



Practical Steps to Achieving Zero Interruptions, Zero Leaks

Background

The opportunity to lay leak-free networks with current technology and good training is an attractive business proposition when considering the savings in fixing defective joints and the interruptions to supply and traffic.

Water companies, their partners and suppliers are committed to improving the quality of pipeline installation work. They recognise that culture change is required so that every part of the supply chain takes accountability for good joints.

The first step in this journey was the updating of WIS 4-32-08 ([Specification for the fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials](#)) in 2016 which offers the chance of incremental improvements in joint quality. The update to the WIS was prepared by members of the BPF Pipes Group and is now compatible with the European Standard for pipes and fittings with directly comparable tests for quality assessment from supply to installation.

Promoting current best practice

Water companies are updating their tender specifications to reference WIS 4-32-08: Issue 4 and are committed to entering contracts with installers who operate to BS EN ISO 9001 for all aspects of fusion jointing.

Engineering contractors are actively introducing schemes to train all staff and carry out regular auditing to ensure that the current best practice in WIS 4-32-08 is being followed on site.

Manufacturers are using WIS 4-32-08 in all their training material and offering detailed technical support to training providers on product specific areas.

To support the water companies and their engineering contractors in these activities, it is essential that the training courses offered are designed and delivered to promote knowledge of the entire fusion jointing process, explain the fundamental principles of good jointing and measure the competency of attendees.

Teaching current best practice

This short guide, produced by the Plastic Pipes Liaison Group (PPLG¹), addresses the key elements that training courses need to offer to underpin the commitments being made by water companies, engineering contractors and manufacturers to best practice jointing.

¹ The PPLG is a joint initiative between Water UK and the BPF Pipes Group.

General

This guide sets out the objectives for, and assessment of, theoretical and practical learning to support employers in choosing training which will fully contribute to improving the quality of pipeline installation work. A companion document “Suggested minimum content for training of fusion welders” provides the detailed content required to support training providers in setting up courses which meet the needs of the water industry to provide leak free pipelines.

The training course should provide a broad understanding of all aspects of constructing joints in PE pipelines for the pipe size range and welding process against which the trainee seeks to be assessed.

It should comprise instruction and assessment in both theoretical principles and the practical application of knowledge.

It is recognised that additional information and skills are required for the construction of larger diameter joints. Training and assessment should allow the welder or supervisor to build on, but not to by-pass, existing skills developed for small diameter pipe joints. This is illustrated in Figures 1 and 2.

Figure 1: Building of skills for electrofusion welding (from 20mm to 630mm)



Figure 2: Building of skills for butt fusion welding (from 63mm to 900mm)



Theoretical learning

As with all learning, it is important that the trainee comprehends the information provided and can show how the fundamental principles are applied to produce good quality joints.

For electrofusion jointing, the theoretical training should be sufficiently detailed so that by completing it, a trainee would:

- be able to describe the equipment and procedures used for jointing PE pipes by electrofusion;
- be able to recognise the adaptations in equipment and procedures needed for different pipe types (e.g. coiled, peelable);
- be able to explain using examples how the incorrect use of equipment and procedures can contribute to poor quality joints; and
- be ready to apply the theoretical learning to practical situations.

This should be assessed in a theoretical test prior to any practical application of the knowledge gained. It is recommended that the test be no more than one hour but include around twenty questions covering equally equipment use and maintenance, site practice and hygiene, production of welds in straight and coiled pipes and saddle branches, assessment of weld quality and record keeping.

For joints greater than 355 mm, the theory and questions would additionally need to include mechanical handling and safe working with heavy items, the use of manufacturer specific equipment and methodologies, and the impact of dimensional tolerances on joint quality.

For butt fusion jointing, the theoretical training should be sufficiently detailed so that by completing it, a trainee would:

- be able to describe the equipment and procedures used for jointing PE pipes by butt fusion;
- be able to recognise the adaptations in equipment and procedures needed for different pipe types (e.g. coiled, straight length) and sizes;
- be able to explain using examples how the incorrect use of equipment and procedures can contribute to poor quality joints; and
- be ready to apply the theoretical learning to practical situations.



This should be assessed in a theoretical test prior to any practical application of the knowledge gained. It is recommended that the test be no more than one hour but include around twenty questions covering equally equipment use and maintenance, site practice, preparation and production of welds, assessment of weld quality and record keeping

For joints greater than 900 mm, the theory and questions would additionally need to include mechanical handling and safe working with heavy items and the use of manufacturer specific equipment.

Practical application

In applying the theoretical learning, it is important that a trainee can demonstrate proper planning to ensure safe and effective working; conducting butt fusion and electrofusion welding in accordance with health and safety requirements and the requirements of WIS 4-32-08 Issue 4; and assessing the quality of welds and identifying welds which should be rejected and removed from the system.

For electrofusion jointing, the practical training should be sufficiently detailed so that by completing it, a trainee would be able to:

- demonstrate the correct preparation and procedures for jointing PE pipes by electrofusion in realistic site conditions chosen to show the different conditions encountered due to seasonal or environmental factors;
- complete the satisfactory jointing of PE pipes by electrofusion in the range of pipe sizes and pipe types (e.g. coiled, peelable) covered by the training (see Figure 1);
- adapt to changes in equipment and procedures needed for different coupler / fitting types; and
- apply the practical learning to the working environment.



This should be assessed in a practical test prior to issue of a completion certificate. It is recommended that the practical test is not carried out by the person delivering the training.

The practical test should require assemblies to be produced using the correct jointing and the assemblies to be visually and destructively tested. The destructive test should meet the pass/fail criteria for the applicable standard (i.e. BS ISO 13956, ISO 13953 or ISO 13955) or may be tested under pressure to destruction (pass criteria, ductile bursting of the pipe only).

It is recommended that the assemblies to be produced during the practical tests, subject to the scope of the course, are:

- For 20 mm – 180mm, electrofusion coupler assembly using 125mm coiled pipe and electrofusion top tee assembled to 125mm pipe.
- For 200 mm – 315 mm, electrofusion coupler assembly using 250mm pipe and branch saddle assembled to 250mm pipe.
- For ≥ 355 mm, electrofusion coupler assembly using pipe of diameter ≥ 355 mm.

For butt fusion jointing, the practical training should be sufficiently detailed so that by completing it, a trainee would be able to:

- demonstrate the correct preparation and procedures for jointing PE pipes by butt fusion in realistic site conditions chosen to show the different conditions encountered due to seasonal or environmental factors;
- complete the satisfactory jointing of PE pipes by butt fusion in the range of pipe sizes and pipe types (e.g. coiled, straight length) covered by the training (see Figure 2); and
- apply the practical learning to the working environment.

As for electrofusion welding, this should be assessed in a practical test requiring the production and testing of assemblies. It is recommended that the assemblies to be produced during the practical tests, subject to the scope of the course, are:

- For 63 mm – 315mm, butt fusion weld using 180mm pipe (ideally coiled pipe).
- For >355 mm – 900mm, butt fusion weld using 450 mm or 500 mm pipe.

What does this mean for your organisation?

The content and delivery of training courses for pipeline jointing vary greatly and the costs of attendance reflect this. You are encouraged to use this guide to evaluate courses when choosing appropriate training for your staff carrying out or supervising fusion jointing. By choosing a course which covers these minimum training requirements and assessment of competency, the engineering contractor can fully contribute to improving the quality of pipeline installation work.

It should be remembered that specifications, performance requirements and technology for PE pipe system jointing are under constant review. Training content should be regularly updated to reflect this.