Jointing Of Polyethylene Pipes Using Waters & Farr 40 Volt Electrofusion Couplers

With electrofusion fitting jointing, an integral electrical resistance element is incorporated in the socket of the fitting which, when connected to an appropriate power supply, melts and fuses the materials of the fitting and inserted pipe together.

Necessary equipment for welding includes:

- proper electrofusion welding unit to maintain electrical parameters and time, for 4.7 mm diameter terminals;
- power source (generator), nominal 240 V, of minimum 5 kVA capacity (dependent of pipe size);
- pipe cutter (saw with saw guide);
- pipe clamps or other approved methods for restraining, aligning and re-rounding the pipes;
- pipe surface preparation tool to remove oxidised surface of the pipe (mechanical or hand scraper);
- Isopropanol impregnated pipewipes or Isopropanol (Isopropyl Alcohol);
- disposable lint-free tissue, cloth, or paper towel.

A shelter should be used to provide adequate protection for pipe, fittings and equipment against adverse weather conditions and contamination.

Generic guidelines

1. Cut the pipe ends squarely, align the pipes

Cut the pipe ends to be jointed square, that is, at right angles to the axis of the pipe. For larger pipe sizes, cut off “curled” factory pipe ends at a distance of one half to one pipe diameter from the end. Remove burrs and shavings.

When cutting an existing pipe, make sure that the line pressure is blocked off or vented.

Use a shelter against adverse weather conditions and cover the pipe ends remote from the joint, as possible, to prevent contamination of the fusion interface or excessive cooling of the weld. Ensure that no water or other fluid can access the fusion area neither from inside nor from outside the pipe. There shall be a sufficient space to permit access to the jointing area. In a trench, a minimum clearance of 150 mm is required all round.

Wipe any traces of dirt, mud, etc. from the pipe ends with a clean, disposable, lint-free material.

Prepare pipe clamps or other means for restraining, aligning and re-rounding the pipes. Position the pipe in the clamp, align (and re-round, if necessary) the pipes.

2. Measure and mark the depth of pipe penetration into the fitting

Measure and mark on the pipe the depth of pipe penetration into the socket (place bagged fitting alongside the pipe end). We recommend marking the depth of pipe penetration into the socket even for couplers with pipe penetration stops in order to ease control over the welding process. For sockets and reducers having no pipe penetration

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stops, measure distance between edge and middle of the fitting, and measure and mark the same distance from edges on the pipe. Mark also the whole length of the fitting on the pipe end if the fitting has to be slid fully on the pipe for subsequent cleaning.

Do not remove the fitting from its packaging (if any) **at this stage.**

3. Prepare the outer surface of the pipe ends

Immediately prior to jointing, use a peeler or a scraper to remove the outer surface of the pipe ends. Any traces of oxidised material remaining on the surface of the pipe will reduce the quality of the weld and may cause a leak in the pipe connection.

Remove the entire surface of the pipes between the edges and past the marks to a depth of 0.2-0.4 mm uniformly, avoiding gouging or removing excessive material from the pipe surface. To ensure that the complete circumference of the pipe has been scraped, check lines may be made around the pipes in the middle of the surface to be scraped. Removing the check line while scraping ensures good cleaning. Use mirror to inspect completeness of scraping under any fixed pipe end.

Remove burrs and shavings.

Do not touch the prepared pipe areas.

4. Clean the pipe and the fitting

Clean the pipe ends, wiping them with Isopropanol impregnated pipewipe or using clean, disposable, lint free and nondyed material moistened in Isopropanol.

Remove the fitting from its packaging (if any) and check that the bore of the fitting is clean. Otherwise (or if the packaging has been punctured or torn) wipe the fitting bore with Isopropanol impregnated pipewipe.

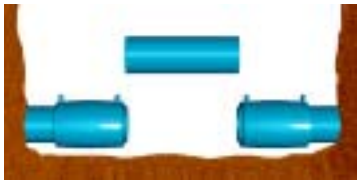
When a fitting has to be slipped fully onto a pipe, clean and dry the pipe end for at least twice the length of the marked zone of pipe penetration to prevent contamination of the inner surface of the fitting during installation.

Ensure the prepared surfaces are completely dry before proceeding. The insertion depth marking may be restored, if removed while cleaning.

Care should be taken not to contaminate the fusion zones again.

5. Centre the fitting on the pipe ends

Check that a gap between the pipe ends does not exceed 2 mm. Insert the pipe ends into the socket till they are in contact with pipe stops (or till edges of the fitting reach the marked depth of pipe penetration into the fitting). Use re-rounding clamps, as necessary.



When inserting a tee or a pipe section, place the coupler on one of the pipe ends and slide it on for its full length (but not out of the previously cleaned area). The pipe penetration stops within the coupler may be removed before cleaning the bore, or sometimes may simply be sheared off by pressing on the fitting and sliding it over the pipe. Once the socket is in place, position the other pipe section, valve or tee.

Centre the fitting on the pipe ends or on the inserted pipe section, valve or tee using previously made marks.

Using pipe clamps, secure the fitting and pipes in place to prevent movement of the joint during the

fusion and cooling cycle. Ensure that the pipes and fitting are properly aligned (with no angle between pipe axes), are not subjected to a bending stress, and are not left to support their own weight in the fitting or weight of the fitting.

For a fitting with separate fusion zones, each side of the fitting shall be fused successively. Cover the other end of the fitting if pipe is not inserted there - this end of the bore of the fitting should be wiped clean and dried again prior to insertion of the second pipe.

6. Attach leads from electrofusion unit to the fitting terminals

Use electrofusion units recommended by Waters & Farr, as available.

Other electrofusion units capable of maintaining the operating voltage marked on the fitting (or 39.5 V to 40 V, if no marking observed) and of setting up an appropriate timing, may be used as well. Waters & Farr fittings are equipped with terminals 4.7 mm in diameter. Consult with the unit manufacturer in respect of usability and power capacity of different electrofusion units for welding 39.5 V electrofusion fittings of required size, and for supply of special adaptors, if necessary. Refer also to the operating instructions for the corresponding electrofusion units. When welding leads are connected to output cable of the unit using power plugs, use Waters & Farr leads.

All equipment should be well-maintained and kept in clean condition at all times (use storage boxes supplied with electrofusion units recommended by Waters & Farr). Check that the hollow terminals of the leads are in good working order with undamaged insulation and fit the fitting terminals tightly. Refer to supplier of the electrofusion unit should any repairs are required.

Generator used should be of appropriate capacity, properly serviced and calibrated according to the manufacturer's recommendations. Check that there is sufficient fuel for the generator to complete the joint. Check that it is functioning correctly before connecting electrofusion unit to the generator.

Connect electrofusion unit to the power source. Start the generator and switch on the unit.

Attach the output leads from the unit to the fitting - place the hollow terminals of the leads upon the pins of the fitting terminals and press them all the way home. **The hollow terminals must not be loose on the fitting terminal pins.**

7. Fuse the pipes and the fitting.

Input welding parameters into the control unit's program by reading barcode information with the scanner or manually (nominal fusion time and voltage are printed on the fitting label). Check that the correct time (which may be temperature adjusted compared to the nominal value – see further in the text) is shown on the control unit display.

Activate the fusion cycle from the electrofusion unit control panel according to the unit operating instructions. Watch for faults. On completion of the heating cycle, the correct time (equal to the required fusion time shown prior to the welding) should be indicated on the control unit display.

Most pressure fittings are also equipped with fusion indicators. Full rise of the indicator pins shows the completion of the fusion operation, however, dependant upon the gap between the fitting and pipe, differing rise of a fusion indicator pin may be noted.

Fusion parameters may be affected if extreme weather conditions

exist. The nominal fusion time is suitable for welding at the specified voltage (usually ±1 V) at the ambient temperature limits 15°C to 25°C. Information contained in the barcode allows electrofusion units to adjust the fusion time automatically. For manual input, the following adjustments may be considered. In very hot weather conditions, reduce the fusion time up to 0.3% of the nominal fusion time per 1°C of the excessive temperature. In conditions of low ambient temperature, fusion time should be increased up to 0.7% of the nominal fusion time per 1°C beneath 15°C. Otherwise, full rise of the fusion indicator pins may be regarded as a sufficient criterion for joint acceptance.

If the fusion cycle terminates before completion of the fusion time, check for faults as indicated by the control unit. If the fault is equipment related, the fitting may be re-fused. **Do not attempt a second fusion cycle within one hour of the first attempt.** Make sure that the fusion interface is not contaminated in any way in that time.

Precaution: Observe closely the rise of the fusion indicator pins - if very fluid melt emerges around the pins or around the edges of the fitting, the fusion cycle should be stopped. Observe normal precautions when using electrical equipment, particularly in wet conditions. We recommend to remain at least 1 m away from the fusion area to avoid burns by molten polyethylene material that may be ejected should a malfunction occur or due to high ambient temperature.

8. Disconnect leads from the fitting

On completion of the cooling time, carefully disconnect the welding leads from the fitting. The cooling time is indicated on the fitting label, or recommendations of the table below may be used. If both the pipe and the fitting are securely fixed (that is, neither can be moved or disturbed), the leads can be removed from the fitting terminals at the end of the fusion process, though we do not recommend such practice.

Pipe sizes, mm		Minimum cooling time*, min.	Waiting time before applying operating pressure or full test*, min.
Nominal bore	Nominal OD		
Up to 25 (1")	Up to 32	5	10
32-40 (1¼-1½")	40-50	10	20
50 (2")	63	15	30
80 (3")	90-110	20	45
100 (4")	125	25	60

* This time should be increased for extremely hot weather conditions.

Take all necessary means to prevent any movement of the joint and to avoid any stresses being applied to the joint during the cooling time duration. Restraining clamp, re-rounding or alignment tools must not be removed until completion of the cooling period. We recommend extending these restrictions to the whole duration of the waiting time, if possible (see the table above).

9. To accept the joint before testing or applying operating pressure, assure the fusion cycle has been completed without interruption within the time specified for the fitting type and size used (see also our recommendations regarding the fusion cycle adjustment to the actual welding conditions above)**.**

If a fitting is not equipped with fusion indicators, we recommend marking it (e.g., writing the actual fusion time) when disconnecting the electrofusion unit leads from the fitting.

10. A pipeline (or its section), whether new or repaired, shall not be operated until it has passed the required field testing. We recommend to keep all connection points exposed and accessible for the test.

The time after which the pipeline can be subjected to a full test and to operating pressure is specified in the table above (this time has to be increased for hot weather conditions).