

STUDY NOTES: ELECTROFUSION WELDING (EGEPLAST IRELAND LTD)

PURPOSE OF THIS COURSE

The goal of this training course is to provide a standardised, minimum level of operator proficiency when conducting electrofusion (EF) welding in PE (polyethylene) pipe systems. It covers essential knowledge, safety, standards, and best practices as recommended by Egeplast Ireland and aligned with Uisce Éireann (Irish Water) guidelines.

This course is aimed at ensuring the consistent production of high-quality EF joints while maintaining safety and compliance across water and gas infrastructure projects.

1. **WHAT ARE THERMOPLASTICS?** Thermoplastics are plastic materials that soften when heated and harden when cooled. PE pipes and fittings are made from these materials. They can be:
 - Amorphous: Good elasticity, low load resistance.
 - Crystalline: High strength and temperature resistance, but less elasticity.

All PE pipes are sized by outer diameter (OD) in millimetres. SDR (Standard Dimension Ratio) = OD / Wall Thickness Example: OD 110mm, Wall Thickness 10mm → SDR = 11

2. PIPE MATERIAL TYPES

- PE80: MRS = 8 MPa; May be PE-MD or PE-HD
- PE100: MRS = 10 MPa; Always PE-HD

PE100 is superior and is now the industry standard. PE80 and PE100 can be welded together using a compatible EF coupler, following WIS 4-32-08 and WIS 4-32-16.

3. PIPE COLOUR CODES

- Blue: Potable Water (EN 12201)
- Yellow: Gas (EN 1555, PE80)
- Orange: Gas (PE100)
- Black: Semi-treated water or general PE use (also suitable for UV exposure)

4. WELDING FUNDAMENTALS

EF welding uses a fitting with an embedded coil. A voltage (8–48V) heats the coil, fusing the fitting and pipe.

- Ideal for confined spaces, heights, small-diameter pipes, house connections, repairs, or live line branches.
- Steps: Clamp and position → Energise → Melt and fuse → Maintain pressure through cooling.

5. PIPE PREPARATION & CLEANING

- Only use rotary or hand scrapers (never grinders).
- Remove 0.2–0.4mm of oxidised surface.
- Re-scrape if welding is not done within 30 minutes.
- Clean with 90% isopropyl or 95% ethanol wipes. No alternatives allowed.

6. ENVIRONMENTAL CONSIDERATIONS

- **Cold (<0°C):** Use tents, preheat ends, remove moisture.
- **Hot (up to 49°C):** Provide shade, monitor temperatures.
- **Wind:** Shelter fusion zone, plug pipe ends.

7. EQUIPMENT REQUIREMENTS (IRISH WATER MINIMUM)

- EF machine with data retrieval
- Rotary & hand scrapers
- 90%+ isopropyl/ethanol wipes
- Welding tent/shelter
- Alignment clamps
- Calibrate equipment every 6 months
- **No extension leads** on control box connectors (WIS 4-32-08)

8. PIPE DAMAGE LIMITS (SCRATCH DEPTHS) Max allowable depth varies:

- 90 SDR11: 0.81mm
- 110 SDR17: 0.65mm
- 125 SDR11: 1.14mm
- 125 SDR17: 0.73mm

- 160 SDR11: 1.45mm
- 160 SDR17: 0.94mm

Alternatively: Max depth = 10% of wall thickness. Wall thickness = OD divided by SDR

9. JOINTING TECHNIQUES

- Butt Fusion: Ideal for >180mm
- Electrofusion: Best for smaller pipes/repairs
- Stub End + Backing Ring: Joins PE to ductile iron
- Mechanical fittings also acceptable

10. FITTING TYPES

- **Coupler:** Straight connector
- **Elbow:** 90° bend
- **Reducer:** Joins different pipe sizes
- **End Cap:** Seals pipe end
- **Tapping Saddle / Spigot Saddle:** For branch connections (tap **after cooling**)

11. PRESSURE TESTING & DEFECTS

- Pressure testing is the best way to confirm weld quality
- Engineers may request: 1 in 30 welds or 1 per week (<250mm OD)
- Weld must be marked with: Welder's initials, Date, Record No., Voltage, Weld & Cool time
- Common Defects: Not inserted fully, angle deviation, coil movement, pipe ends not square

12. STANDARDS & CERTIFICATIONS

- EN 12201 (Water)
- EN 1555 (Gas)
- WIS 4-32-08 & 4-32-16 (Procedures & equipment)
- IW-TEC-1000-01 (Irish Water spec)
- **WIT 08-04 v4 is NOT accepted** on Irish Water or Bord Gáis sites

13. GENERAL KNOWLEDGE CHECKPOINTS

- EF voltages: 8–48V

- PE pipes expand/contract with temperature changes
- Black EF couplers can be used on blue pipes **if certified**
- One EF welder per 12.5 kVA generator
- PE pipes = external diameter sizing
- Service connections must be at least 300mm apart
- PE100 couplers can weld PE80 pipe (if compatible)

14. ADDITIONAL DETAILS NOW INCLUDED:

- **Pinhole Sizes:** Most common EF pin terminal sizes in Europe are **4.0mm and 4.7mm**.
- **Dismantling Joint:** A dismantling joint allows for the **easy removal or replacement of valves**, especially in confined or flanged setups.
- **ISO Standards for Testing:**
 - Socket assemblies **>90mm OD:** ISO 13954
 - Socket assemblies **<90mm OD:** ISO 13955
 - Test specimen width: Typically **25mm**
- **Visual Identification Note:** Images will be shown during assessment. Know how to recognise each fitting type (Coupler, Elbow, Saddle, Tee, End Cap, Reducer, etc.).