

## AREAS FOR FURTHER DEVELOPMENT

### T LEVEL: ENGINEERING, MANUFACTURING, PROCESSING AND CONTROL

T Level learners will have covered a broad spectrum of knowledge and understanding of the concepts, theories and principles relevant to the T level in the core content. They will then specialise and cover the knowledge and skills required in that occupational specialism, putting this into practise during the industry placement. There may be some areas a learner will need to further develop in a workplace environment following a T Level to reach full competence, such as behaviours. Following engagement with employers, industry experts and providers, we have captured below what these areas for development may be following a T Level. This will depend on the learner and an initial assessment. The RPL guidance gives further details.

#### **Occupational Specialism: Fabrications and Welding Technologies** **Standard: Pipe Welder**

##### **Aspects for further development**

Knowledge:

- 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.)
- 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).
- K14: Welder Approval Certificates content and definitions to determine scope of coverage
- 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 welding defects and how their occurrence can be reduced.
- 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).
- K22: Performance success factors in production, inspection reporting, productivity, bore cleanliness/contamination etc.
- K25: Typical problems that may arise within their normal work activities/environment
- 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:

- S7: Receive, inspect, condition and maintain consumables
- 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
- 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
- S15: Deal promptly and effectively with problems within the limits of their responsibility using approved diagnostic methods and techniques
- 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)

### **Additional Learning**

Further Practical Application of knowledge and skills to reach full occupational competence. They will need further support to apply their knowledge and skills, particularly in non-routine situations to develop their:

- Quality of skill
- Pace
- Adaptability
- Independence and focus
- Appropriate workplace behaviours

Behaviours.