



# THE GOOD GUIDE TO ELECTROFUSION JOINTING

**Fusion**

# THE GOOD GUIDE TO ELECTROFUSION JOINTING



This guide will provide basic information to enable the operative to:

- Understand the principles of electrofusion jointing.
- Carry out pre-jointing equipment checks.
- Identify pipe and compatible fittings.
- Inspect for, and identify acceptable quality joints.
- Make satisfactory electrofusion joints from compatible pipes and fittings.
- Site the equipment.

### Safety Notice

To ensure operator safety and comply with Health and Safety regulations all electrofusion control boxes must be operated from an effectively earthed supply in accordance with the manufacturers' operating instructions.

### Equipment required:



Generator of suitable size to power control box - refer to manufacturers' literature for power requirements



Welding tent/shelter and ground sheet



Indelible marker pen



Electrofusion control box with appropriate leads



Re-rounding clamp if pipe has become oval or has a flat spot



Restraining and alignment equipment



Scraping equipment



Pipe cutter



Multiseal test cap



### Principles

Electrofusion is a method of joining PE pipes using fittings with integral heating elements. Socket fittings are used to join mains and service pipes; and saddle fittings are used to connect services to mains.

The term “socket” covers couplers, elbows, reducers etc.

The term “saddle” covers branch saddles and tapping tees.

The pipe to be joined must be prepared by removing the outer surface layer to a depth of around 0.2mm, then pipe and fitting are clamped together to prevent movement. A voltage is applied across the fitting terminals via a control box.

An electric current is passed through the wire which heats the wire and melts the polymer, fusing the fitting to the pipe. After welding, the joint is allowed to cool before removing the restraining clamps.

### Pipe/Fitting Selection



Check that both pipe(s) and fitting to be joined are compatible, **only compatible materials should be joined together**. Check PN and SDR rating marked on fitting and compare with that of the pipe. If in doubt, seek advice from the pipe or fitting manufacturer.

Fusamatic fittings are suitable for jointing in ambient temperatures between -10°C and +40°C and do not require any form of pre-heat or temperature compensation. For jointing outside these temperatures guidance should be sought from the manufacturer.

### Siting Equipment

Wherever possible, the electrofusion equipment should be placed on a suitable clean, dry base board or ground sheet inside a tent/shelter to minimise contamination.



Ensure that the area where the weld is to be carried out has any surface water removed and that some form of groundsheet is used to isolate the jointing area from the trench floor.

# THE GOOD GUIDE TO ELECTROFUSION SOCKET JOINTING

## Pre-Jointing Checks

- Use only equipment which has been regularly serviced and is in good condition.
- Check that clamps and liners are correct and clean. Advice on appropriate clamps and scrapers is available from all fitting manufacturers.
- Check that the scrapers are clean and the blade is not damaged and is in good condition.
- Check that the fitting is still in its original packaging and that the bag is not damaged or contains any condensation or dust.

## Pipe preparation - controlling ovality

- Ovality in PE pipe can occur as a result of coiling, storage and transportation.
- Fusamatic Electrofusion fittings have been designed to allow for a small degree of ovality (1 – 2%), but excessive gaps should be avoided by using alignment clamps with a re-rounding ability.
- In order to correct the effects of pipe ovality prior to the electrofusion process it is recommended that re-rounding clamps and/or tools be used as appropriate. This is particularly important where coiled or thin walled pipe is being used as ovality in these cases can be extreme.
- Use the appropriate re-rounding clamp as per manufacturers' instructions.

## SOCKETS JOINT ASSEMBLY PREPARATION

**1.** Check that the pipe ends are cut square and are free from surface damage and swarf.

**2.** Wipe loose dirt from the area of pipe to be clamped and fused with a prescribed wipe, damp cloth or paper towel. (Wipe any contaminates from the inside of the pipe).



**3.** Mark the insertion depth on the pipe by holding the bagged fitting against the pipe.



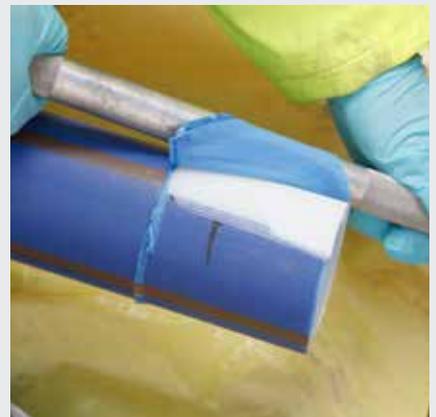
**4.** Cross hatch the area to be scraped plus an additional 20-50mm using the indelible marker pen.



**5.** Scrape one pipe end using a prescribed tool, for the length of the insertion depth plus 10-20mm. Ensure the whole surface area has been scraped.



**6.** For skinned pipe use the manufacturers' recommended tools to remove the skin. Some skinned pipe still requires a scraping operation but seek advice from the pipe manufacturer before preparing to join the pipe.



**7.** Open fitting bag, check the fitting is clean and immediately place over pipe end and push up to centre stops, or for fittings without centre stops insert the pipe to half the overall fitting length (mark this distance on the pipe prior to insertion). Leave bag over fitting for temporary protection.



8. Prepare the second pipe in the same way as the first, as previously described.

9. Remove the bag and push the second pipe into the fitting. Mark the penetration depth on the pipe and tighten the restraining clamp.

10. Check fitting penetration - using previously marked lines on pipe. Visually check pipe alignment in all planes. Rotate the fitting to ensure no excessive forces are present.



N.B. Spigot fittings i.e. saddle outlets, spigot outlet on tees, stub flanges should be scraped and restrained as with pipes.

**Important Note:** It is imperative that both the pipe and fitting jointing surfaces are kept clean and dry during the assembly and welding process. This is best achieved by preparing the pipe and then immediately assembling.

In certain circumstances it is accepted procedure to use alcohol wipes to clean any contamination from the joint surfaces, however we recommend that this practice be only used where absolutely necessary.

### Making the weld

1. Check generator has sufficient fuel.

2. Start the generator and then plug the control box input lead into the generator output socket. Connect the control box output leads to the fitting terminals - if automatic fittings and control box are being used, connect the red lead to the fitting terminal with the red pin, connect black lead to plain pin.



3. Check that the weld time marked on the fitting is displayed on the control box display. For manual fittings, check the weld time marked on the fitting and enter this figure into the control box. For 'barcode' fittings weld parameters are selected by scanning the barcode with the barcode scanner.

4. Respond to prompts from the box. Press 'START' and hold down until display begins countdown. The weld cycle is complete when the timer reaches zero and the control box 'CYCLE FINISH' indicator shows.



5. Allow weld to cool for the full time stated on fitting before removing clamps and moving the assembly.

### Quality Checks

- Check for any error messages on the control box.
- Check fusion indicators have risen on both sides of the fitting.
- Check for signs of melt exudation from the ends of the fitting.
- Check that the pipe has not moved by looking at the insertion depth marks.

# THE GOOD GUIDE TO ELECTROFUSION SADDLE JOINTING

## ADDITIONAL EQUIPMENT REQUIRED:

- 12mm cutter key (min length 150mm) and drive
- For stackload versions an appropriate clamp will be required
- For underclamp saddles (other than Multiseal) an appropriate sized socket will be required

## SADDLE JOINT ASSEMBLY PREPARATION

1. Expose pipe to which saddle is to be welded ensuring the pipe has no inclusions or gouges in the area where the fitting is to be fused.
2. Ensure enough clearance has been provided (in a trench environment) to carry out the installation.
3. Remove loose dirt from the pipe using a prescribed wipe, damp cloth or paper towel and ensure any risk of contamination from trench wall is minimized.
4. With the fitting still in its protective bag, place over required position on pipe. Mark pipe surface 10mm clear all around contact area and cross hatch the area using a marker pen.



5. Scrape the marked area, ensuring that each stroke of the scraper overlaps the preceding one, keeping hand clear of the scraped surface at all times.



6. For skinned pipe use the manufacturers' recommended tools to remove the skin. Some skinned pipe still requires a scraping operation but seek advice from the pipe manufacturer prior to commencement of the installation.

7. Immediately after pipe preparation remove fitting from bag and attach to pipe using suitable clamping equipment.



N.B. For Stackload fittings always bring the clamp to the located fitting, do not slide the fitting under the clamp.

**Important Note:** Do not touch either prepared pipe surface or the electrofusion surface of the saddle.

## Making the weld

1. Follow the same procedure as per socket jointing.
2. Allow weld to cool for the full time stated on fitting before removing stack load clamp or carrying out any cutting or pressure testing operations.



## Quality Checks

- Check for any error messages on the control box
- Check fusion indicator has risen on the fitting (saddle fittings only usually have one indicator).
- Check for signs of melt exudation around the saddle base.
- Check that the fitting is square to the main.

### SADDLE OUTLET JOINT ASSEMBLY PREPARATION

1. Scrape outlet of tapping tee and service pipe following the procedure described previously for sockets, using an appropriate mechanical scraper



2. Align service pipe and fittings with restraining clamp and make the weld as before.



3. Carry out quality checks as detailed previously

### PRESSURE TESTING OF JOINT

- Once the tapping tee has been fused to the pipe and connected to the service pipe, a pressure test can be carried out using a test cap in accordance with the appropriate industry guidelines. Please note it is not possible to use a universal test cap on a Multiseal Tapping Tee
- It is recommended that a pressure no greater than 1.5x the working pressure be used to test the joint integrity.

### FAILURE OF PRESSURE TEST AND QUALITY CHECK

If the weld fails any of the above checks then:

- a) for sockets - cut out the joint and replace.
- b) for saddles - do not tap the main and cut off the stack so it cannot be used. Carry out a repeat weld using a new fitting at least one pipe diameter away from the failed joint (this may differ depending on utility requirements).

### CUTTING THROUGH MAIN

The Multiseal Tapping Tee offers two cutting options for 'dead' and 'live' mains situations:

#### OPTION 1 - DEAD OR LOW PRESSURE

1. Unscrew cap and insert cutter key into integral cutter.
2. Turn the cutter key clockwise until the cutter has cut through the main.



3. Retract cutter until top is flush with stack and refit cap.

**\* Note: with this option a small amount of leakage will occur until the cutter is fully retracted.**

#### OPTION 2 - LIVE OR MEDIUM PRESSURE

1. Retract the cutter until its top surface is level with the top of the tapping tee stack.
2. Insert the tube into the cutter by pushing and twisting around 1/4 of a turn. There should be no gap between the cutter and the step on the tube.
3. Insert the 12mm cutter key ensuring it is located at the bottom of the cutter drive.



4. Turn the cutter key clockwise until the cutter has cut through the wall of the main, then retract the cutter until top of the cutter is level with the top of the tapping tee stack.

**DO NOT REMOVE THE CUTTER KEY FROM THE TUBE UNTIL THE CUTTER HAS FULLY RETRACTED.**

Once the cutter is in the fully retracted position, remove the cutter key and then remove the tube. The cap can then be hand tightened on the tapping tee. Please note that once the cap has been fully tightened down it cannot be removed.

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## ELECTROFUSION DO'S

- Use a shelter and ground sheet in wet or dry conditions.
- Always use equipment that has been regularly maintained and calibrated.
- Ensure control box voltage is compatible with fitting.
- Always use alignment/restraining clamps.
- Cut pipe ends square for electrofusion sockets.
- Scrape pipe and/or spigot surfaces fully.
- Keep scraped pipe and/or spigot surfaces and fittings clean.
- Ensure correct fusion and cooling times are adhered to.
- Assemble joint and fuse immediately after scraping pipe.
- Carry out quality checks before cutting through pipe.
- Mark the fused fitting with the joint number for traceability.

## ELECTROFUSION DONT'S

- Do not start the joining process unless it can be completed in one go.
- Do not leave fittings out of protective bags.
- Do not use dirty fittings.
- Do not touch prepared pipe surfaces or fusion areas.
- Do not allow assemblies to get damp prior to joining.
- Do not touch fusion indicators during the welding cycle.
- Do not remove joint from clamps until the full cooling time has elapsed.
- Do not remove integral cutter from the saddle once the main has been drilled.
- Do not use control box in a trench with gaseous atmosphere.
- Never fuse a fitting for a second time.
- Failed joints should not be used. Cut out failed joint and fuse another fitting to the required specification on distance from failed fitting.
- Electrofusion joints should not be carried out on slotted or drilled pipe sections, only solid walled pipe sections.

## SAFETY NOTES

Although we make every effort in the design of our products to ensure operator safety, please remember the following precautions:

- Never allow molten or semi-molten polyethylene to come into contact with the skin. If this happens, flush the affected area with cold water and seek expert medical advice.

### **DO NOT UNDER ANY CIRCUMSTANCE ATTEMPT TO PULL THE MATERIAL FROM THE SKIN AS THIS COULD REMOVE THE SKIN TOO.**

- Do not attempt to lift long lengths of pipe without assistance or mechanical aid.
- Normal precautions should be observed when handling electrical equipment although, for safety reasons, all 110v portable generator sets should be "Centre Tapped" for site use +55/0/-55 volts.
- To afford protection during jointing, it is advisable to wear protective workwear such as gloves, safety glasses and safety boots.
- Ensure that equipment is serviced on a regular basis as recommended by the equipment manufacturer.

### **DISCLAIMER**

**THE DATA PROVIDED IN THIS DOCUMENT IS NOT BINDING AND MAY BE SUBJECT TO MODIFICATIONS.**

**THIS DOCUMENT IS SUPPLIED AS A GUIDANCE ONLY. THE WELDING OPERATOR IS RESPONSIBLE FOR ENSURING ALL WORK IS PERFORMED EXCLUSIVELY BY TRAINED AND COMPETENT PERSONNEL AND IN COMPLIANCE WITH BOTH NATIONAL AND INTERNATIONAL RULES AND GUIDELINES FOR ELECTROFUSION INSTALLATION.**

## ADDITIONAL INFORMATION

### STANDARD DIMENSION RATIO (SDR)

The SDR is calculated by dividing the minimum (nominal) outside diameter (OD) by the minimum wall thickness (WT) i.e.

SDR =	OD	125	
	WT	11.4	= 11

From 25mm PE pipe and above the ratio between the outside diameter and the wall thickness remains constant for specific pressure ratings of the pipe.

### TRANSITION FROM PE PIPE TO OTHER PIPE AND FITTINGS

Various transition fittings are available to connect to metallic valves, hydrants and pipework. One common method is the use of PE flanges.

It is important to follow manufacturers' recommendations for tightening the necessary bolts. Bolt torque details are supplied with the flanges. It is also important to support any equipment independently of all PE pipework (ie. valves to be mounted on concrete blocks).



# THE GOOD GUIDE TO BUTT FUSION JOINTING



THE GOOD GUIDE TO  
BUTT FUSION JOINTING



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## FOR GAS AND WATER



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**Fusion Group Limited**

Chesterfield  
Derbyshire  
S41 9PZ  
England, UK

T: +44 (0) 1246 268666  
E: [sales@fusiongroup.com](mailto:sales@fusiongroup.com)  
[www.fusiongroup.com](http://www.fusiongroup.com)

