

Electrofusion jointing guidance

The following general guidance provides an overview of the method used for making joints using the electrofusion jointing technique.

Installers of electrofusion fittings...

- Must be competent
- Have undertaken the appropriate industry training and assessment
- Have acquired the necessary knowledge
- Have experience of the jointing method

Requirements to achieve a successful electrofusion joint

- The electrofusion process must be carried out as one continuous process from pipe surface preparation to fitting cooling stage
- Electrofusion jointing should be undertaken in a clean, dry and dust free environment. A shelter must be used to protect the work area from environmental contamination
- Where there is evidence of pipe ovality, the pipe must be re-rounded using industry approved equipment. Greater levels of ovality are found in coiled pipes, in pipes with higher SDRs and in diameters above 400mm
- The electrofusion equipment must be compatible, calibrated and capable of providing the correct fusion voltage for the full duration of the electrofusion cycle
- Alignment clamps must be used to ensure there is no movement between the pipe and fitting during the fusion and cooling processes
- For large diameter Easigrip® couplers, combined hydraulic re-rounding and alignment clamps must be used. For more guidance, please refer to the Easigrip® instructions detailed within this brochure
- For saddle fittings a top loading clamp is required. It should be calibrated and capable of applying the correct clamping force



Quality assessment

- Following the electrofusion process, the fitting should be inspected to ensure that the fusion indicator(s) is (are) raised. The fusion indicator identifies that the electrofusion process has taken place. It is not confirmation of a quality joint
- For a good quality joint, there should be no visible melted material beyond the fitting's edges
- At the end of the electrofusion cycle, the control box should be checked to confirm that the cycle has completed without error
- The fusion joint record data should be retrievable for quality inspection or joint investigation
- Each joint should be marked with the joint reference details
- Follow industry approved pressure test procedures before commissioning the joint

Electrofusion jointing guidance

Easigrip® couplers jointing guidance and compatible equipment

Radius Systems' Easigrip® electrofusion couplers (450 to 630mm) must be installed using approved Easigrip® compatible equipment which is capable of delivering the 3 stage electrofusion heating cycle: 'warm-up', 'soak' and 'weld' (fuse), followed by the cooling cycle.

For successful jointing, a compatible electrofusion control box and matching generator capable of delivering a minimum constant power of 4.8 kW for the duration of the electrofusion cycle, are required (the fitting supply shall be 78 V to 80 V AC rms).

Minimum equipment requirements

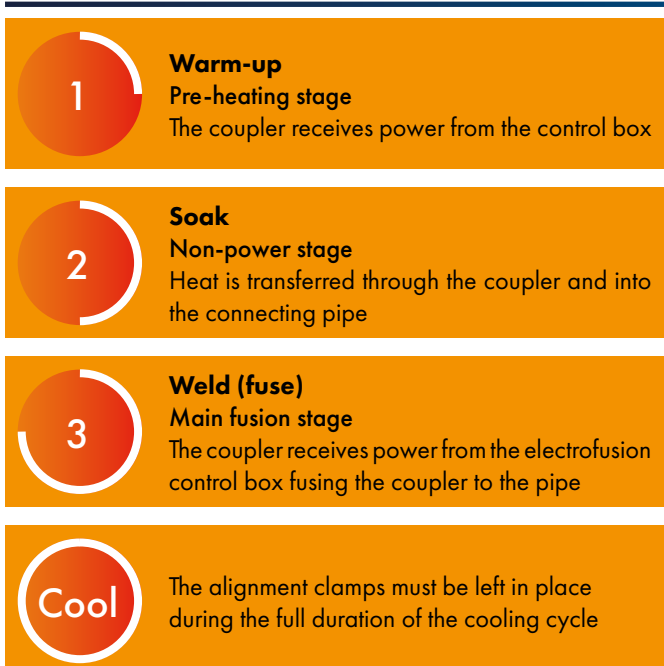
1. Easigrip® compatible 80 V electrofusion control unit
2. Generator capable of providing the required power for the full duration of the electrofusion cycle. A 7.5-10 kVA generator will be required depending on the manufacturer
3. Easigrip® compatible re-rounding clamps and alignment bars
4. Industry approved pipe surface preparation tool (rotary pipe preparation tool preferred. For ProFuse® pipe, use the pipe exposure tool - PET)
5. Welding shelter
6. Ground sheet
7. Measuring equipment
8. Approved marker pen
9. Suitable pipe cleaning equipment and disposable paper cleaning towels



ONLY fusion equipment bearing the Easigrip® compatible label should be used with Easigrip® couplers.

Compatible electrofusion control boxes can be obtained through a wide range of pipe jointing equipment suppliers. Please contact Radius Systems for more details.

3 stage electrofusion heating cycle



Minimum recommended personal protection equipment (PPE)



The weight of the electrofusion coupler is detailed on the packaging label. Please follow published safety practices when handling Easigrip couplers.



The fitting will remain hot to the touch beyond the prescribed cool time.



Before carrying out an electrofusion joint

- The inside and outside of the pipe must be completely dry
- Visually check all electrical components including the generator, electrofusion control box and all cables to ensure that they are in good working order and fit for use. Follow the supplier's recommendations
- Do not use the electrofusion fitting if the electrical terminal connections are damaged

Socket fitting jointing overview using solid wall PE pipe for water and gas



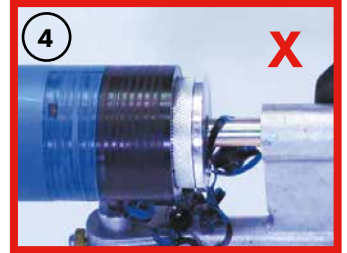
1 Ensure the pipe to be joined is free from damage, cut square and re-rounded when required. The pipe's exterior and interior must be clean and dry.



2 Mark the fitting's insertion depth plus 25mm, using an approved marker pen. Mark the area to be prepared



3 Prepare the pipe surface using an industry approved rotary or hand scraping tool.



4 Do not remove excessive material during pipe preparation, as this may lead to a poor quality joint.



5 Inspect the scraped area and ensure it is correctly prepared, clean and free from contaminants.



6 Place the fitting on the pipe up to the insertion stops and mark the pipe as shown.



7 Follow steps 1 to 5 for the preparation of the connecting pipe surface and fully insert into the fitting's socket. Mark the pipe as shown in step 6.



8 Clamp the pipe joint in place and connect the electrofusion control box terminal leads to the fitting.



9 Follow the instructions on the electrofusion control box.



10 Scan or manually enter the fitting's fusion details into the control box and start the welding process.



11 Melt indicators show that the fusion process has taken place. It is not confirmation of a quality joint. Clamps must remain in place during the full cooling period.



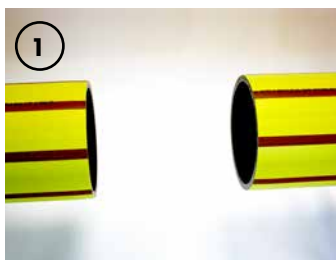
12 Remove the clamps after the cooling period has elapsed. The joint is complete. Follow industry approved pressure test procedures before commissioning the joint.



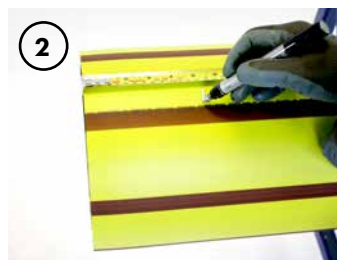
Keep the environment clean,
by removing all pipe shavings and offcuts
and dispose of them responsibly.

Electrofusion jointing guidance

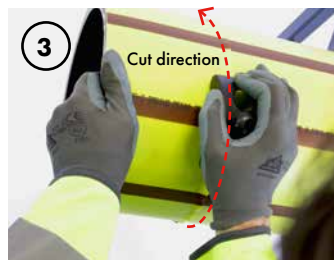
Socket fitting jointing overview using ProFuse® peelable pipe for water and gas



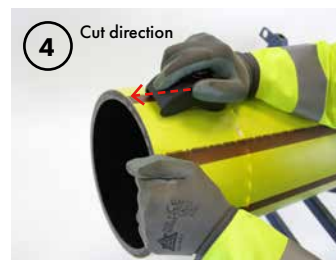
1
Ensure the pipe to be joined is free from damage, cut square and re-rounded when required. The pipe's interior must be clean and dry.



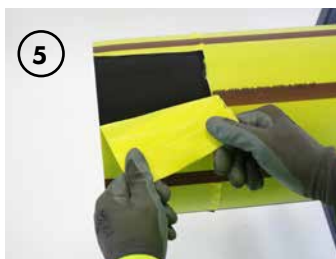
2
Using an approved marker pen, mark the fitting insertion depth plus 25mm, on the pipe.



3
Using the ProFuse® pipe exposure tool (PET), score the outer skin around the circumference of the pipe. **DO NOT USE** open bladed knives



4
Rotate the ProFuse® PET 90° and score the outer skin axially, starting on the circumferential cut to the edge of the pipe.



5
Lift and pull the edge of the outer skin away from the core pipe and peel the skin. Take care not to contaminate the pipe surface.



6
Place the fitting on the pipe up to the insertion stops and mark the pipe. Leave the fitting in its packaging.



7
Repeat stages 2 to 5 for the preparation of the connecting pipe and fully insert into the fitting's socket.



8
Mark the pipe and follow steps 8 to 12 on the previous page to weld and commission the fitting.

Note: If the exposed pipe surface becomes contaminated during the skin removal process, the core pipe should be treated as a solid wall pipe and prepared using a rotary pipe surface preparation tool

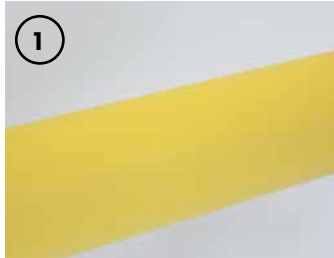
ProFuse® PET - Product code: FT0648

- The only tool recommended for the quick, simple and safe removal of the ProFuse® skin
- The PET tool must be used, **DO NOT USE** open bladed knives
- The minimum recommended skin removal is the fitting's socket depth plus 25mm
- For butt-fusion jointing, remove a minimum 25mm wide strip, to ensure enough of the core polyethylene material is exposed for the jointing process



Top loading tapping tee jointing guidance using solid wall PE pipe for water and gas

Radius Systems' tapping tee products, including PurgeTee™ and Anaconda® are supplied with an integral cutter within the body of the tapping tee. This is a 'non-captive cutter'. During the commissioning of the tapping tee product, some let-by of gas or water past the cutter threads may occur. This is normal and consistent with the design functionality of the tapping tee and will cease once the commissioning operation is complete. It is essential that the following tapping tee installation guidance is adhered to.



1 Inspect the pipe and ensure it is free from damage and the pipe surface is clean and dry.



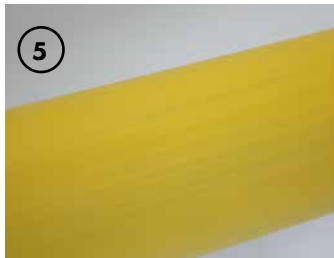
2 Using the saddle fitting as a guide, mark the outline area of the pipe to prepare for electrofusion jointing, using an approved marker pen.



3 Mark the area as shown using a cross hatch pattern to indicate the area to be prepared.



4 Prepare the pipe surface using an industry approved hand scraping tool.



5 Inspect the pipe surface and ensure it is clean and free from contamination.



6 Using an approved calibrated clamp, secure the saddle fitting in place. Ensure the correct clamping force is applied (check clamp indicator).



7 Connect the electrofusion control box terminal leads to the fitting and follow the instructions on the control box.



8 Melt indicators show that the fusion process has taken place. It is not confirmation of a quality joint. Clamps must remain in place during the full cooling period.



9 Prepare the outlet of the tapping tee and place the socket fitting onto the outlet. Prepare the service pipe and make the socket joint following the socket fitting jointing procedure within this brochure.



10 Tapping the main
Use a 12 mm hexagonal T key and turn in a clockwise direction until the cutter cuts through the top of the main

Retracting the cutter
Turn the T key in an anti-clockwise direction until the top of the cutter is flush with the top of the stack.



11 Do not remove the cutter from the stack. Ensure the top of the cutter is flush with the top of the stack.

Removal of the cutter will result in an uncontrolled release of fluid from the pipeline.



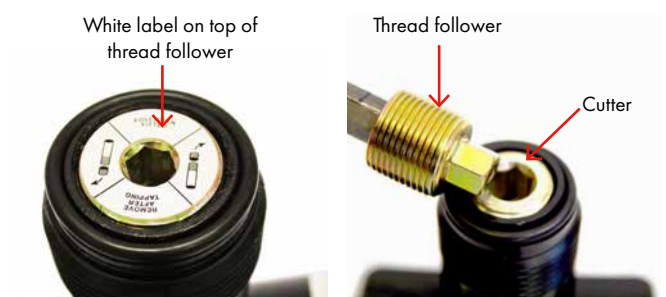
12 Check the O-ring seal is in place at the top of the stack and adequately tighten the cap. Check for leakage using industry best practice. The connection and commissioning are now complete.

Pressure test the service before commissioning.

IMPORTANT NOTE

A thread follower is supplied with our range of large diameter tapping tees in sizes 200mm and above. Where a thread follower is included, a white label will be visible when the tapping tee cap is removed.

Thread followers ensure that the threads within the body of the tapping tee products are not overstressed when tapping the main. The follower should be retracted and removed when the tapping operation is complete. Do not remove the cutter from the stack. Ensure the top of the cutter is flush with the top of the stack.

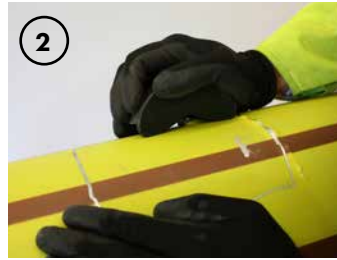


Electrofusion jointing guidance

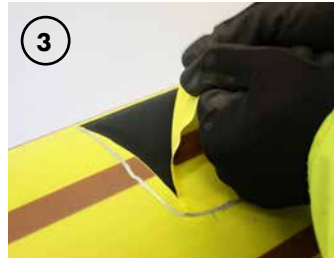
Top loading tapping tees jointing guidance using ProFuse® peelable pipe for water and gas



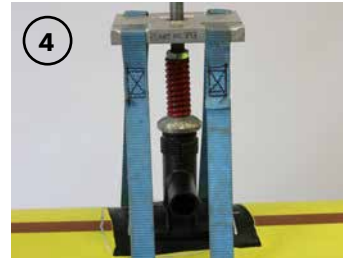
Using the tapping tee as a guide, mark the outline area of the pipe to prepare for electrofusion jointing, using an approved marker pen.



Using the ProFuse® PET, score and cut the outer skin around the perimeter of the marked area. **DO NOT USE** open bladed knives.



Lift and pull the edge of the outer skin away from the core pipe and peel the skin. Take care not to contaminate the pipe surface.



Once the outer skin is removed, follow steps from the 'Top loading tapping tee jointing guidance' section within this brochure to complete the connection.

Note: If the exposed pipe surface becomes contaminated during the skin removal process, the core pipe should be treated as a solid wall pipe and prepared using an approved pipe surface preparation tool

40 x 32 mm under-clamp saddle fitting jointing guidance



The 40 x 32 mm under-clamp tapping tee is supplied with a separate underpart.



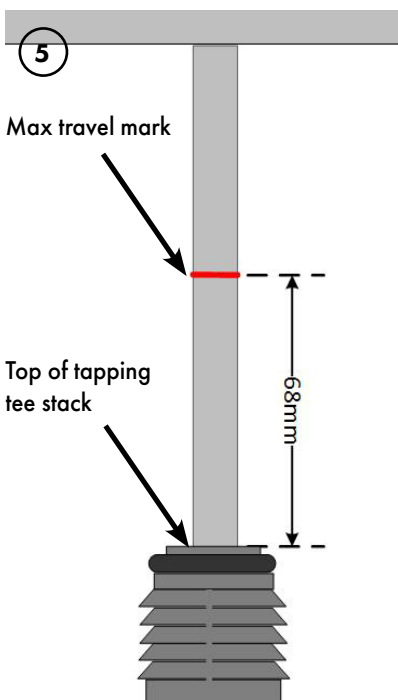
Prepare the pipe surface following the 'Top loading tapping tee jointing guidance' within this brochure. Place the fitting on the pipe. Position and slide the underpart in the groove of the upper saddle as shown.



Hold the upper saddle firmly while tapping the underpart with a suitable soft-blow hammer to fully engage the underpart.



Follow steps from the 'Top loading tapping tee jointing guidance' section within this brochure to complete the connection.



Tapping the main

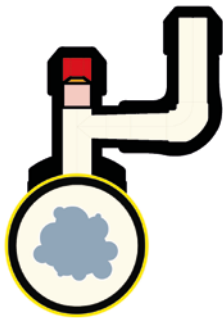
- Remove the cap
- Ensure the top of the cutter is at the top of the tapping tee stack
- Insert the 12 mm hexagonal T key into the cutter
- Mark the T key to indicate the maximum length of travel required = 68 mm
- Turn the T key clockwise until the maximum travel mark is flush with the top of the stack. The top of the pipe has now been cut through
- Retract the cutter by turning the T key anti-clockwise until the top of the cutter is flush with the top of the stack
- Do not remove the cutter from the stack
- Remove the T key, replace the cap and fully tighten
- Check for leakage using industry best practice. The connection is complete

Cutter position at the top of stack before and after pipe cut through



PurgeTee™ for gas applications - Principle of operation

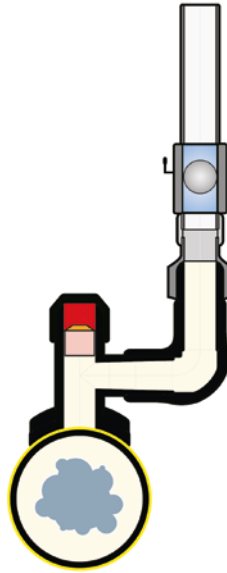
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Fuse the PurgeTee™ onto the PE main, using the same procedure for saddle fittings in this document.

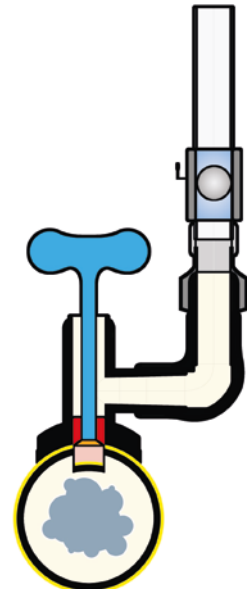
Remove the outlet cap and carry out a pressure test to prove weld integrity.

2



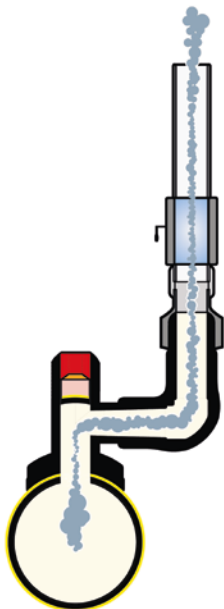
Fit the purge tube to the PurgeTee's elbow outlet using the reusable thread adaptor (product code FT0655 or FT0656).

3



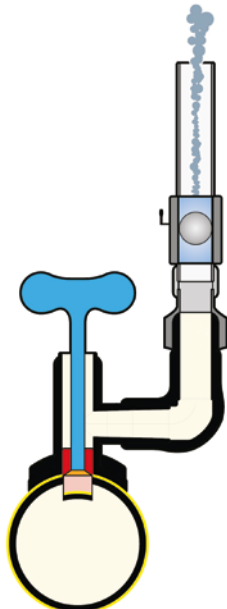
Using a short arm T key, tap the PE main. Retract the cutter to the top of the stack. Do not remove the cutter. (Follow tapping the main instructions for saddle fittings within this brochure)

4



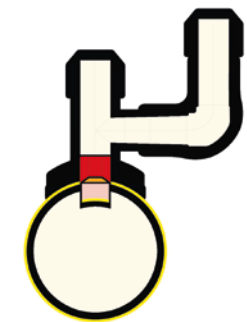
Open the valve on the purge tube to allow the gas / air to escape through the PurgeTee™.

5



When the purging operation is complete, close the valve and wind the cutter down, so that it plugs the cut hole in the crown of the PE pipe.

6



Now that the flow of gas is controlled, remove the purge tube and adaptor. Check the O-ring seal is in place at the top of the stack and adequately tighten the cap. Check for leakage using industry best practice procedures.

For complete jointing guidance and jointing videos, please visit our website www.radius-systems.com.
For further jointing advice, please contact our technical support team on: t: +44 (0)1773 811112,
e: techsupport@radius-systems.com.

Why do Radius Systems electrofusion fittings use exposed wire technology?

Exposed wire technology means that the metallic heating element is visible, whilst being embedded within the fitting's body. Radius Systems consider that the exposed wire technology provides a more efficient heat transfer during the electrofusion process, whilst increasing joint integrity.

I want to use an electrofusion coupler as a repair coupler. Is this possible and what do I need to do?

Electrofusion couplers may be used as repair couplers by removing the fitting's centre stops; these can be cut off at the base to create a clear bore. It is important that the fitting's internal surface, including the heating element, do not become damaged or contaminated during the removal of the stops.

Why are there 2 different terminal pin dimensions for electrofusion fittings?

Different terminal pin diameters are used for 40 and 80 Volt fittings:

- 4.0 mm terminal pins are used for 40 Volt electrofusion fittings
- 5.7 mm terminal pins are used for 80 Volt electrofusion fittings in larger diameter.

The larger diameter fittings with a 5.7mm terminal pin need a higher voltage input to make the weld using the correct control box and leads.

I have stock of identical fitting's, but with different electrofusion fuse and cool times. Why is this?

Radius Systems have a programme of continuous product development and improvement and this may result in changes to a fitting's design, including changes to a fitting's fuse and cool times. The correct fuse and cool times for each fitting are identified on the individual fitting's packaging label. Always refer to the packaging label for the fitting's details but if in doubt, please contact Radius Systems.

Radius Systems have supplied fittings with 4.0 mm terminal pins. However, my electrofusion control box is fitted with 4.7 mm terminal pin connection leads. How should I proceed?

Terminal pin adaptors are available to convert the terminal pin connection leads from 4.7 mm to 4.0 mm. These pin converters are available from electrofusion tooling and equipment suppliers.

When making connections onto coiled pipes, I have noticed that the pipe is not truly circular, unlike straight pipes. What should I do to carry out an electrofusion joint?

When polyethylene pipes are supplied in coil format, there will be a greater level of pipe ovality than that of pipe supplied in straight lengths. The pipe should be re-rounded using approved re-rounding clamps where the joint is going to be made.

Why do I need to prepare the pipe surface before making an electrofusion joint?

To ensure a successful welded connection is achieved, it is important that when a joint is made, no contaminants are present at the joint interface or within the welded connection. During storage, transportation, handling and installation, the external surface of a polyethylene pipe will become contaminated with dirt and debris, which must be removed before making an electrofusion joint, using recommended pipe surface preparation techniques (see jointing overview within this brochure).

When preparing the surface of a solid wall polyethylene pipe for electrofusion jointing, what equipment should I use?

For tapping tee connections, an industry approved 'hand scraper' should be used. For socket fittings, industry approved rotary pipe surface preparation tools are preferred. Such tools have the added benefit of removing a continuous layer of polyethylene material around the pipe's circumference for the full length of the socket.

Once I have prepared the pipe surface for electrofusion jointing, how long can I leave the pipe surface exposed before I make the joint?

Making an electrofusion joint is a continuous process and once the pipe surface has been prepared, the electrofusion joint should be made without delay. Delay in making the joint, may result in contamination of the pipe surface, which could lead to premature failure of the electrofusion joint.

Can I prepare the pipe surface and then use wipes to remove airborne dust and dirt?

The use of wipes to remove airborne dust and dirt is not recommended as the final method for pipe preparation. The only acceptable method of final pipe surface preparation is the use of a hand or rotary pipe scraper. Wipes and towels are only recommended to remove dust and dirt before using a hand or rotary scraper.

Why is it recommended to use a welding shelter when making electrofusion joints?

Welding shelters are recommended to ensure that environmental contamination on the surfaces to be joined is minimised:

- Airborne dust in dry weather
- Rain and moisture in wet conditions

When making an electrofusion joint, dust, dirt, rain and moisture act as contaminants and will reduce the quality of the electrofusion joint, if present between the pipe and fitting's jointing surfaces.

Why do I need to leave the fitting in its packaging right up to the point of connection?

Electrofusion fittings are supplied in sealed packaging to prevent contamination of the jointing surfaces. It is therefore recommended that the packaging is only removed at the point of connection to eliminate contamination of the fitting's jointing surface.

Why do I need to use electrofusion alignment clamps?

Electrofusion alignment clamps are used for pipe to socket fitting connection and ensure that the pipe and fitting are in true alignment with one another and that there is a uniform gap between the pipe's outer surface and the fitting's internal surface. This ensures that during the heating phase of the electrofusion process the molten material is evenly distributed around the annular gap between the pipe and the fitting to ensure joint quality.

Why do I need to use a top loading clamp when making a tapping tee connection onto a pipeline?

Top loading clamps are used with top loading tapping tees to ensure that the correct force is applied between the tapping tee body and the connecting pipe and achieve the correct weld interface pressure during the electrofusion process. Failure to adequately clamp the tapping tee body will result in incorrect fusion pressure and potential premature failure of the electrofusion joint.

When making an electrofusion fitting joint, what is the power requirements and what size of generator do I need?

The size of generator is fully dependent on the age and efficiency of the generator. Please refer to the power requirements and generator size table within this brochure. The generator supplier will be able to confirm the generator size required for a given fitting.

If my generator runs out of fuel part way through the electrofusion process, is it acceptable to add more fuel to the generator and continue from where I left off?

It is important to check the generator and ensure that there is an adequate amount of fuel to complete the electrofusion process, before making a joint. If a generator runs out of fuel part way through the fusion cycle, the electrofusion process should be terminated and under no circumstances should a second electrofusion process be undertaken. Once cool, the fitting must be removed from the system.

Once I have satisfactorily welded a tapping tee onto a pipeline, is it acceptable to proceed to tap into the live main?

Tapping into the main should only take place after the tapping tee's cooling time has elapsed and the fitting is fully cooled. All joints should be tested for leak tightness before tapping the live main.

What equipment do I need to tap into the main?

Radius Systems' tapping tees are fitted with an integral cutter. A 12mm T Key is recommended to commission the tapping tee as it allows the application of a symmetrical torque to the tapping tee when cutting through the main. Radius Systems do not recommend the use of single arm, ratchet or power tools when commissioning tapping tees due to the potential damage to the tapping tee internal threads.

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In which position should the tapping tee cutter be, once I have commissioned the service?

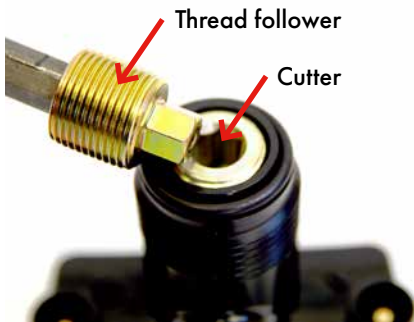
The tapping tee cutter must always remain in the tapping tee. The top of the cutter should be flush with the top of the tapping tee stack.

Cutter position at top of stack after tapping the main



Why is there a thread follower included with the large diameter tapping tees?

The thread follower included in all large diameter tapping tees 200 mm and above, is designed to ensure that the threads within the body of the tapping tee are not overstressed when tapping the main.



How do I know if there is a thread follower in the tapping tee?

A thread follower is included in all tapping tees 200 mm and above. It is positioned directly above and engaged in the tapping tee cutter. A white label is applied to the top of the thread follower to indicate its presence.



Thread follower label on tapping tees 200 mm and above

Once I have commissioned the tapping tee, should I leave the thread follower in the fitting?

The thread follower is used solely for the tapping tee commissioning procedure and should be removed once the procedure is completed. Retract the thread follower to the top of the tapping tee stack and remove carefully. The cutter must remain in the tapping tee. Ensure that the top of the cutter is flush with the top of the tapping tee stack.

Is it normal for the fitting's external surface to become hot during and immediately after the electrofusion heating cycle?

Electrofusion joints are made by applying a constant voltage to the fitting's terminal connections, which causes the fitting's heating element to become hot. This in turn, heats the adjoining pipe surface, resulting in a homogeneous melt between the pipe and fitting. This heating process causes the fitting to become hot during and for some time after the heating cycle. Do not touch the fitting until it has fully cooled.

The fitting's external surface remains hot beyond the prescribed cool time. Is this normal?

Yes. The cooling time is designed to allow the molten PE material to solidify. Once the cooling time has elapsed, the clamps can be removed. However, the fitting's external surface will remain hot and should not be touched until it has fully cooled.

Why do Radius Systems' large diameter electrofusion fitting's use a 3 stage heating cycle?

Radius Systems' large diameter electrofusion couplers use a 3 stage heating cycle - heat - soak - weld, to ensure that the heat between the fitting and the pipe is uniformly transferred for optimum joint quality. The 3 stage heating cycle also allows for the fusion of the fitting to be carried out as one operation and specific electrofusion control boxes capable of delivering this 3 stage heating cycle are required. Please refer to the Easigrip® section within this brochure for more details.

Why are Radius Systems' electrofusion fittings supplied with both manual (fixed) fusion time and barcode (variable) fusion time and what is the difference between them?

The manual (fixed) fusion time, which is embossed on the fitting, is intended primarily for the UK market and is suitable for electrofusion jointing at an ambient temperature range between -5°C and $+23^{\circ}\text{C}$.

The barcode fusion time, which is variable, with built-in ambient temperature compensation, is suitable for jointing at temperatures between -30°C and $+50^{\circ}\text{C}$. The electrofusion fitting heating duration is automatically adjusted at the point of making the joint. An electrofusion control unit with barcode scanning capability is required to read the electrofusion barcode.

