# PIPE WELDER

**PIPE WELDER**

**Reference Number:** ST0851

**Details of standard**

**Occupation summary**

This occupation is found in a wide range of sectors where piping systems are used for fluid transport and pressure containment. This will include Engineering Construction, Maintenance and Project upgrades, Oil & Gas (upstream extraction, bulk fluid transport & distribution, downstream processing), Chemicals & Pharmaceuticals (manufacturing and process plant); Power Generation (Thermal, Biomass & Nuclear); Food, Dairy & Brewery Process plant and equipment; Water and Water treatment (processing, bulk transport & distribution and remediation); and Fuel & Coolant systems for Transport Vehicles (Aerospace, Marine, Road & Rail systems). Employers range in size from small businesses to multi-national organisations.

The broad purpose of the occupation is to manually weld tubes and pipes to high standards of quality and integrity using a minimum of two manual arc welding processes from Tungsten Inert Gas (TIG), Plasma Arc Welding (PAW), Manual Metal Arc (MMA), Metal Inert Gas (MIG)/Metal Active Gas (MAG) and Flux Cored Arc Welding (FCAW). The occupation requires the pipe welding of a minimum of four material groups from Carbon Steel, Low Alloy Steel, High Alloy Ferritic/Martensitic Steel, Austenitic Stainless Steel, Nickel & Nickel Alloys, Aluminium & Aluminium alloys, Titanium & Titanium Alloys, Copper & Copper Alloys. Pipe welders must use all welding positions and 3 main joint configurations from Single Sided Butt, Socket, Flange and Set-on Branch welds. For example, a pipe welder might use Tungsten Inert Gas (TIG) and Manual Metal Arc (MMA) to join Carbon Steel, Low Alloy Steel, Austenitic Stainless Steel and Nickel Alloy materials. Each welding process requiring significantly different welding equipment, assemblies, controls, skills and techniques, and represents an individual production process. Each material type requires specific controls and techniques to achieve a satisfactory weld. The final components being welded are often used in highly safety critical applications for the movement and control of high temperature fluids, cryogenic fluids, highly corrosive or flammable media, and are regulated by the Pressure Equipment Directive. Some piping systems are used in the processing of pharmaceuticals, food and drink, where welding and fabrication control of pipe bore cleanliness is vital to the hygiene and integrity of the installation and quality of goods manufactured. Pipe Welders are required to continually monitor and adapt their orientation to achieve the quality of work demanded by high integrity piping systems, necessitating significant manual dexterity, and coordination. This is essential to the UK economy as Pipe Welders are key to the successful fabrication, construction and repair & maintenance of major infrastructure projects. Pipe welders are required to work to detailed engineering specifications necessary to ensure safe & reliable operation of the finished pipe work system. Pipe welders support many employers in the construction, engineering and manufacturing sectors. They can be employed by the supply chain organisations or the direct owner/operator.

In their daily work, an employee in this occupation interacts with a wide range of people and organisations including Supervisors, Engineers, Pipe Fitters, Riggers, Stores Operatives, Welding Inspectors, Non-Destructive Technicians, Quality personnel, Insurance Inspectors and associated Technicians (e.g. Thermal Treatment, Non-Destructive Testing). Pipe welders' work is regularly assessed to ensure continued quality of welding though visual inspection, non-destructive testing and pre-commissioning pressure testing (hydraulic or pneumatic testing). They can work anywhere in the world and provide services in a range of demanding environments, including working at height, confined spaces, on live plant and equipment. This could include fabrication workshops, oil rigs, power stations, process plant facilities, on-board marine vessels. Pipe welders may need to work shifts and flexible work patterns. They can work in organisations ranging from multi-national organisations to very small businesses.

An employee in this occupation will be responsible for the safety, quality, productivity and accuracy of their own work whilst ensuring it conforms to a relevant pipe welding specification. Ensuring the bore cleanliness is maintained to the requirements of the piping system to assure the integrity of the system, components and product that will flow within the completed pipe system. Pipe Welders can hold a range of responsibilities ranging from working autonomously during their planning and production activities to being an integrated part of a wider team working on the overall pipework system, reporting to a workplace supervisor. This can vary based on the size of organisation and sector in which they work.

**Typical job titles**

Typical job titles include Pipe Welder, Pipeline Welder, Class A Welder, Pressure Parts Welder, Coded Pipe Welder.

**Occupation duties**

<table>
<thead>
<tr>
<th>Duty</th>
<th>Description</th>
<th>KSBs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duty 1</strong></td>
<td>Plan and prepare for the pipe welding activities before commencing work</td>
<td>K3 K4 K6 K7 K8 K9 K10 K11 K12 K13 K15 K17 K18 K19 K20 K21 K23 K25 S1 S2 S3 S4 S5 S6 S7 S9 S10 S11 B1 B2 B3 B4 B5 B6 B8</td>
</tr>
<tr>
<td><strong>Duty 2</strong></td>
<td>Check materials conform to the specified grades, dimensions, thicknesses and diameters.</td>
<td>K1 K4 K16 K18 K22 S1 S2 S3 S5 S7 S15 B1 B2 B3 B4 B5 B6 B7 B8</td>
</tr>
<tr>
<td><strong>Duty 3</strong></td>
<td>Inspect weld preparations, assembly and apply remedial material conditioning appropriate to the preparation processes applied</td>
<td>K4 K5 K6 K11 K12 K13 K16 S1 S2 S3 S6 S11 S15 B1 B2 B3 B4 B5 B6 B7 B8</td>
</tr>
</tbody>
</table>

[https://www.instituteforapprenticeships.org/apprenticeship-standards/pipe-welder/](https://www.instituteforapprenticeships.org/apprenticeship-standards/pipe-welder/)
Duty 4 Align and position pipes to be welded, recognising ovality, mismatch, clean contamination and foreign material ingress exclusion requirements

K4 K5 K6 K9 K19 K20 K21 K22 K23 K25
S1 S2 S3 S4 S5 S6 S8 S9 S10 S11 S15 S16
B1 B2 B3 B4 B5 B6 B7 B8

Duty 5 Establish necessary purging and bore protection of the weld deposit, using dams, barriers, pastes or fluxes

K9 K10 K11 K12 K13 K20 K26
S1 S2 S3 S5 S6 S9 S10 S15 S16
B1 B2 B3 B4 B5 B6 B7 B8

Duty 6 Set-up and check the equipment to be used in the preparation and welding of pipes and tubes

K3 K4 K7 K8 K13 K15
S1 S2 S3 S4 S8 S9 S10 S11 S15
B1 B2 B3 B5 B7 B8

Duty 7 Adjust and maintain the equipment to be used during the welding of pipes and tubes, applicable to the process being used

K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K15
S1 S8 S13 S15
B1 B2 B5 B7 B8

Duty 8 Read, interpret and apply technical specifications, inspection criteria & drawings to establish detailed welding process controls, bore protection methods and consumable selection

K3 K4 K5 K9 K10 K11 K12 K13 K14 K17 K18 K19 K20
S2 S3 S5 S6 S7 S8 S9 S10 S12 S13 S15
B1 B2 B3 B4 B5 B7 B8

Duty 9 Use appropriate tools, equipment and techniques to weld pipes and tubes, whilst considering welding parameters on the integrity of the finished material properties, characteristics and risk of defects.

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S15 S16 S17 S18 S19 S20 S21 S22
B1 B2 B3 B4 B5 B6 B7 B8

Duty 10 Monitor productivity, quality and consumable consumption throughout the welding of components and identify areas for improving the production process where possible (e.g. access & positioning, technique modification, filler metals, welding gas, purging gas, fluxing systems, electrodes).

K7 K11 K13 K15 K17 K18 K20 K21 K22 K23 K25
S1 S2 S12 S13 S15 S16 S17 S18 S19 S20 S21 S22
B1 B2 B3 B5 B6 B7 B8

Duty 11 Adjust parameters throughout the welding of components, recognising the need to adapt to accommodate ongoing changes in welding position and technique (e.g. Preheat, Interpass Temperature, Heat Input).

K7 K11 K13 K15 K17 K18 K20 K21 K22 K23 K25
S1 S2 S11 S12 S13 S15 S17 S18 S19 S20 S21 S22
B1 B2 B3 B4 B5 B6 B7 B8

Duty 12 Remove material using manual powered and non-powered hand tools before welding to clean the pipe bore, remove non-integral tack welds, dress anomalies in weld preparations and remove latent defects.

K2 K4 K6 K12 K13 K15 K16 K18 K19 K20 K23 K26 K28
S1 S2 S6 S11 S15
B1 B2 B4 B5 B6 B7 B8

Duty 13 Remove material using manual powered and non-powered hand tools, during welding to remove defects (e.g. porosity) and to prevent potential defects being created (e.g. Slag traps).

K2 K6 K13 K15 K16 K18 K19 K23 K26 K28
S1 S2 S6 S11 S15
B1 B2 B4 B5 B6 B7 B8

Duty 14 Inspect the completed initial weld run to confirm bore penetration level, profile, oxidation and linear shrinkage prior to final closure then visually inspect the bore side deposit and profile using appropriate inspection techniques

K1 K2 K3 K4 K6 K7 K9 K10 K11 K12 K13 K16 K20 K21 K25 K26 K27 K28
S1 S2 S12 S13 S15 S17 S18 S19 S20 S21 S22
B1 B2 B3 B5 B6 B7 B8

Duty 15 Monitor component changes and associated with weld shrinkage, visually inspecting the weld deposit during pipe and tube welding operations.

K1 K2 K13 K15 K16 K19 K20 K21 K25 K27
S1 S2 S8 S12 S13 S15 S18 S19 S20 S21 S22
B1 B2 B3 B5 B7 B8
Duty 16 Inspect the final pipe weld and component to ensure, surface finish, weld profile and component geometry meet specification

K5 K12 K15 K16 K22 K28
S1 S2 S8 S12 S13 S15 S17 S18 S19 S20 S21 S22
B1 B2 B3 B5 B7 B8

Duty 17 Dress finished weld cap as required in the specification to accommodate subsequent inspection techniques.

K13 K16 K19 K20 K21 K22 K23 K27 K28
S1 S2 S11 S12 S13 S15 S17 S18 S19 S20 S21 S22 B1 B2 B3 B5 B7 B8

Duty 18 Restore the work area, welding equipment, and purging devices to a safe and reliable condition on completion of welding

K1 K2 K6 K8 K9 K12 K18 K22 K25 K26
S1 S2 S14 S15 S16 B1 B2 B5 B7 B8

Duty 19 Return unused consumables for re-conditioning and re-use or disposal.

K9 K11 K12 K13 K17 K18 K21 K22 K23 K27
S1 S2 S14 S15 S16 B1 B2 B5 B7 B8

Duty 20 Collate and submit quality records information including batch identification, welder identification, weld map and quality dossier

S2 S13 S15 S16 B1 B2 B3 B5 B6 B7 B8

KSBs
Knowledge

K1: The mechanical properties (strength, ductility, toughness, etc.), physical properties (dimensions, weight, corrosion susceptibility, contamination) of commonly welded materials.

K2: The fundamentals of welding metallurgy (Weld Metal Solidification and Heat Affected Zone) and how this can affect weldability of materials and final joint integrity

K3: The common manual arc welding processes and the relative merits for a given application including Tungsten Inert Gas (TIG), Manual Metal Arc (MMA), Plasma Arc Welding (PAW), Metal Inert Gas (MIG), Metal Active Gas (MAG), Flux Cored Arc Welding (FCAW)

K4: Pipe and tube weld joint types (Butt, Socket, Set-on Branch, Set-in Branch, Set-Through Branch, Flange) and the relative merits of the multiple preparation types (e.g. J-, V-, U- and double/triple compound angles) and their effect on pre-welding pipe preparation times, weld shrinkage, restrictive access to the pipe weld preparation, welding technique to be adopted and risk of causing defects during welding production.

K5: The welding positions and progression directions associated with welding pipe e.g. Rotated Pipe; Horizontal - Fixed Vertical Pipe; Vertical Weld - Fixed Horizontal Pipe (either upward or downward progression); Inclined - Fixed 45 degree Pipe Overhead (either upward or downward progression).

K6: Pipe bore contamination and how weld root profile affects product performance in service (corrosion, erosion, flow restriction, post-weld conditioning treatments, product contamination (e.g. food, beverage, pharmaceutical) or damage to other components within the piping system (e.g. valves/turbines)

K7: Welding controls to establish and maintain the key primary parameters associated with the welding process (e.g. Current, Arc Voltage, Wire Feed Speed, Shielding Gas Flow Rates, Electrode Polarity etc.)

K8: The major components of welding equipment, ancillary equipment, cabling and their assembly, including Power Source, Wire Feed System, TIG & PAW Arc Initiation Systems, interconnecting communications cables, torches, tongs, gas equipment etc.

K9: Purging systems and damming mechanisms, including their relative merits and limitations, locating relative to the weld and subsequent removal from the piping system (e.g. dams, bungs, foams, ashless paper, soluble films etc.)

K10: Purging gas selection and its relative merits for a given material and weld location/orientation within a piping system, considering its buoyancy, leakage path, risk of asphyxiation, reaction with the molten weld pool and potential effect on weld metal properties.

K11: The relative merits of purge gas injection into the bore to consider the route of gas supply, orifice diameter, volume to be purged, flow rate, acceptable oxygen levels, turbulence effects, waiting time to achieve specified levels and trigger point for withdrawal of purge protection from pipe bore

K12: Flux based bore side root protection mechanisms (bore side fluxes, pastes, flux-carrying consumables such as flux coated and flux-cored rod stock (e.g. MMA, TIG, FCAW etc.), deoxidants within solid wires) and their relative merits, limitations and risks (post weld conditioning processes, foreign material exclusion requirements, product media contamination, downstream component degradation).

K13: Welding Procedure Specification requirements, content and information derived to establish specific production information

K14: Welder Approval Certificates content and definitions to determine scope of coverage

https://www.instituteforapprenticeships.org/apprenticeship-standards/pipe-welder/
K15: Mechanisms to measure, monitor and control secondary welding parameters (e.g. Bore Cleanliness, Bore side Oxidation, Heat Input, Interpass Temperature), linear shrinkage

K16: Identification and the causes of typical weld defects and how their occurrence can be reduced.

K17: Different types and functions of welding consumables and the requirement for correct identification, storage, conditioning, handling and recycling or disposal.

K18: The requirements for correct storage, handling and segregation of materials and tooling to prevent cross contamination between sensitive materials

K19: When and how to use material removal processes (powered and non-powered tools)

K20: Supporting activities often provided by others and must be checked to ensure the successful production of pipe welding activities (bore alignment, ovality, bore contamination, fitting, purging, thermal treatment).

K21: Welding quality documentation, organisational reporting systems, procedures and their role within the overall quality process

K22: Performance success factors in production, inspection reporting, productivity, bore cleanliness/contamination etc.

K23: Risks and mitigation measures associated with welding and the working environment, and the organisational risk management processes

K24: Statutory, quality, organisational and health, safety and environmental regulations

K25: Typical problems that may arise within their normal work activities/environment

K26: Organisational systems to control and administer approved processes, procedures, documentation and the potential implications for the organisation if not followed.

K27: Continuous improvement processes, performance review and how this is undertaken within their organisation.

K28: Non-destructive testing reports and radiographs including identification of particular defect types and the associated improvements to process and techniques needed to prevent recurrence

Skills

S1 Work safely at all times, comply with health & safety and environmental legislation, regulations and organisational requirements

S2 Obtain, check and use appropriate documentation (such as job instructions, drawings, quality control documentation)

S3 Plan all preparatory tasks and interfaces and pipe welding activity, before commencing work

S4 Obtain, position and assemble welding equipment and associated safety protection needed for each activity

S5 Prepare, check and protect materials and work areas ready for welding

S6 Inspect the assembly to be welded and undertake remedial work to comply with specification, or implement quality steps if rejected

S7 Receive, inspect, condition and maintain consumables

S8 Set, test, and monitor key welding parameters as detailed within the Welding Procedure Specification and adjust as necessary to accommodate changing orientation as the weld progresses around the pipe joint.

S9 Set-up purge protection within the pipe bore and associate monitoring methods

S10 Set-up bore side protection controls to avoid foreign material ingress into the pipe bore

S11 Remove materials using manual processes, including powered and non-powered equipment

S12 Achieve a quality of work to meet international standards e.g. ISO 5817, ISO 9606, ASME IX, ASME B31.3 for dimensional, surface inspection (e.g. Visual, Magnetic Particle, Dye Penetrant) and volumetric inspection (e.g. Radiography, Ultrasonic inspection, including Time of Flight and Phased Array methods).

S13 Monitor weld quality and dimensions throughout welding activity and on completion of welding and report any issues through organisational production / quality control process prior to release for formal examination by others

S14 Restore the work area on completion of the activity and where applicable return any resources and consumables to the appropriate location

S15 Deal promptly and effectively with problems within the limits of their responsibility using approved diagnostic methods and techniques

S16 Complete any required documentation using the defined recording systems at the appropriate stages of the work activity

S17 Produce pipe welds using two welding processes from TIG, PAW, MMA, MIG/MAG, FCAW

S18 Produce pipe welds using four material groups from Carbon Steel, Low Alloy Steel, High Alloy Ferritic/Martensitic Steel, Austenitic Stainless Steel, Nickel & Nickel Alloys, Aluminium & Aluminium alloys, Titanium & Titanium Alloys, Copper & Copper Alloys

S19 Produce pipe welds covering ALL defined pipe welding positions. These are Flat - Rotated Pipe; Horizontal - Fixed Vertical Pipe; Vertical Weld - Fixed Horizontal Pipe (either upward or downward progression); Inclined - Fixed 45 degree Pipe Overhead (either upward or downward progression)

S20 Produce pipe welds in 3 main joint configurations from Single Sided Butt, Socket, Flange and Set-on Branch.

S21 Produce pipe welds in by continually adjusting the orientation of the welder, welding torch, and welding consumable filler, including restricted access conditions

S22 Produce pipe welds in restricted access conditions by welding with both left and right hands (e.g. boiler tube bundles, proximity of other plant and equipment, limited access locations, welds located with limited visibility of the weld joint)

Behaviour
B1: Takes responsibility for decision-making, without autonomy and within the guidelines of the work instruction, for their workplace, the application of welding processes, and for their productivity.

B2: Enquires and seeks guidance, in order to understand the processes and associated industrial applications.

B3: Committed to maintaining competence through Continuing Professional Development planning, preparation and reflection to ensure safety, quality and production and ensuring Continuing Professional Development goals are achieved.

B4: Intervene and challenge poor practice and have confidence to channel feedback to the appropriate authorities to implement change.

B5: Consistently and reliably deliver expectations in safety, production, quality, ethics and self-development.

B6: Encourages and supports the development of others and completes point of work risk assessments.

B7: Follows the specified procedures and controls and be personally responsible and accountable for their production work and personal development.

B8: Reflect on current and past performance and provide information and recommendations for continuous improvements in efficiency and effectiveness of working practices, and training and development requirements.

Qualifications

English and Maths qualifications

Apprentices without level 2 English and maths will need to achieve this level prior to taking the End-Point Assessment. For those with an education, health and care plan or a legacy statement, the apprenticeship's English and maths minimum requirement is Entry Level 3. A British Sign Language (BSL) qualification is an alternative to the English qualification for those whose primary language is BSL.

Professional recognition

The Welding Institute / Engineering Technician

Additional details

Occupational Level: 3
Duration (months): 48

Review

This standard will be reviewed after three years.

Crown copyright © 2020. You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. Visit www.nationalarchives.gov.uk/doc/open-government-licence

Find an apprenticeship

Postcode (optional)

Version log

<table>
<thead>
<tr>
<th>VERSION</th>
<th>DATE UPDATED</th>
<th>CHANGE</th>
<th>PREVIOUS VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19/07/2019</td>
<td>Assessment plan and funding band first published</td>
<td>Not available</td>
</tr>
<tr>
<td>1</td>
<td>25/04/2019</td>
<td>Standard first published</td>
<td>Not available</td>
</tr>
</tbody>
</table>

https://www.instituteforapprenticeships.org/apprenticeship-standards/pipeweld/