



Regulated Qualifications Unit and Assessment Specification

Unit title	Forming and Assembling Pipework Systems
Regulator unit code	R/616/6830
SQA unit code	FT2X 60
SSC ref	Unit 82

History of changes

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Version number	Date	Description	Authorised by
02	December 2017	Unit Specification updated to reflect current Ofqual terminology.	Qualifications Officer

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Regulated qualifications unit specification

Title	Forming and Assembling Pipework Systems	
Level	2	
Credit value	14	
Outcomes	Assessment criteria	
The learner will:	The learner can:	
1 Form and assemble pipework systems.	1.1	Work safely at all times, complying with Health and Safety legislation, regulations and other relevant guidelines.
	1.2	Carry out all of the following during the pipe bending, forming and fitting activities: <ul style="list-style-type: none"> ◆ adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations ◆ check that the bending and forming equipment is in a safe and usable condition ◆ return all tools and equipment to the correct location on completion of the pipe fitting activities ◆ apply safe working practices at all times
	1.3	Plan the pipe fitting activities before they start them.
	1.4	Produce pipework assemblies using two of the following types of pipe: <ul style="list-style-type: none"> ◆ carbon steel ◆ stainless steel ◆ copper ◆ brass ◆ aluminium ◆ plastic

Outcomes	Assessment criteria
The learner will:	The learner can:
	<p>1.5 Mark out pipework, using the following method:</p> <ul style="list-style-type: none"> ◆ direct marking using tapes and markers <p>Plus one more from the following:</p> <ul style="list-style-type: none"> ◆ set-outs of pipework using templates ◆ producing set wires ◆ set-outs of pipework onto floor <p>1.6 Cut the pipes to the appropriate lengths making allowances for bending and attachment of fittings.</p> <p>1.7 Cut and prepare the pipes for forming and assembly, to include carrying out all of the following:</p> <ul style="list-style-type: none"> ◆ cutting pipes to length with appropriate allowance for fittings ◆ removing all external and internal burrs ◆ cleaning pipe ends for soldering or gluing (where appropriate) ◆ cutting threads on pipe ends to the appropriate length (where appropriate) ◆ checking that prepared pipes are the correct length <p>1.8 Cut and prepare pipework using the following:</p> <ul style="list-style-type: none"> ◆ saws (hand or power) <p>Plus two more from the following:</p> <ul style="list-style-type: none"> ◆ pipe/tube cutter ◆ de-burring reamers ◆ abrasive cloth ◆ wire pipe cleaners

Outcomes	Assessment criteria
The learner will:	The learner can:
	<p>1.9 Bend and form the pipes using the appropriate tools and equipment for the types and sizes of pipe.</p> <p>1.10 Bend and form pipe using the following method:</p> <ul style="list-style-type: none"> ◆ hand operated pipe bender <p>Plus one more of the following:</p> <ul style="list-style-type: none"> ◆ bending springs ◆ hydraulic pipe bending equipment ◆ pipe expander ◆ heating methods ◆ swaging kit ◆ fillers <p>1.11 Produce pipework bends/forms that include both of the following:</p> <ul style="list-style-type: none"> ◆ angular bends ◆ offsets <p>Plus one more from the following:</p> <ul style="list-style-type: none"> ◆ bridge sets ◆ expansion loops ◆ radii ◆ external swaged ends ◆ internal swaged ends

Outcomes	Assessment criteria
The learner will:	The learner can:
<p>2 Form and assemble further pipework systems.</p>	<p>2.1 Assemble and secure the pipework, using the correct fittings and joining techniques.</p> <p>2.2 Produce pipework assemblies which combine a range of different fittings, covering all of the following:</p> <ul style="list-style-type: none"> ◆ straight couplings ◆ elbows ◆ tee pieces <p>Plus three more from the following:</p> <ul style="list-style-type: none"> ◆ flanges ◆ unions ◆ reduction pieces ◆ valves ◆ drain/bleeding devices ◆ blanking caps ◆ screwed fittings (such as tank, tap, pump, gauges) <p>2.3 Assemble pipes using three of the following methods:</p> <ul style="list-style-type: none"> ◆ compression fittings ◆ snap-on/push fittings ◆ screwed connections ◆ soldered fittings ◆ brazed fittings ◆ cemented/glued fittings ◆ welded joints <p>2.4 Assemble pipework using all of the following methods and techniques:</p> <ul style="list-style-type: none"> ◆ securing pipework supports to structures ◆ fitting pipework supports ◆ connecting pipe-to-pipe ◆ connecting pipe-to-equipment ◆ using gaskets, seals/sealing tapes or jointing compounds ◆ alignment/levelling equipment <p>2.5 Produce pipework assemblies which comply with all of the following:</p> <ul style="list-style-type: none"> ◆ pipes are bent to the appropriate shape/form and position ◆ all pipe bends are free from buckling or deformation

Outcomes	Assessment criteria
The learner will:	The learner can:
	<ul style="list-style-type: none"> ◆ appropriate fittings are used, and are secure and leak free ◆ soldered and glued fittings are free from excessive residues ◆ the completed assembly meets the specific system requirements <p>2.6 Check the completed assembly to ensure that all operations have been completed and that the finished pipe assembly meets the required specification.</p> <p>2.7 Test the completed pipe assembly, using the appropriate techniques, tools and equipment.</p> <p>2.8 Carry out tests on the assembled pipework, to include one of the following:</p> <ul style="list-style-type: none"> ◆ hydraulic pressure testing ◆ water testing ◆ soap and water bubble test <p>2.9 Deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve.</p> <p>2.10 Leave the work area in a safe and tidy condition on completion of the assembly activities.</p>
<p>3 Know how to form and assemble pipework systems.</p>	<p>3.1 Describe the health and safety requirements, and safe working practices and procedures required for the pipe fitting activities undertaken.</p> <p>3.2 Describe the importance of wearing appropriate protective clothing and equipment, and keeping the work area safe and tidy.</p>

Outcomes	Assessment criteria
The learner will:	The learner can:
	<p>3.3 Describe the hazards associated with the pipe fitting activities (such as handling long pipe lengths, using damaged or badly maintained tools and equipment, using pipe bending equipment, using heating and soldering equipment), and how they can be minimised.</p> <p>3.4 Describe the procedure for obtaining the required drawings, job instructions and other related specifications.</p> <p>3.5 Explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken.</p> <p>3.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing.</p> <p>3.7 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).</p> <p>3.8 Explain how to prepare the pipes in readiness for the marking out activities (visually checking for defects, cleaning the materials, removing burrs and sharp edges).</p> <p>3.9 Explain how to determine the overall length of the pipework required, taking into account allowances for pipe fittings and (where appropriate) screwed connections.</p> <p>3.10 Describe the tools and equipment used in the cutting and preparing the pipes (such as saws, pipe and tube cutters).</p>

Outcomes	Assessment criteria
The learner will:	The learner can:
	<p>3.11 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.</p> <p>3.12 Describe the methods used to hand bend and form the pipe (including the use of bending springs, hand bending machines, fillers, heating methods).</p> <p>3.13 Explain how to produce the various bends required (such as angled bends, dog-leg sets, bridge sets and expansion loops).</p> <p>3.14 Describe the reasons for incorporating expansion loops in a system, and where they should be positioned.</p> <p>3.15 Explain how to prepare pipework and fittings for the assembly operation (such as checking for damage, removing foreign objects, dirt and swarf from bore of pipe, removing burrs).</p> <p>3.16 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).</p> <p>3.17 Describe the different types of fittings available, such as screwed fittings, soldered fittings, compression fittings, push fit fittings and glued/cemented fittings.</p> <p>3.18 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).</p>

Outcomes	Assessment criteria
The learner will:	The learner can:
<p>4 Know how to form and assemble further pipework systems.</p>	<p>4.1 Describe the methods used to seal screwed joints (such as tapes and sealing compounds).</p> <p>4.2 Describe the use of flanges to connect pipes; use of gaskets; and torque loading of flange bolts.</p> <p>4.3 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.</p> <p>4.4 Describe the various types of soldered connectors available (such as solder ring types and capillary fittings).</p> <p>4.5 Describe the methods used to solder the joints, and how to recognise when the fitting is correctly soldered.</p> <p>4.6 Describe the precautions to be taken when using gas torches to form the joint, and the effect of overheating the joint.</p> <p>4.7 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.</p> <p>4.8 Describe the methods used to glue the joints, and how to recognise when the fitting is correctly secured.</p> <p>4.9 Describe the various adhesives and sealing compounds that are used on non-metallic pipework.</p> <p>4.10 Describe the precautions to be taken when using the adhesives and sealing compounds (such as adequate ventilation, away from naked flames, avoiding skin contact).</p>

Outcomes	Assessment criteria
The learner will:	The learner can:
	<p>4.11 Describe the use of compression fittings; how the pipes are sealed; and the effects of over tightening the fittings.</p> <p>4.12 Describe the use of push-fit connectors, and their advantages and disadvantages.</p> <p>4.13 Explain how to identify the correct orientation of fittings with regard to flow, and the consequences of incorrect orientation.</p> <p>4.14 Describe the supporting methods that are used when assembling pipework, and the type of fittings that are used.</p> <p>4.15 Describe the methods of testing pipework systems for leaks (using air, water or hydraulic testing methods).</p> <p>4.16 Describe the extent of their own responsibility and whom they should report to if they have problems that they cannot resolve.</p> <p>4.17 Describe the importance of leaving the work area in a safe and clean condition on completion of the pipework assembly activities (such as removing and storing power leads, returning hand tools and equipment to its designated location, cleaning the work area and removing and disposing of waste).</p>

Additional information about the unit
Unit purpose and aim(s)
To provide the learner with the practical pipeworking skills and procedures required to undertake duties as an Electro-technical Officer on board a merchant vessel.
Unit start date
01/09/2011
Details of the relationship between the unit and relevant national occupational standards (if appropriate)
N/A
Details of the relationship between the unit and other standards or curricula (if appropriate)
C31 — Contribute to maintenance of vessel mechanical equipment, C34 — Carry out maintenance of vessel mechanical equipment and systems. International Maritime Organisation (IMO) standards for training and certification for watchkeeping (stcw) requirements for an Electro-technical Officer at Operational Level.
Assessment requirements specified by a sector or regulatory body (if appropriate)
This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from Semta's website: http://www.semta.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's Performing Engineering Operations Level 2 unit assessment strategy which can be downloaded from Semta's website: http://www.semta.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx Unit specific additional assessment requirements: In order to prove their ability to combine different pipe assembly operations, at least one of the pipe assemblies produced must be of a significant nature, and must have a minimum of five of the fittings listed in Assessment Criteria 1.13.
Endorsement of the unit by a sector or other appropriate body (if required)
Maritime and Coastguard Agency (MCA)

Additional information about the unit (cont)
Location of the unit within the subject/sector classification system
4.1 Engineering
Name of the organisation submitting the unit
EAL
Guided learning hours
80

Regulated qualifications assessment specification

Assessment (evidence) requirements

The following evidence is required to demonstrate that learners have the practical skills and procedures required to undertake duties as an Electro-technical Officer on board a merchant vessel. All outcomes and assessment criteria must be achieved.

Written and/or recorded oral evidence is required for the following:

- ◆ Outcomes 3 and 4

Performance evidence in the workplace or in an appropriate simulated environment is required for the following:

- ◆ Outcomes 1 and 2

This could be achieved through the observation of learners undertaking practical exercises.

An approved Maritime Skills Alliance (MSA) approved Training Record Book (TRB) should be used to record evidence of achievement.

Guidance on assessment

Performance evidence can be generated using an approved Maritime Skills Alliance (MSA) approved Training Record Book (TRB) and/or practical exercises.

Short answer written questions and/or oral interview could be used for the other outcomes and assessment criteria.