2022 Version 2.0



## Qualification at a glance

<b>Subject area</b>	<b>Mechanical Manufacturing Engineering</b>
<b>City &amp; Guilds number</b>	1712
<b>Age group approved</b>	16+
<b>Entry requirements</b>	None
<b>Assessment</b>	Portfolio of evidence
<b>Automatic approval</b>	Available
<b>Support materials</b>	Centre handbook
<b>Registration and certification</b>	Consult the Walled Garden/Online Catalogue for last dates

<b>Title and level</b>	<b>GLH</b>	<b>TQT</b>	<b>City &amp; Guilds number</b>	<b>Accreditation number</b>
Level 3 NVQ Extended Diploma in Mechanical Manufacturing Engineering – Pipe Fitting and Assembly	439	1060	1712-34	601/0081/3

<b>Version and date</b>	<b>Change detail</b>	<b>Section</b>
1.1 February 2018	Added TQT and GLH details  Deleted QCF	<b>Qualification at a Glance, Structure</b>  <b>Throughout</b>
1.2 October 2018	Changed from a seven to a nine	<b>Unit 201 Assessment criteria 2.3</b>
2.0 November 2022	Adjusted document to only fit extended diploma requirements, as the original diploma has expired  Adjusted TQT & GLH  Added PEO Requirements  Links updated throughout	<b>Structure</b>  <b>GLH &amp; TQT</b>  <b>Throughout</b>





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# 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 candidates who work or want to work as mechanical manufacturing engineers – pipe fitting and assembly in the mechanical manufacturing engineering sector
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the mechanical manufacturing engineering sector.
Is the qualification part of a framework or initiative?	It serves as a competence qualification, in the Engineering Apprenticeship framework.
What opportunities for progression are there?	It allows candidates to progress into employment or to the following City & Guilds qualifications: <ul style="list-style-type: none"> <li>• City &amp; Guilds level 4 engineering qualifications</li> <li>• Foundation degree or other higher education qualifications</li> </ul>

## Structure

To achieve the **Level 3 NVQ Extended Diploma in Mechanical Manufacturing Engineering (Pipe Fitting and Assembly)**, Learners must achieve the minimum requirements from the Performing Engineering Operations (PEO) units, which can be found on the “1712 L2 Unit pack” document on the mechanical manufacturing engineering (1712) page (cityandguilds.com):

- A minimum of **27 credits** and **3 units** from PEO pathway A (704-761, 765-773), or:
- A minimum of **51 credits** must be achieved from PEO pathway B: this must be achieved from:
  - **11 credits** and **1 unit** from group B1 (704, 731,761)
  - **16 credits** and **2 units** from group B2 (762-764) and
  - **24 credits** and **2 units** from group B3 (765-768)
- If PEO pathway A is undertaken learners **must** note the following barred units
  - Only one unit from 704, 732 and 761 may be included in the learner’s choice of three units
  - If unit 765 is selected units 705, 706, 708, 711, 712, 715, 716, 717 cannot be included in the learner’s choice of three units

- If unit 766 is selected units 710, 722, 723, 725, 726, 727, 728, 729, 730, 734 cannot be included in the learner's choice of three units.
- If unit 767 is selected units 733, 735, 736, 740 cannot be included in the learner's choice of three units.
- If unit 768 is selected units 719, 721, 737, 738, 739, 740, 758, 759 cannot be included in the learner's choice of three units.

Learners must also achieve **15** credits from the mandatory units, plus **46** credits from the optional units available in group A and a minimum of **60** credits from a minimum of **2** units from the optional units in group C.

<b>Unit accreditation number</b>	<b>City &amp; Guilds unit number</b>	<b>Unit title</b>	<b>Credit value</b>
<b>Mandatory</b>			
A/601/5013	Unit 201	Complying with Statutory Regulations and Organisational Safety Requirements	5
Y/601/5102	Unit 202	Using and Interpreting Engineering Data and Documentation	5
K/601/5055	Unit 303	Working Efficiently and Effectively in Engineering	5
<b>Optional Group A</b>			
Y/600/5542	Unit 374	Pipe Bending and Forming by Hand Methods	46
T/600/5547	Unit 375	Pipe Bending and Forming using Bending Machines	46
<b>Optional Group B</b>			
L/600/5554	Unit 376	Assembling Screwed Pipework	30
D/600/5557	Unit 377	Assembling Small Bore Non-Ferrous Pipework	30
K/600/5562	Unit 378	Assembling Non-Metallic Pipework	30

J/600/5567	Unit 379	Preparing and Testing Pipework Systems	46
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L/600/5571	Unit 380	Producing Socket and Flange Fillet Welded Joints in Pipe using a Manual Welding Process	86
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### 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.

<b>Title and level</b>	<b>GLH</b>	<b>TQT</b>
Level 3 NVQ Extended Diploma in Mechanical Manufacturing Engineering – Pipe Fitting and Assembly	439	1060



## 2 Centre requirements

### Approval

Centres currently offering the City & Guilds Level 3 NVQ in Mechanical Manufacturing Engineering (1682) 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 areas 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, e.g. 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 reasons 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
- any units they have already completed, or credit they have accumulated which is relevant to the qualification
- the appropriate type and level of qualification.

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

### Recommended delivery strategies

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

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

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

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

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

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

### Recording documents

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

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

### 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 outcomes.

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
- 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: **The Register of Regulated Qualifications: Home page** ([ofqual.gov.uk](http://ofqual.gov.uk))

### Structure of units

These units each have the following:

- City & Guilds unit number
- Title
- Unit Accreditation Number (UAN)
- Level
- Credit value
- Recommended Guided Learning Hours (GLH)
- Relationship to National Occupational Standards (NOS), other qualifications and frameworks
- Endorsement by a sector or other appropriate body
- Unit aim(s)
- Learning outcomes which are comprised of a number of assessment criteria.

## Unit 201

# Complying with statutory regulations and organisational safety requirements

<b>UAN:</b>	<b>A/601/5013</b>
<b>Level:</b>	2
<b>Credit value:</b>	5
<b>GLH:</b>	35
<b>Relationship to NOS:</b>	This unit has been derived from Semta national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	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

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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.

<b>Learning outcome</b>
The learner will: 1. comply with statutory regulations and organisational safety requirements
<b>Assessment criteria</b>
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: <ul style="list-style-type: none"><li>• applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act</li><li>• identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as:<ul style="list-style-type: none"><li>- eye protection and Personal Protective Equipment (PPE)</li><li>- COSHH regulations</li><li>- risk assessments</li></ul></li><li>• identifying the warning signs and labels of the main groups of hazardous or dangerous substances</li><li>• complying with the appropriate statutory regulations at all times</li></ul> 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: <ul style="list-style-type: none"> <li>• identifying the appropriate qualified first aiders and the location of first aid facilities</li> <li>• identifying the procedures to be followed in the event of injury to themselves or others</li> <li>• following organisational procedures in the event of fire and the evacuation of premises</li> <li>• identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment</li> </ul>
1.6	recognise and control hazards in the workplace
1.7	identify the hazards and risks that are associated with the following: <ul style="list-style-type: none"> <li>• their working environment</li> <li>• the equipment that they use</li> <li>• materials and substances (where appropriate) that they use</li> <li>• working practices that do not follow laid-down procedures</li> </ul>
1.8	use correct manual lifting and carrying techniques
1.9	demonstrate one of the following methods of manual lifting and carrying: <ul style="list-style-type: none"> <li>• lifting alone</li> <li>• with assistance of others</li> <li>• with mechanical assistance</li> </ul>
1.10	apply safe working practices and procedures to include: <ul style="list-style-type: none"> <li>• maintaining a tidy workplace, with exits and gangways free from obstruction</li> <li>• using equipment safely and only for the purpose intended</li> <li>• observing organisational safety rules, signs and hazard warnings</li> <li>• taking measures to protect others from any harm resulting from the work that they are carrying out.</li> </ul>

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

<b>UAN:</b>	<b>Y/601/5102</b>
<b>Level:</b>	2
<b>Credit value:</b>	5
<b>GLH:</b>	25
<b>Relationship to NOS:</b>	This unit has been derived from Semta national occupational standard: Using and interpreting engineering data and documentation (Suite 2).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>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.</p>

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

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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.

<b>Learning outcome</b>
The learner will: 1. use and interpret engineering data and documentation
<b>Assessment criteria</b>
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: <ul style="list-style-type: none"><li>• check the currency and validity of the data and documentation used</li><li>• exercise care and control over the documents at all times</li><li>• correctly extract all necessary data in order to carry out the required tasks</li><li>• seek out additional information where there are gaps or deficiencies in the information obtained</li><li>• deal with or report any problems found with the data and documentation</li><li>• make valid decisions based on the evaluation of the engineering information extracted from the documents</li><li>• return all documents to the approved location on completion of the work</li><li>• complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation</li></ul> 1.3 correctly identify, interpret and extract the required information 1.4 extract information that includes three of the following: <ul style="list-style-type: none"><li>• materials or components required</li><li>• dimensions</li><li>• tolerances</li><li>• build quality</li><li>• installation requirements</li><li>• customer requirements</li><li>• time scales</li><li>• financial information</li><li>• operating parameters</li><li>• surface texture requirements</li></ul>

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



	<ul style="list-style-type: none"> <li>• specifications (such as material, finish, process, contractual, calibration)</li> <li>• reference materials (such as manuals, tables, charts, guides, notes)</li> <li>• schedules</li> <li>• operation sheets</li> <li>• service/test information</li> <li>• planning documentation</li> <li>• quality control documents</li> <li>• company specific technical instructions</li> <li>• national, international and organisational standards</li> <li>• health and safety standards relating to the activity (such as COSHH)</li> <li>• other specific related documentation</li> </ul>
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.

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

<b>UAN:</b>	<b>K/601/5055</b>
<b>Level:</b>	3
<b>Credit value:</b>	5
<b>GLH:</b>	25
<b>Relationship to NOS:</b>	This unit has been derived from Semta national occupational standard: Working efficiently and effectively in engineering (Suite 3).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>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.</p> <p>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.</p> <p>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</p>

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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.

<b>Learning outcome</b>
The learner will: 1. work efficiently and effectively in engineering
<b>Assessment criteria</b>
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: <ul style="list-style-type: none"><li>• the work area is free from hazards and is suitably prepared for the activities to be undertaken</li><li>• any required safety procedures are implemented</li><li>• any necessary personal protection equipment is obtained and is in a usable condition</li><li>• tools and equipment required are obtained and checked that</li></ul>

- they are in a safe and useable condition
  - all necessary drawings, specifications and associated documentation is obtained
  - job instructions are obtained and understood
  - the correct materials or components are obtained
  - storage arrangements for work are appropriate
  - appropriate authorisation to carry out the work is obtained
- 1.4 check that there are sufficient supplies of materials and/or consumables and that they meet work requirements
- 1.5 ensure 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:
- completing all necessary documentation accurately and legibly
  - returning tools and equipment
  - returning drawings and work instructions
  - identifying, where appropriate, any unusable tools, equipment or components
  - 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:
- materials
  - tools and equipment
  - drawings
  - job specification
  - quality
  - people
  - timescales
  - safety
  - 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:
- working practices
  - working methods
  - quality
  - safety
  - tools and equipment
  - supplier relationships
  - internal communication
  - customer service
  - training and development
  - teamwork
  - other
- 1.12 maintain effective working relationships with colleagues to include

two of the following:

- colleagues within own working group
- colleagues outside normal working group
- line management
- 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:

- dual or multi-skilling
- training on new equipment / technology
- increased responsibility
- understanding of company working practices, procedures, plans and policies
- other specific requirements.

### **Learning outcome**

The learner will:

2. know how to work efficiently and effectively in engineering

### **Assessment criteria**

The learner can:

- 2.1 describe the safe working practices and procedures to be followed whilst preparing and tidying up their work 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 374

## Pipe bending and forming by hand methods

<b>UAN:</b>	<b>Y/600/5542</b>
<b>Level:</b>	3
<b>Credit value:</b>	46
<b>GLH:</b>	150
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 74: Pipe Bending and Forming by Hand Methods (Level 3).
<b>Endorsement by a sector or regulatory body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	This unit covers the skills and knowledge needed to prove the competences required to bend and form ferrous, non-ferrous and/or non-metallic pipe, using hand methods, in accordance with approved procedures. In producing pipe bends and forms, the learner will be expected to select and use a range of hand tools, forming equipment and techniques, which are appropriate to the type of material and operations being performed.

Activities will include cutting the pipes to the required lengths using hand sawing, band sawing or pipe/cutting machines, bending pipes using hand bending machines, springs, fillers or heating techniques, and the use of templates or set wires to check bend profiles. The pipework produced will have the features that include angular bends, offsets, bridge sets and expansion loops.

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



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the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying pipe bending and forming procedures. The learner will understand the pipe bending and forming activities, and their application, and will know about the pipe bending and forming equipment and techniques, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output is completed to the required specification.

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

<b>Learning outcome</b>
The learner will: 1. bend and form pipe by hand methods
<b>Assessment criteria</b>
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 pipe hand forming and bending activities: <ul style="list-style-type: none"><li>• obtain and use the appropriate documentation (such as job instructions, drawings, planning documentation, quality control documentation, pipe and tube specifications)</li><li>• adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work</li><li>• check that bending and forming equipment is in a safe and usable condition</li><li>• follow safe practice/approved pipe bending techniques and procedures at all times</li><li>• return all tools and equipment to the correct location on completion of the pipe bending activities</li><li>• leave the work area in a safe and appropriate condition on completion of the activities</li></ul> 1.3 follow the correct component drawing and any other related specifications for the component to be produced 1.4 determine what has to be done and how this will be achieved 1.5 mark out pipework using two of the following methods:

- direct marking using tapes and markers
  - set-outs of pipework using templates
  - producing set wires
  - set-outs of pipework onto floor
- 1.6 use the appropriate tools and equipment for the pressure shaping operations and check that they are in a safe and usable condition
- 1.7 shape the materials to the required specification using appropriate methods and techniques
- 1.8 bend and form two of the following types of pipe:
- carbon steel
  - stainless steel
  - copper
  - brass
  - aluminium
  - plastic
- 1.9 cut and prepare pipework using three of the following:
- hack saws
  - power saw
  - pipe/tube cutter
  - de-burring reamers
  - abrasive discs
- 1.10 bend and form pipe using four of the following methods:
- bending springs
  - pipe bender
  - pipe expander
  - heating methods
  - swaging kit
  - fillers
- 1.11 produce pipework forms that include three of the following:
- angular bends
  - offsets
  - bridge sets
  - expansion loops
  - radii
  - external swaged ends
  - internal swaged ends
- 1.12 check that all the required shaping operations have been completed to the required standard
- 1.13 produce pipe bends and forms which comply with one of the following quality and accuracy standards:
- BS, ISO or BSEN standards
  - customer standards and requirements
  - company standards and procedures
  - specific system requirements
- 1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

<b>Learning outcome</b>
The learner will: 2. know how to bend and form pipe by hand methods
<b>Assessment criteria</b>
The learner can: 2.1 describe the specific safety precautions to be taken when working with pipe bending and cutting equipment 2.2 describe the specific Personal Protective Equipment to be worn when carrying out the pipe bending activities 2.3 describe the hazards associated with carrying out the pipe bending activities (such as handling long pipe lengths, using bending equipment, using heating equipment), and how to minimise them and reduce any risks 2.4 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken 2.5 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.6 describe the principles and methods of marking out pipework, and the type of equipment used (such as direct marking, use of templates, use of set wires) 2.7 explain how to prepare the pipes in readiness for the marking-out activities (such as visually checking for defects, cleaning the materials, removing burrs and sharp edges) 2.8 describe the methods of holding and supporting pipework during the marking out activities, and the equipment that can be used 2.9 describe the allowances to be made in the marking out, for bending or the assembly of the various fittings that will be used 2.10 describe the characteristics of the various materials that are to be used with regard to the bending operations, and why some materials may require the addition of heat/hot air to aid the bending process 2.11 describe the methods used to hand bend and form the pipe (such as the use of bending springs, hand bending machines, fillers, heating methods) 2.12 explain how to produce the various bends required (such as angled bends, dog-leg sets, bridge sets and expansion loops) 2.13 describe the reasons for incorporating expansion loops in a system, and where they should be positioned 2.14 describe the tools and equipment used in the cutting, bending and forming process 2.15 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 375

## Pipe bending and forming using bending machines

<b>UAN:</b>	<b>T/600/5547</b>
<b>Level:</b>	3
<b>Credit value:</b>	46
<b>GLH:</b>	150
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 75: Pipe Bending and Forming using Bending Machines (Level 3).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	This unit covers the skills and knowledge needed to prove the competences required to bend and form ferrous, non-ferrous and/or non-metallic pipe, using bending machines, in accordance with approved procedures. In producing pipe bends and forms, the learner will be expected to select and use a range of tools, forming equipment and techniques that are appropriate to the type of material and operations being performed.

Activities will include cutting the pipes to the required lengths using saws or pipe/cutting machines, bending pipes using hydraulic bending machines or power operated equipment such as presses, the use of heating techniques to aid the bending process, and the use of templates or set wires to check bend profiles. The pipework produced will have features that include angular bends, offsets, bridge sets and expansion loops.

The learner's responsibilities will require them to comply with organisational policy and procedures for the pipe bending and forming activities undertaken, and to report any problems with the equipment, materials or pipe bending activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with a

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

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying pipe bending and forming procedures. The learner will understand the pipe bending and forming activities, and their application, and will know about the pipe bending and forming equipment and techniques, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring the work output is completed to the required specification.

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

<b>Learning outcome</b>
The learner will: 1. bend and form pipe using bending machines
<b>Assessment criteria</b>
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 activities during hand forming and bending: <ul style="list-style-type: none"><li>• obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, specifications)</li><li>• adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work</li><li>• check that the bending machine and equipment is in a safe and usable condition</li><li>• follow safe practice/approved machine bending techniques and procedures at all times</li><li>• return all tools and equipment to the correct location on completion of the inspection activities</li><li>• leave the work area in a safe and appropriate condition on completion of the activities</li></ul> 1.3 confirm that the equipment is set up correctly and is ready for use 1.4 mark out pipework using two of the following methods:

<ul style="list-style-type: none"> <li>• direct marking using tapes and markers</li> <li>• set-outs of pipework using templates</li> <li>• producing and using set wires</li> <li>• set-outs of pipework onto floor</li> </ul> <p>1.5 manipulate the machine controls safely and correctly in line with operational procedures</p> <p>1.6 produce components to the required specification</p> <p>1.7 bend and form two of the following types of pipe:</p> <ul style="list-style-type: none"> <li>• carbon steel</li> <li>• stainless steel</li> <li>• copper</li> <li>• brass</li> <li>• aluminium</li> <li>• plastic</li> </ul> <p>1.8 cut and prepare pipework using two of the following:</p> <ul style="list-style-type: none"> <li>• pipe cutting machine</li> <li>• power saw</li> <li>• abrasive discs</li> <li>• gas cutting equipment</li> </ul> <p>1.9 bend and form pipe using two of the following methods:</p> <ul style="list-style-type: none"> <li>• hand operated pipe bending machine</li> <li>• hydraulic pipe bending equipment</li> <li>• heating methods</li> <li>• power operated equipment (such as presses)</li> </ul> <p>1.10 produce pipework forms that include all of the following:</p> <ul style="list-style-type: none"> <li>• angular bends</li> <li>• offsets</li> <li>• bridge sets</li> <li>• expansion loops</li> </ul> <p>1.11 carry out quality sampling checks at suitable intervals</p> <p>1.12 produce pipe bends and forms which comply with one of the following quality and accuracy standards:</p> <ul style="list-style-type: none"> <li>• BS, ISO or BSEN standards</li> <li>• customer standards and requirements</li> <li>• company standards and procedures</li> <li>• specific system requirements</li> </ul> <p>1.13 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.14 shut down the equipment to a safe condition on conclusion of the machining activities.</p>
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<b>Learning outcome</b>
The learner will: 2. know how to bend and form pipe using bending machines
<b>Assessment criteria</b>
The learner can: 2.1 describe the specific safety precautions to be taken when working

- with pipe bending and cutting equipment
- 2.2 describe the specific Personal Protective Equipment to be worn when carrying out the pipe bending activities
  - 2.3 describe the hazards associated with carrying out the pipe bending activities using machines (such as handling long pipe lengths, using power operated bending equipment, using heating equipment), and how to minimise them and reduce any risks
  - 2.4 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken
  - 2.5 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
  - 2.6 describe the principles and methods of marking out pipework, and the equipment to be used (such as direct marking, use of templates, use of set wires)
  - 2.7 explain how to prepare the pipes in readiness for the marking out activities (such as visually checking for defects, cleaning the materials, removing burrs and sharp edges)
  - 2.8 describe the methods of holding and supporting pipework during the marking-out activities, and the equipment that can be used
  - 2.9 describe the allowances to be made in the marking out, for bending or the assembly of the various fittings that will be used
  - 2.10 describe the characteristics of the various materials that are to be used with regard to the bending operations, and why some materials may require the addition of heat/hot air to aid the bending process
  - 2.11 describe the methods used to bend and form the pipe (such as the use of hand bending machines, hydraulic bending equipment, power operated equipment and heating methods)
  - 2.12 explain how to produce the various bends required (such as angled bends, dog-leg sets, bridge sets and expansion loops)
  - 2.13 describe the reasons for incorporating expansion loops in a system, and where they should be positioned
  - 2.14 describe the tools and equipment used in the cutting, bending and forming process
  - 2.15 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 376

## Assembling screwed pipework

<b>UAN:</b>	<b>L/600/5554</b>
<b>Level:</b>	3
<b>Credit value:</b>	30
<b>GLH:</b>	91
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 76: Assembling Screwed Pipework (Level 3).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	This unit covers the skills and knowledge needed to prove the competences required to assemble screwed pipework, in accordance with approved procedures. In producing assemblies, the learner will be expected to select and use a range of equipment, hand tools and techniques appropriate to the operations being performed.

The assembly activities will include producing threads on the external ends of the pipe, using stocks and dies or threading machines, and joining the pipes using a range of fittings, which will include flanges and gaskets, straight couplings, elbows, tee pieces, reduction pieces and other fittings as appropriate to the application.

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

The learner's knowledge will provide a good



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understanding of their work, and will provide an informed approach to applying screwed pipework assembly procedures. The learner will understand the pipework assembly, and its application, and will know about the screwed pipework assembly process, components and materials used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the work output is produced to the required specification.

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

<b>Learning outcome</b>
The learner will: 1. assemble screwed pipework
<b>Assessment criteria</b>
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 pipe assembly activities: <ul style="list-style-type: none"><li>• obtain and use the appropriate documentation (such as job instructions, pipe assembly drawings, planning and quality control documentation)</li><li>• adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work</li><li>• check all tools and equipment are in a safe and usable condition</li><li>• follow safe practice/approved pipe fitting and assembly techniques at all times</li><li>• ensure that the components and pipes used are free from foreign objects, dirt or other contamination before assembling them</li><li>• return all tools and equipment to the correct location on completion of the pipe fitting activities</li><li>• leave the work area and assembly in a safe and appropriate condition on completion of the activities</li></ul> 1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 ensure that the specified components are available and that they are in a usable condition 1.5 use the appropriate methods and techniques to assemble the components in their correct positions

- 1.6 cut pipes and produce screw threads on pipe ends, to include all of the following:
- cutting pipes to length with appropriate allowance for threading
  - selecting and setting up dies in stocks or threading machines
  - cutting threads on pipe ends to the appropriate length
  - checking the completed threads have the required fit
- 1.7 assemble screwed pipework using six the following screwed fittings:
- straight couplings
  - elbows
  - tee pieces
  - flanges
  - reduction pieces
  - valves
  - drain/bleeding devices
  - blanking caps
- 1.8 produce assembled pipework which contains three of the following features:
- angular bends
  - offsets
  - bridge sets
  - expansion loops
- 1.9 assemble pipework using all of the following methods and techniques:
- securing pipework supports to structures
  - fitting pipework supports
  - connecting pipe-to-pipe
  - hand tools
  - connecting pipe-to-equipment
  - using gaskets, seals or jointing compounds
  - alignment/levelling equipment
  - torque loading of bolts
- 1.10 secure the components using the specified connectors and securing devices
- 1.11 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification
- 1.12 produce pipework assemblies which comply with one of the following quality and accuracy standards:
- BS, ISO or BSEN standards
  - customer standards and requirements
  - company standards and procedures
  - specific system requirements
- 1.13 deal promptly and effectively with problems within their control and report those that cannot be solved.

<b>Learning outcome</b>
The learner will: 2. know how to assemble screwed pipework
<b>Assessment criteria</b>
The learner can: 2.1 describe the specific safety precautions to be taken when assembling screwed pipework 2.2 describe the Personal Protective Equipment to be used when assembling screwed pipework 2.3 describe the hazards associated with the carrying out pipework assembly activities (such as handling long lengths of pipe, using pipe screwing machinery, handling sealing agents), and how to minimise them and reduce any risks 2.4 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken 2.5 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, work reference points and system of tolerancing 2.6 describe the preparation of pipework and fittings for the assembly operation (such as checking for damage, removing foreign objects, dirt and swarf from bore of pipe, removing burrs) 2.7 describe the range of pipe fittings that can be used, and how to identify them (such as straight connectors, elbows, tee pieces, reduction pieces, flanged fittings, valves, blanking pieces/cap ends) 2.8 explain how to determine the overall length of the pipework required, taking into account allowances for pipe fittings and screwed connections 2.9 explain how to produce screw threads on the pipe ends, and the tools and equipment that can be used (such as stocks and dies, pipe threading machines) 2.10 describe the methods used to seal screwed joints (such as tapes and sealing compounds) 2.11 describe the use of flanges to connect pipes; use of gaskets; and torque loading of flange bolts 2.12 explain how to identify the correct orientation of fittings with regard to flow 2.13 describe the methods used to handle pipework assemblies 2.14 describe the supporting methods that are used when assembling pipework, and the types of fitting that are used 2.15 describe the tools and equipment used when assembling pipework 2.16 describe the standards to be attained, and the company quality procedures 2.17 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

## Unit 377

## Assembling small bore non-ferrous pipework

<b>UAN:</b>	<b>D/600/5557</b>
<b>Level:</b>	3
<b>Credit value:</b>	30
<b>GLH:</b>	91
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 77: Assembling Small Bore Non-Ferrous Pipework (Level 3).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>This unit covers the skills and knowledge needed to prove the competences required to assemble small bore non-ferrous pipework, in accordance with approved procedures. In producing assemblies, the learner will be expected to select and use a range of equipment, hand tools and techniques appropriate to the operations being performed.</p> <p>The assembly activities will include producing soldered joints, brazed joints and compression joints. The pipe assemblies produced will use a range of fittings which will include straight connectors, elbows, tee pieces, reduction pieces, tank connectors, tap connectors, valves and other fittings, as appropriate to the application.</p> <p>The learner's responsibilities will require them to comply with organisational policy and procedures for the pipework assembly activities undertaken, and to report any problems with the equipment, materials or assembly activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.</p>

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The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying small bore non-ferrous pipework assembly procedures. The learner will understand the pipework assembly, and its application, and will know about the assembly and soldering/brazing process, pipe components and materials used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring that the work output is produced to the required specification.

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

<b>Learning outcome</b>
The learner will: 1. assemble small bore non-ferrous pipework
<b>Assessment criteria</b>
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 pipe assembly activities: <ul style="list-style-type: none"><li>• obtain and use the appropriate documentation (such as job instructions, pipe assembly drawings, planning and quality control documentation)</li><li>• adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work</li><li>• check that all tools and equipment are in a safe and usable condition</li><li>• follow safe practice/approved pipe fitting and assembly techniques at all times</li><li>• ensure that the components and pipes used are free from foreign objects, dirt or other contamination before assembling them</li><li>• return all tools and equipment to the correct location on completion of the pipe fitting activities</li><li>• leave the work area and assembly in a safe and appropriate condition on completion of the activities</li></ul> 1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 ensure that the specified components are available and that they are

in a usable condition

- 1.5 use the appropriate methods and techniques to assemble the components in their correct positions
- 1.6 cut pipes and assemble them, using three of the following methods:
  - compression fittings
  - snap-on/push fittings
  - soldered fittings
  - brazed fittings
- 1.7 produce pipework assemblies which contain six of the following types of fitting:
  - straight couplings
  - valves
  - elbows
  - blanking caps
  - tee pieces
  - pipe clips/supports
  - reduction pieces
  - drain/bleeding devices
  - screwed fittings (such as tank, tap, pump, gauges)
- 1.8 produce assembled pipe work which contains two of the following features:
  - angular bends
  - offsets
  - bridge sets
- 1.9 assemble pipework using six of the following:
  - soft solder
  - silver solder
  - flux
  - hand tools
  - pipe cutters
  - gas torches
  - sealing tapes, seals or compounds
- 1.10 assemble pipework using all of the following methods and techniques:
  - securing pipework supports to structures
  - fitting pipework supports
  - connecting pipe-to-pipe
  - hand tools
  - connecting pipe-to-equipment
  - using gaskets, seals or jointing compounds
  - alignment/levelling equipment
  - torque loading of bolts
- 1.11 secure the components using the specified connectors and securing devices
- 1.12 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification
- 1.13 produce pipework assemblies which comply with one of the

following quality and accuracy standards:

- BS, ISO or BSEN standards
- customer standards and requirements
- company standards and procedures
- specific system requirements

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 assemble small bore non-ferrous pipework

### **Assessment criteria**

The learner can:

- 2.1 describe the specific safety precautions to be taken when assembling small bore non-ferrous pipework
- 2.2 describe the Personal Protective Equipment to be used when assembling pipework
- 2.3 describe the hazards associated with carrying out the pipework assembly activities (such as handling long lengths of pipe, using gas torches and brazing equipment, handling sealing agents and fluxes), and how to minimise them and reduce any risks
- 2.4 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken
- 2.5 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, work reference points and system of tolerancing
- 2.6 describe the preparation of pipework and fittings for the assembly operation (such as checking for damage, removing foreign objects, dirt and swarf from bore of pipe, removing burrs)
- 2.7 describe the range of pipe fittings that can be used, and how to identify them (such as straight connectors, elbows, tee pieces, reduction pieces, screwed fittings, valves, blanking pieces/cap ends)
- 2.8 describe the different types of fitting available (such as soldered fittings, compression fittings and push-fit fittings)
- 2.9 explain how to determine the overall length of the pipework required, taking into account allowances for pipe fittings
- 2.10 explain how to identify the correct orientation of fittings with regard to flow, and the consequences of incorrectly orientating the fitting
- 2.11 describe the methods used to prepare pipe ends and fittings for soldering or brazing, and why it is necessary to ensure that these preparations are carried out
- 2.12 describe the various types of soldered connectors available (such as solder ring types and capillary fittings)
- 2.13 describe the methods used to solder the joints, and how to recognise when the fitting is correctly soldered
- 2.14 describe the precautions to be taken when using gas torches to form the joint, and the effect of overheating the joint
- 2.15 describe the use of compression fittings; how the pipes are sealed;

and the effects of over tightening the fittings

- 2.16 describe the use of push-fit connectors, and their advantages and disadvantages
- 2.17 describe the methods of supporting pipework, and the types of fitting that are used
- 2.18 describe the tools and equipment used when assembling small bore pipework
- 2.19 describe the standards to be attained, and the company quality procedures
- 2.20 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.



## Unit 378

## Assembling non-metallic pipework

<b>UAN:</b>	<b>K/600/5562</b>
<b>Level:</b>	3
<b>Credit value:</b>	30
<b>GLH:</b>	91
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 78: Assembling Non-Metallic Pipework (Level 3).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>This unit covers the skills and knowledge needed to prove the competences required to produce assemblies in non-metallic pipework, in accordance with approved procedures. In producing assemblies, the learner will be expected to select and use a range of equipment, hand tools and techniques appropriate to the operations being performed.</p> <p>The assembly activities will include producing cemented/glued joints, compression joints and push-fit joints. The pipe assemblies produced will use a range of fittings, which will include straight connectors, elbows, tee pieces, reduction pieces, flanges, tank connectors, tap connectors, valves and other fittings, as appropriate to the application.</p> <p>The learner's responsibilities will require them to comply with organisational policy and procedures for the pipework assembly activities undertaken, and to report any problems with the equipment, materials or assembly activities that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they produce.</p>

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying non-metallic pipework assembly procedures. The learner will understand the pipework assembly, and its application, and will know about the assembly techniques, pipe components and materials used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the work output is produced to the required specification.

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

<b>Learning outcome</b>
The learner will: 1. assemble non-metallic pipework
<b>Assessment criteria</b>
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 pipe assembly activities: <ul style="list-style-type: none"> <li>• obtain and use the appropriate documentation (such as job instructions, pipe assembly drawings, planning and quality control documentation)</li> <li>• adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work</li> <li>• check that all tools and equipment are in a safe and usable condition</li> <li>• follow safe practice/approved pipe fitting and assembly techniques at all times</li> <li>• ensure that the components and pipes used are free from foreign objects, dirt or other contamination before assembling them</li> <li>• return all tools and equipment to the correct location on completion of the pipe fitting activities</li> <li>• leave the work area and assembly in a safe and appropriate condition on completion of the activities</li> </ul> 1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 ensure that the specified components are available and that they are in a usable condition

- 1.5 use the appropriate methods and techniques to assemble the components in their correct positions
- 1.6 cut pipes and assemble them using all of the following methods:
  - compression fittings
  - snap-on/push fittings
  - cemented/glued fittings
- 1.7 produce pipework assemblies which contain six of the following types of fitting:
  - straight couplings
  - valves
  - elbows
  - blanking caps
  - tee pieces
  - pipe clips/supports
  - reduction pieces
  - drain/bleeding devices
  - screwed fittings (such as tank, tap, pump, gauges)
- 1.8 produce assembled pipework which contains two of the following features:
  - angular bends
  - offsets
  - bridge sets
- 1.9 assemble pipework using all of the following methods and techniques:
  - securing pipework supports to structures
  - fitting pipework supports
  - connecting pipe-to-pipe
  - hand tools
  - adhesives
  - connecting pipe-to-equipment
  - using gaskets, seals or jointing compounds
  - alignment/levelling equipment
  - torque loading of bolts
  - hot air/gas torches
- 1.10 secure the components using the specified connectors and securing devices
- 1.11 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification
- 1.12 produce pipework assemblies which comply with one of the following quality and accuracy standards:
  - BS, ISO or BSEN standards
  - customer standards and requirements
  - company standards and procedures
  - specific system requirements
- 1.13 deal promptly and effectively with problems within their control and report those that cannot be solved.

<b>Learning outcome</b>
The learner will: 2. know how to assemble non-metallic pipework
<b>Assessment criteria</b>
The learner can: 2.1 describe the specific safety precautions to be taken when assembling non-metallic pipework 2.2 describe the Personal Protective Equipment to be used when assembling non-metallic pipework 2.3 describe the hazards associated with the pipework assembly activities (such as handling long lengths of pipe, using hot air/gas torches, handling adhesives and sealing agents), and how to minimise them and reduce any risks 2.4 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken 2.5 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, work reference points and system of tolerancing 2.6 describe the preparation of pipework and fittings for the assembly operation (such as checking for damage, removing foreign objects, dirt and swarf from bore of pipe, removing burrs) 2.7 describe the range of pipe fittings that can be used, and how to identify them (such as straight connectors, elbows, tee pieces, reduction pieces, tank fittings, valves, blanking pieces/cap ends) 2.8 describe the different types of fitting available (such as cemented/glued fittings, compression fittings and push-fit fittings) 2.9 explain how to determine the overall length of the pipework required, taking into account allowances for pipe fittings 2.10 explain how to identify the correct orientation of fittings with regard to flow, and the consequences of incorrectly orientating the fitting 2.11 describe the methods used to prepare pipe ends and fittings when using adhesives, and why it is necessary to ensure that these preparations are carried out 2.12 describe the methods used to glue the joints, and how to recognise when the fitting is correctly secured 2.13 describe the various adhesives and sealing compounds that are used on non-metallic pipework 2.14 describe the precautions to be taken when using the adhesives and sealing compounds (such as adequate ventilation, away from naked flames, avoiding skin contact) 2.15 describe the precautions to be taken when using hot air/gas torches to form the joint, and the effect of overheating the joint 2.16 describe the use of compression fittings; how the pipes are sealed; and the effects of over tightening the fittings 2.17 describe the use of push-fit connectors, and their advantages and disadvantages 2.18 describe the methods of supporting pipework and the types of fitting that are used 2.19 describe the tools and equipment used when assembling pipework 2.20 describe the standards to be attained, and the company quality

procedures

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

## Unit 379

## Preparing and testing pipework systems

<b>UAN:</b>	<b>J/600/5567</b>
<b>Level:</b>	3
<b>Credit value:</b>	46
<b>GLH:</b>	150
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 79: Preparing and Testing Pipework Systems (Level 3)
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>This unit covers the skills and knowledge needed to prove the competences required to test ferrous, non-ferrous and non-metallic pipework systems, in accordance with approved procedures. The learner will be required to select appropriate tools and test equipment to be used, based on the pipework system and test procedures being carried out. In preparing and testing the pipework system, the learner will be expected to use a range of hand tools, test equipment and techniques which are important to the test procedures. These activities will include such things as purging equipment and materials, compressed air test rigs, pressure gauges, and leak repair equipment and materials.</p> <p>The learner's responsibilities will require them to comply with organisational policy and procedures for the preparation and testing of the pipework, and to report any problems with the equipment, testing activities or installations tested that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.</p> <p>The learner's knowledge will provide a good</p>

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understanding of their work, and will provide an informed approach to applying pipework preparation and testing activities. The learner will understand the pipework system being tested, and its application, and will know about the preparations required, equipment to be used and tests to be carried out, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the completed system performs to the required specification.

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

<b>Learning outcome</b>
The learner will: 1. prepare and test pipework systems
<b>Assessment criteria</b>
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 testing activities: <ul style="list-style-type: none"><li>• obtain and use the appropriate documentation (such as job instructions, test procedures, pipe drawings, test specifications and quality control documentation)</li><li>• adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work check that all tools and equipment are in a safe and usable condition and are within current calibration date</li><li>• obtain clearance/authority to work on the installation</li><li>• provide and maintain a safe working environment for the testing activities (such as ensuring that isolation procedures are followed, safe working distance procedures are set up, relevant warning notices or safety signs are displayed)</li><li>• ensure that appropriate safety measures are taken to protect test personnel (such as guards, distance, incremental pressure tests)</li><li>• follow safe practice/approved pipe testing techniques at all times</li><li>• return all tools and equipment to the correct location on completion of the pipe testing activities</li><li>• leave the work area and pipe system in a safe and appropriate condition on completion of the activities</li><li>• complete the relevant test documentation</li></ul>

- 1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests
- 1.4 prepare the installation for testing by carrying out all of the following, as applicable to the system:
  - checking the security of all joints
  - purging or flushing the system (as appropriate)
  - fitting appropriate blanking plugs/plates to exposed ends of pipe or equipment
  - connecting an appropriate test source
  - fitting leak detection equipment and/or pressure gauges
- 1.5 set up and carry out the tests using the correct procedures and within agreed timescales
- 1.6 carry out tests on two of the following types of pipework installation:
  - ferrous pipework
  - small bore non-ferrous pipework
  - non-metallic pipework
- 1.7 use one of the following types of test equipment:
  - hydraulic test equipment
  - compressed air test equipment
  - gas test equipment
  - water test equipment
- 1.8 deal with two of the following complexities:
  - systems with no faults
  - incomplete or incorrect test results
  - systems with faults
  - systems with intermittent faults
- 1.9 during tests, use two of the following fault finding techniques:
  - half-split technique
  - function/performance testing
  - input/output technique
  - six point technique
- 1.10 carry out appropriate tests, to include all of the following, as applicable to the system under test:
  - filling system with appropriate test medium
  - venting air from the system
  - applying test pressures in incremental stages
  - checking for leaks at each stage
  - recording test results
  - depressurising the system
  - draining down the system (where appropriate)
- 1.11 carry out tests to pipework systems, in compliance with one of the following:
  - BS, ISO or BSEN standards
  - customer standards and requirements
  - company standards and procedures
  - specific system requirements
- 1.12 record the results of the tests in the appropriate format



1.13 review the results and carry out further tests if necessary.

### **Learning outcome**

The learner will:

2. know how to prepare and test pipework systems

### **Assessment criteria**

The learner can:

- 2.1 describe the specific safety precautions to be taken when carrying out test procedures on pipework systems
- 2.2 describe the Personal Protective Equipment to be worn whilst carrying out the testing activities
- 2.3 describe the hazards associated with testing pipework systems, and how to minimise them and reduce any risks
- 2.4 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken
- 2.5 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- 2.6 describe the importance of pipework colour codes, and the reasons for using the correct type of pipe material
- 2.7 describe the colour code standard used for identifying pipes, and why it is important
- 2.8 describe the various pressure test methods used on ferrous, non-ferrous and non-metallic pipelines
- 2.9 describe the importance of components being fitted in the correct relation to the direction of flow
- 2.10 describe the reasons for purging and venting pipework systems, and the consequences of not purging the pipework system
- 2.11 explain how to identify the fluids that can be used for flushing pipework systems, and the consequences of not flushing or of using the incorrect flushing agent
- 2.12 describe the methods of testing the system, and the need to gradually increase pressure in the pipework system
- 2.13 describe the methods used to isolate parts of the pipework system for testing, and how this can be achieved
- 2.14 explain how the amount of test fluid for the pipework system is determined, and what problems would be caused if the incorrect amount were used
- 2.15 describe the factors that govern the choice of test equipment used in pressure testing of pipework systems, and the importance of equipment being calibrated
- 2.16 explain how the test pressures are determined, and the methods used to record pressure test results
- 2.17 describe the reasons for maintaining test pressures for specific times
- 2.18 explain how the results of the pressure test are analysed, and why this is important
- 2.19 explain how pipework systems are depressurised, and what environmental precautions must be taken
- 2.20 describe the procedures for recording test results and for reporting

them to the relevant people

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

## Unit 380

## Producing socket and flange fillet welded joints in pipe using a manual welding process

<b>UAN:</b>	<b>L/600/5571</b>
<b>Level:</b>	3
<b>Credit value:</b>	86
<b>GLH:</b>	210
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 80: Producing Socket and Flange Fillet Welded Joints in Pipe using a Manual Welding Process (Level 3).
<b>Endorsement by a sector or other appropriate body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>This unit covers the skills and knowledge needed to prove the competences required to produce socket and flange fillet welded joints in pipe, using a manual welding process, such as MMA, MIG, MAG, TIG, flux cored wire, plasma or gas welding equipment, in accordance with instructions and/or approved welding procedures. The learner will be required to check that all the workholding equipment and manipulating devices required are available and in a usable condition. The learner will be expected to check the welding equipment to ensure that all the leads/cables, hoses and wire feed mechanisms are securely connected and free from damage.</p> <p>In preparing to weld, the learner will need to set and adjust the welding conditions, in line with the instructions or welding procedure specification. The learner must operate the equipment safely and correctly, and make any necessary adjustments to settings, in line with their permitted authority, in order to produce the welded joints to the required specification. The learner will be required to demonstrate their capability to produce the fillet welds to the required quality, and this could be through tests according to BS 4872</p>

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

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

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

<b>Learning outcome</b>
The learner will: 1. produce socket and flange fillet welded joints in pipe using a manual welding process
<b>Assessment criteria</b>
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 pipe welding activities: <ul style="list-style-type: none"><li>• obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation)</li><li>• adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work</li><li>• follow safe practice/approved pipe welding techniques and procedures at all times</li><li>• check that all tools and equipment are in a safe and usable condition</li><li>• ensure that the components and pipes used are free from</li></ul>

- damage, foreign objects, dirt or other contamination before welding them
- return all tools and equipment to the correct location on completion of the welding activities
  - leave the work area in a safe and appropriate condition on completion of the activities
- 1.3 follow the relevant joining procedure and job instructions
- 1.4 check that the joint preparation complies with the specification
- 1.5 check that joining and related equipment and consumables are as specified and fit for purpose
- 1.6 set up, check, adjust and use welding and related equipment for one of the following welding processes:
- manual metal arc
  - MIG/MAG
  - TIG
  - cored wire
  - plasma
  - gas welding
- 1.7 use consumables appropriate to the material and application, to include **either**:
- two types of electrode from:
- rutile
  - basic
  - cellulosic
  - nickel alloy
  - aluminium
- or**
- two types of filler wire from different material groups
- 1.8 make the joints as specified using the appropriate thermal joining technique
- 1.9 produce socket and flange fillet welded joints in one of the following:
- small bore pipe (50mm outside diameter or less)
  - large bore pipe (above 50mm outside diameter)
- 1.10 produce joints of the required quality and of specified dimensional accuracy
- 1.11 weld joints according to BS EN287, in good access situations, in four of the following positions:
- flat (PA) rotating
  - horizontal vertical (PB) fixed
  - horizontal vertical (PB) rotating
  - vertical upwards (PF) fixed
  - vertical down (PG) fixed
  - horizontal overhead (PD) fixed
- 1.12 produce welded pipes which meet all of the following:
- achieve minimum weld quality requirements applicable to fillet welds equivalent to those given in the relevant European/International Standards (e.g. EN 25817/ISO 5187 and EN 30042/ISO 10042) as required by the application standard or specification

<ul style="list-style-type: none"> <li>• meet the required dimensional accuracy within specified tolerance</li> </ul> <p>1.13 shut down the equipment to a safe condition on completion of joining activities</p> <p>1.14 deal promptly with excess and waste materials and temporary attachments, in line with approved and agreed procedures</p> <p>1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.</p>
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<p><b>Learning outcome</b></p> <p>The learner will:</p> <p>2. know how to produce socket and flange fillet welded joints in pipe using a manual welding process</p>
<p><b>Assessment criteria</b></p> <p>The learner can:</p> <p>2.1 describe the safe working practices and procedures to be observed when working with the selected welding equipment (such as general workshop and site safety, appropriate Personal Protective Equipment, fire prevention, protecting other workers from arc eye, safety in enclosed/confined spaces, fume control, accident procedure, statutory regulations, risk assessment procedures and COSHH regulations)</p> <p>2.2 describe the correct handling and storage of gas cylinders (such as manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features, emergency shutdown procedures)</p> <p>2.3 describe the hazards associated with the selected welding process (such as live electrical components, poor earthing, arc radiation, fumes and gases, gas supply leaks, spatter, hot slag and metal, elevated working, enclosed spaces, slips, trips and falls), and how to minimise them and reduce any risks</p> <p>2.4 describe the manual welding process selected, and an awareness of the different types of welding equipment (such as basic principles of fusion welding, AC and DC power sources, ancillary equipment, power ranges, care of equipment, terminology used in welding, flame setting)</p> <p>2.5 explain how to extract information required from drawings and welding procedure specifications (such as interpretation of welding symbols, scope, content and application of the welding procedure specification)</p> <p>2.6 describe the consumables associated with the chosen welding process (such as types of electrode and or filler metal and application, types of shielding gas and their application, gas supply and control, correct storage and drying of electrodes and filler wire)</p> <p>2.7 describe the types and features of welded joints in pipe (such as fillet and butt welds, single and multi-run welds, welding positions, weld quality)</p> <p>2.8 describe the methods of setting up and restraining the joint, to achieve correct location of components and control of distortion (such as edge preparation, use of jigs and fixtures, manipulators and positioners, tack welding size and spacing in relationship to material thickness and component size, use of temporary attachments, pre-setting)</p>

- 2.9 explain how to prepare the welding equipment, and the checks to be made to ensure that it is safe and ready to use (such as electrical connections, earthing arrangements, equipment calibration, setting welding parameters)
- 2.10 describe the techniques of operating the welding equipment to produce a range of joints in the various joint positions (such as fine tuning parameters, correct manipulation of the welding gun or electrode, safe closing down of the welding equipment)
- 2.11 describe the importance of complying with job instructions and the welding procedure specification
- 2.12 describe the problems that can occur with the welding activities, and how these can be overcome (such as causes of distortion and methods of control, effects of welding on materials, sources of weld defects and methods of prevention)
- 2.13 describe the organisational quality systems used and weld standards to be achieved; weld inspection and test procedures used, including visual and non-destructive tests
- 2.14 describe the personal approval tests and their applicability to their work
- 2.15 describe the extent of their own responsibility and to whom they should report 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 in Mechanical Manufacturing Engineering (1682)

### Literacy, language, numeracy and ICT skills development

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

- Functional Skills (England) – see **Functional Skills | City & Guilds (cityandguilds.com)**
- Essential Skills (Northern Ireland) – see **Essential Skills (Northern Ireland) qualifications and training courses | City & Guilds (cityandguilds.com)**
- Essential Skills Wales – see **Skills for Wales - Wales | City & Guilds (cityandguilds.com)**





## 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

**Our Quality Assurance Requirements** encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

**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 e-assessments.

## Useful contacts

<b>UK learners</b> <b>General qualification information</b>	<b>T: +44 (0)844 543 0033</b> <b>E: learnersupport@cityandguilds.com</b>
<b>International learners</b> General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: <b>intcg@cityandguilds.com</b>
<b>Centres</b> 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: <b>centresupport@cityandguilds.com</b>
<b>Single subject qualifications</b> 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: <b>singlesubjects@cityandguilds.com</b>
<b>International awards</b> 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: <b>intops@cityandguilds.com</b>
<b>Walled Garden</b> Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: <b>walledgarden@cityandguilds.com</b>
<b>Employer</b> Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: <b>business@cityandguilds.com</b>
<b>Publications</b> Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

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**If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: [feedbackandcomplaints@cityandguilds.com](mailto:feedbackandcomplaints@cityandguilds.com)**

### **About City & Guilds**

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

### **City & Guilds Group**

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

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WW-06-1712