

Overview

This standard covers a broad range of basic pipe fitting competences that will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or that will provide a basis for the development of additional skills and occupational competences in the working environment.

You will be expected to prepare for the pipe fitting activities by obtaining all the necessary information, documentation, tools and equipment required, and to plan how you intend to carry out the required pipe fitting activities and the sequence of operations you intend to use. You will be expected to select the appropriate equipment to use, based on the operations to be carried out and the accuracy required.

In producing the pipework systems, you will be expected to select and use a range of hand tools, pipe bending and forming equipment and pipe assembly techniques, appropriate to the type of material and operations being performed. Activities will include cutting the pipes to the required lengths using hand saws, power saws or pipe cutters; bending pipes using hand bending machines, springs, fillers or heating techniques; and the use of templates or set wires to check bend profiles which will include angular bends, offsets, bridge sets and expansion loops. You will then be expected to assemble the pipes, using a range of different connectors such as straight connectors, elbows, tee pieces, reducers, tank connectors and valves.

During, and on completion of, the pipe fitting operations, you will be expected to check the quality of the work, using measuring equipment appropriate to the aspects being checked and the tolerances to be achieved. You will need to be able to recognise pipe bending and fitting defects, to take appropriate action to remedy any faults that occur and to ensure that the finished system is within the drawing requirements. On completion of the pipe fitting activities, you will be expected to return all tools and equipment to the correct locations, and to leave the work area in a safe and tidy condition.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for the pipe bending, forming and fitting activities undertaken. You will need to take account of any potential difficulties or problems that may arise with the activities, and to seek appropriate help and advice in determining and implementing a suitable solution. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

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Your underpinning knowledge will provide an understanding of your work, and will enable you to apply appropriate pipe bending, forming and fitting techniques safely. You will understand the pipe bending, forming and fitting equipment and techniques, and their application, and will know about the equipment, materials and consumables, to the required depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the pipe bending, forming and fitting activities, and when using the associated tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

Specific Standard Requirements

In order to prove your 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 scope 9.

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Performance criteria

- You must be able to:*
- P1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
 - P2 plan the pipe fitting activities before you start them
 - P3 cut the pipes to the appropriate lengths making allowances for bending and attachment of fittings
 - P4 bend and form the pipes using the appropriate tools and equipment for the types and sizes of pipe
 - P5 assemble and secure the pipework, using the correct fittings and joining techniques
 - P6 check the completed assembly to ensure that all operations have been completed and that the finished pipe assembly meets the required specification
 - P7 test the completed pipe assembly, using the appropriate techniques, tools and equipment
 - P8 deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve
 - P9 leave the work area in a safe and tidy condition on completion of the assembly activities

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Knowledge and understanding

You need to know and understand:

- K1 the health and safety requirements, and safe working practices and procedures required for the pipe fitting activities undertaken
- K2 the importance of wearing appropriate protective clothing and equipment (PPE), and keeping the work area safe and tidy
- K3 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, using adhesives), and how they can be minimised
- K4 the procedure for obtaining the required drawings, job instructions and other related specifications
- K5 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
- K6 How to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- K7 principles and methods of marking out pipework, and the type of equipment used (such as direct marking, use of templates, use of set wires)
- K8 how to prepare the pipes in readiness for the marking out activities (visually checking for defects, cleaning the materials, removing burrs and sharp edges)
- K9 how to determine the overall length of the pipework required, taking into account allowances for pipe fittings and (where appropriate) screwed connections
- K10 the tools and equipment used in the cutting and preparing the pipes (such as saws, pipe and tube cutters)
- K11 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
- K12 the methods used to hand bend and form the pipe (including the use of bending springs, hand bending machines, fillers, heating methods)
- K13 how to produce the various bends required (such as angled bends, dog-leg sets, bridge sets and expansion loops)
- K14 the reasons for incorporating expansion loops in a system, and where they should be positioned
- K15 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)
- K16 the range of pipe fittings that can be used, and how to identify them (such as straight connectors, elbows, tee pieces, reduction pieces,

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- flanged fittings, valves, blanking pieces/cap ends)
- K17 the different types of fittings available, such as screwed fittings, soldered fittings, compression fittings, push fit fittings and glued/cemented fittings
- K18 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)
- K19 methods used to seal screwed joints (such as tapes and sealing compounds)
- K20 the use of flanges to connect pipes; use of gaskets; and torque loading of flange bolts
- K21 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
- K22 the various types of soldered connectors available (such as solder ring types and capillary fittings)
- K23 the methods used to solder the joints, and how to recognise when the fitting is correctly soldered
- K24 the precautions to be taken when using gas torches to form the joint, and the effect of overheating the joint
- K25 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
- K26 the methods used to cement the joints, and how to recognise when the fitting is correctly secured
- K27 the various adhesives and sealing compounds that are used on non-metallic pipework
- K28 the precautions to be taken when using the adhesives, cements and sealing compounds (such as adequate ventilation, fume extraction, away from naked flames, avoiding skin contact)
- K29 the use of compression fittings; how the pipes are sealed; and the effects of over tightening the fittings
- K30 the use of push-fit connectors, and their advantages and disadvantages
- K31 how to identify the correct orientation of fittings with regard to flow, and the consequences of incorrect orientation
- K32 the supporting methods that are used when assembling pipework, and the type of fittings that are used
- K33 methods of testing pipework systems for leaks (using air, water or hydraulic testing methods)
- K34 the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve
- K35 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)

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Additional Information

Scope/range related to performance criteria

You must be able to:

1. Carry out **all** of the following during the pipe bending, forming and fitting activities:
 - 1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
 - 1.2 follow job instructions, assembly drawings and procedures
 - 1.3 check that the bending and forming equipment is in a safe and usable condition
 - 1.4 return all tools and equipment to the correct location on completion of the pipe fitting activities
 - 1.5 apply safe working practices at all times

2. Produce pipework assemblies using **two** of the following types of pipe:
 - 2.1 carbon steel
 - 2.2 copper
 - 2.3 aluminium
 - 2.4 stainless steel
 - 2.5 brass
 - 2.6 plastic

3. Mark out pipework, using the following method:
 - 3.1 direct marking using tapes and markersPlus **one** more from the following:
 - 3.2 set-outs of pipework using templates
 - 3.3 producing set wires
 - 3.4 set-outs of pipework onto floor

4. Cut and prepare the pipes for forming and assembly, to include carrying out **all** of the following:
 - 4.1 cutting pipes to length with appropriate allowance for fittings
 - 4.2 removing all external and internal burrs
 - 4.3 cleaning pipe ends for soldering or cementing (where appropriate)
 - 4.4 cutting threads on pipe ends to the appropriate length (where appropriate)
 - 4.5 checking that prepared pipes are the correct length

5. Cut and prepare pipework using the following:

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- 5.1 saws (hand or power)
Plus **two** more from the following:
 - 5.2 pipe/tube cutter
 - 5.3 de-burring reamers
 - 5.4 abrasive cloth
 - 5.5 wire pipe cleaners

6. Bend and form pipe using the following method:
 - 6.1 hand operated pipe benderPlus **one** more of the following
 - 6.2 bending springs
 - 6.3 pipe expander
 - 6.4 swaging kit
 - 6.5 hydraulic pipe bending equipment
 - 6.6 heating methods
 - 6.7 fillers

7. Produce pipework bends/forms that include **both** of the following:
 - 7.1 angular bends
 - 7.2 offsetsPlus **one** more from the following:
 - 7.3 bridge sets
 - 7.4 radii
 - 7.5 internal swaged ends
 - 7.6 expansion loops
 - 7.7 external swaged ends

8. Assemble pipes using **three** of the following methods:
 - 8.1 compression fittings
 - 8.2 soldered fittings
 - 8.3 cemented fittings
 - 8.4 snap-on/push fittings
 - 8.5 brazed fittings
 - 8.6 welded joints
 - 8.7 screwed connections

9. Produce pipework assemblies which combine a range of different fittings, covering **all** of the following:
 - 9.1 straight couplings
 - 9.2 elbows
 - 9.3 tee piecesPlus **three** more from the following:
 - 9.4 flanges
 - 9.5 reduction pieces
 - 9.6 drain/bleeding devices
 - 9.7 unions

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- 9.8 valves
 - 9.9 blanking caps
 - 9.10 screwed fittings (such as tank, tap, pump, gauges)
10. Assemble pipework using **all** of the following methods and techniques:
- 10.1 securing pipework supports to structures
 - 10.2 connecting pipe-to-equipment
 - 10.3 fitting pipework supports
 - 10.4 using gaskets, seals/sealing tapes or jointing compounds
 - 10.5 connecting pipe-to-pipe
 - 10.6 alignment/levelling equipment
11. Carry out tests on the assembled pipework, to include **one** of the following:
- 11.1 hydraulic pressure testing
 - 11.2 gas/air leakage test
 - 11.3 water leakage testing
12. Produce pipework assemblies which comply with **all** of the following:
- 12.1 pipes are bent to the appropriate shape/form and position
 - 12.2 all pipe bends are free from buckling or deformation
 - 12.3 appropriate fittings are used, and are secure and leak free
 - 12.4 soldered and cemented fittings are free from excessive residues
 - 12.5 the completed assembly meets the specific system requirements

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